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# FACTORS AFFECTING THE PROBABILITY OF DEFAULT OF THE MELLI BANK'S LOANS IN AGRICULTURAL SECTOR IN NORTH, SOUTH AND RAZAVI KHORASAN PROVINCES IN IRAN

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**ABSTRACT**

Considering that the problem of non-payment on time and default of facilities in the banking system has been increasing in recent years and the above issue causes credit risk in the banking system, Therefore, in order to manage credit risk and select customers with lower risk, it is necessary to pay attention to the factors that increase the probability of default. In this study, seven characteristics of borrowers in four groups, which are the group of timely payers of facilities, the group with past due facilities, the group with deferred facilities and the group with doubtful facilities have been examined. In this regard, the sequential logit model has been used. The results of the sequential logit model show that increasing interest and penalties for defaulting facilities reduces the probability of timely payment of facilities and decreasing profits and penalties for defaulting facilities increases the probability of timely payment of facilities. Therefore, it is suggested that in order to improve the situation of banks' claims, the Central Bank and the Ministry of Economy, at the same time as reducing inflation, reduce the facility rate in order to reduce the bank's overdue claims.

***Keywords:*** Altman's Z, financial ratio, non-repayment facilities, Ordered Logit Model, profit of facilities, surcharge of facilities

## INTRODUCTION

Financial crises will shake up financial markets, erode consumer and investor confidence, and make financial institutions worry about the global economy and financial markets' stability. As the central pillar of any economy operating in the two capital and money markets, financial institutions are the main factor in the country's capital and money flow (Lin, 2009). The provision of facilities will affect the country's money flow and provide the capital required for other units' activities through facilities provision (Karimi *et al.,* 2016). Facilities are also known to be the main asset of any financial institution as a source of institutional income (Dolatkhah and Badie, 2016). The banking sector, governments and financial institutions play a role in preventing the effects of such financial crises to grow, and while market imbalances have been a major cause of global financial market turmoil, credit risk has played a significant role in the credit crunch (Moshiri and Nadali, 2013). Providing credit and capital is one of the approaches that banks can use to reduce the effects of financial crises (Maddala, 1991). Indeed, the lack of capital and the absence of appropriate capital resources are the major obstacles to economic growth and development of the various economic sectors (Ghahramanzadeh *et al.,* 2016). With the development of the capital and credit allocation process in credit and financial institutions, with more financing sources, the scope of decision-making and evaluation will be widely available (Bahrami and Bagheri, 2013). However, it is critical for the supervision of various groups, including policymakers and investors, to pay attention to banks' financial warning systems. Default is a factor that can easily lead to a bank financial crisis, and dealing with it requires careful attention and planning (Koopahi, 2002). The circulation of money and capital in society, despite the numerous advantages of facilities, will expose financial institutions to a variety of production and price risks. In order to continue their economic lives, the presence of risk in society's activities has led institutions to control, reduce and manage their risks. Therefore, better strength will be accomplished by reducing the risk of loaning by financial institutions. What is important for the banks is to assess the borrowers' possibility of non-repayment before granting the facility and to choose a group to ensure that their debt will be repaid on time. Through a comprehensive system, optimal structure and suitable criteria, this becomes possible (Mehrara *et al.,* 2017). Using credit rating models to distinguish customers is one of the plans employed by financial institutes. The evaluation of the probability of repayment or non-repayment by the borrowers before granting the facility is indeed vital for the financial institutions. This will contribute significantly to the choice of customers with less risk. In fact, the separation of customers is done in order to determine what group of customers are "customers with low credit risk" (with a high probability of repayment of financial obligations) and what group of customers are "customers with high credit risk" (with a high probability non-repayment of financial obligations) (Astawa, 2018). However, creating credit models requires data mining techniques, customer payment records, demographic characteristics, and statistical techniques. In banking and legal terms, the inability to meet obligations is called default. The term default is used to define investment

risks. The three broad categories of conventional models used to estimate credit risk at the loan level are: Expert systems of internal and external credit rating and Credit Scoring Models (Altman, 1968). However, any problems with the repayment of loans and debts from financial institutions will make it difficult for financial institutions to repay loans to the community (Moshiri and Nadali, 2013). Failure to repay the overdue facility on time can decrease the performance of receiving the facility granted and eventually reduce the bank's financial resources (Ghadermazy, 2015). In terms of the fact that the receipt of payment credits in any financial institution is a key factor for the survival of credit institutions and, on the other hand, the strong reliance of the financial resources of the bank on the credits received, the factors affecting the non-repayment of financial institutions need to be investigated (Chizari and Zare, 2001). Therefore, due to the importance of the issue, the factors affecting Bank Melli's agricultural legal customers' default in the provinces of Razavi, North and South Khorasan were studied in the present study.

**Research background**

Chizari and Zare (2001) investigated the impacts of loans allocated to Melli and Keshavarzi banks in Mazandaran province, intending to compare the two banks. The purpose of this study was to determine the most crucial indicator of bank loan non-repayment by borrowers by examining individual and banking factors. The results showed that both factors have positive impacts on borrowers' repayment of loans. Yousefi (2010) evaluated factors affecting the Export Development Bank's credit risk of Iran's legal customers. The results showed that the cash flow to total debt ratio variables has an adverse impact, and the free cash flow ratio and the total debt ratio directly impact credit risk. Asadi (2012) evaluated the factors that affect the credit risk of Tejarat Bank customers in Neka city. The results indicate that the probability of non-repayment and the granted facility's rate increases when the facility's repayment period decreases. It has been shown that bank deposits have the most significant effect on different collateral types and that promissory notes have the least impact on reducing the possibility of non-repayment of loans. Interest-free loans have the most impact on loan facilities, and participation facilities have the least impact on increasing the likelihood of bank loan non-repayment. Ravanbakhsh (2014) examined the factors affecting the deviation in facilities and the amount of overdue receivables of customers in the branches of Bank Saderat in Zahedan Province. The results indicate that the variables of gender, loan amount, instalment amount, facility repayment period, bank history, job and education are significant. Karimi Moghari *et al* (2016) examined the factors affecting the credit risk of commercial bank branches' real customers. The results showed that the variables of facility duration, facility rate and type of collateral have a significant effect on the receipt of bank receivables. In contrast, the facility's variable of obligation or non-obligation does not significantly affect the default probability. The factors affecting the non-timely repayment of the facilities granted were analyzed by Ali Mahaei (2017), and the factors were separated into two categories: internal and external. External factors include inflation, economic turmoil, and emergencies. The results have shown that each factor can affect the risk of default and non-repayment of facilities Agbeko *et al.,* (2016) investigated whether loan customer training and supervision enhances loan repayment rates. The effects of educational and monitoring interventions on loan repayment were analyzed using the data of 229 Ghana Bank loan client files. The study revealed that there was no significant impact on educational interventions to improve the rate of loan repayment. Interestingly, borrower facility monitoring improves the repayment rate, regardless of the level of education, business experience or gender. The results indicate that the repayment rate can improve significantly if the bank is continually monitoring its customers. One of the issues Bank Melli is struggling with is the issue of overdue receivables.

According to the statistics available at Bank Melli, on average, between 15 and 20% of the facilities granted in the agricultural sector are either not paid at all or have multiple instalments as well as significant delays over the ten-year period (2007-2017) (Bank Melli Internal Publication No. 728). Therefore, the investigation of the factors affecting the possibility of agricultural borrowers defaulting before granting facilities, as well as the creation of a credit rating system for the classification of agricultural borrowers, can lead to a reduction in the deferred facilities in this sector and the bank can use the resources obtained in this way and provide more facilities in this sector, resulting in a reduction in the deferred facilities in this sector. Legal facilities that have financial statements were selected in this study because it is assumed that the financial ratios extracted from the financial statements are significant for the company's financial situation to be carefully examined. Three hundred agricultural companies receiving facilities from Bank Melli (Razavi, North and South Khorasan provinces) were selected in this study.

38% of the legal facilities received by the agricultural sector in these three provinces represent the number of facilities received by these companies. In total, between 7 and 9% of the total backlog of the agricultural sector is related to the recipients of the legal sector's facilities. Therefore, an attempt has been made in this study to extract the practical factors for the failure of the legal facilities of the agricultural sector in Bank Melli (Razavi, North and South Khorasan provinces) and also to credit the credit facilities of the legal facilities of the agricultural sector in order to provide guidelines for reducing bank arrears in the agricultural sector. This study's statistical population is medium-sized and large agricultural companies that have received facilities from the Razavi, North, and South Khorasan Provinces National Bank over the years (2007-2017). In the agricultural sector, the number of these firms is 1395 law firms. Thirty hundred companies were chosen in three provinces using simple random sampling (with

95 per cent confidence level, the error rate of 0.05 and a population of 1395 companies). Having audited financial statements is considered a statistical population because, in most studies, the ratios and financial data extracted from the financial statements were significant and influential in the probability of default. According to the domestic and foreign studies and models used in this study, the factors identified and investigated using the sequential Logit model will affect the probability of default of legal borrowers in the National Bank's agricultural sector in the Razavi, North and South Khorasan Provinces.

## MATERIALS AND METHODS

In this study, the effect of explanatory variables on the possibility of default and how each factor affects the probability of being in four groups, Expiry date or issue date, timely paid facilities, past due (facilities that are more than the due date of the debt or the date of termination of instalments more than past two months and not over six months) should be investigated and determined. The explanatory variables in this model were chosen from the essential factors based on the opinion of the banking experts on the likelihood of default, namely, z Altman, the repayment period of the facility, the total amount of customer obligations before the facility was granted, the history of the CEO, the supply of raw materials from abroad, the supervision of the branch in granting facilities, the combined index of customer obligations before the facility was granted, The purpose of the study is to investigate the effect of factors affecting the likelihood of default on the borrower in four categories, which is the reason for selecting these variables (facilities paid on time, past due, deferred and doubtful).

Altman introduced Altman Z as an indicator for predicting corporate bankruptcy and was amended in 1983 as follows.

$$z=0.717x_1+0.847\,x_2+3.107x_3+0.420x_4+0.998x_5$$

where in:

Z = total index

x1 = Ratio of working capital to total assets

x2 = Ratio of accumulated profit to total assets

x3 = Ratio of profit before interest and tax to total assets

x4 = Ratio of book value of company shares to book value of total liabilities

x5 = Ratio of sales to total assets

In this model, the lower the z, the higher the company's financial crisis, companies with a z score higher than 2.9 enter the category of healthy companies and with a z score less than 1.23 are classified as bankrupt companies, and z between 1.23 and 2.9 is considered a zone of doubt, moreover, the area should be interpreted with caution. Altman achieved 94% accurate predictions with this model (Altman, 1968)

The logit pattern is sequential based on a continuously hidden variable, as shown below (Asadi, 2012).

$$(1)\quad Y_i^* = \beta X_i + \varepsilon_i \quad -\infty Y_i^* < +\infty$$

wherein:

The probability of being in the four groups mentioned.

The vector of the observed non-random explanatory variable that indicates the property of the i-recipient facility (above are the names of the explanatory variables)

The vector is the parameters that must be estimated is an error sentence that has a logistic distribution

Suppose the variable is a discrete and observable variable and represents the different classes of facility-receiver default. In that case, the relationship between the invisible variable and the observable variable and the existing is obtained from the sequential logit model as follows: (Ghahraman Zade *et al.,* 2016) & (Psillaki *et al.,* 2010)

$$(2)\ Y_i = 1 \quad if \quad -\infty < Y_i^* < M_1 i = 1,2,3,\dots,n$$

$$(3)\ Y_i = 2 \quad if M_1 < Y_i^* < M_2 i = 1,2,3,\dots,n$$

$$(4)\ Y_i = 3 \quad if M_2 < Y_i^* < M_3 i = 1,2,3,\dots,n$$

$$(5)\ Y_i = J if M_{j-1} < Y_i^* < +\infty \quad i = 1,2,3,\dots,n$$

Accordingly, n is the sample size, and M is the thresholds that define the observed discrete responses and should be estimated. In order to test the rationality of the parameter equality hypothesis in the above model for all groups, Brent parallel regression test was used. In this test, the model estimated with a set of coefficients for all groups is compared with a model with separate coefficients set for each group. The null hypothesis of this test is that the status characteristics are the same for all response groups. In this case, if the estimated current model, which is the same as hypothesis zero, is accepted, it shows that the status parameters are the same for all response groups. For Brent test and parallel regressions, is calculated according to the following equations: (Lin, 2009) & (Psillaki *et al.,* 2010).

$$(6)\ \chi^2 = -2\,loglikelihood_{CM} - (-2\,loglikelihood_{GM})$$

Gm and Cm represent the current pattern and the general pattern, respectively. If calculated from the above relation is greater than its value in the table, it indicates that the null hypothesis is not accepted, i.e., the current models correct value. The met parameters are obtained from the maximum straightening method (Astawa, 2018) & (Lin, 2009).

$$(7)\ (y|\beta: M_1, M_2, \dots, M_{j-1}) = \prod_{i=1}^{n}\prod_{j=0}^{j}[y(M_j - \hat{\beta}X_i) - y(M_{j-1} - \hat{\beta}X_i]^{z_{ij}}$$

Where is a binary variable when the experimental group for the recipient i is equal to j, it is equal to one, and if it is not equal, it will be equal to zero. The Newton-Raphson algorithm is used in the maximization process.

In models whose dependent variable is limited, the

**Table 1.** The independent variables characteristics

| Variable | Definition | Percentage | Variable type |
|---|---|---|---|
| Altman's Z | Percentage above 2.9 | 14 | Quantitative |
| | Percentage under 1.23 | 52 | |
| | Percentage between 1.23-2.9 | 34 | |
| The period of repayment | % Short-term (1 year and less) | 64 | Quantitative |
| | % Long-term (more than 1 year) | 36 | |
| Total amount of customer obligations | Customers who have commitment. | 81 | Quantitative |
| | Customers who do not have commitment | 19 | |
| The history of CEO activity | % less than 10 years | 45 | Quantitative |
| | % more than 10 years | 55 | |
| Providing raw material abroad | Domestic raw materials | 48 | Dummy |
| | External raw materials | 52 | |
| The branch controls the granting of facilities | Percentage of Branches oversee the granting of facilities | 52 | Dummy |
| | Percentage of Branches did not oversee the granting of facilities | 48 | |
| Combined index of interest on facilities and fines | The average amount of interest and fines granted to the facility after granting | - | Quantitative |

* Source: Research Findings

**Table 2.** The summary of the results of different classes of facility recipients for the Repayment of facilities period

| The classes of facility recipients | Frequency | Percentage |
|---|---|---|
| Timely received facilities | 84 | 29.37 |
| Expired facilities | 52 | 18.18 |
| Deferred facilities | 64 | 22.37 |
| Facilities that may not be paid | 86 | 30.08 |

* Source: Research Findings

**Table 3.** The results of estimating the Ordered Logit model in order to determine the factors affecting the probability of default facilities

| Variable | Coefficient | standard error | z Statistics | Significance level |
|---|---|---|---|---|
| Altman's Z | -4.83 | 0.40 | -11.89 | 0.0001 |
| The period of repayment | 0.01 | 0.00* | 1.16 | 0.024 |
| Total amount of customer obligations | -6.94 | 3.19 | -2.18 | 0.029 |
| The history of CEO activity | -0.029 | 0.017 | -4.63 | 0.0103 |
| Providing raw material abroad | 0.512 | 0.32 | 8.56 | 0.0118 |
| The branch controls the granting of facilities | 0.611 | 0.45 | 9.33 | 0.0182 |
| Combined index of interest on facilities and crimes | -5.50 | 2.74 | -2.00 | 0.045 |
| First threshold | -8.81 | 0.917 | | |
| Second threshold | -5.38 | 0.744 | | |
| Third threshold | -2.45 | 0.621 | | |
| Accuracy of prediction | %72 | | | |
| Pseudo R2 | 0.5593 | | | |
| Prob > chi2 | 0.00 | | | |
| LR chi2 | 437.06 | | | |

* The number is very small and is given in this way because of the numbers with two decimal places being reported.
* Source: Research Findings

coefficient of determination cannot be a good criterion for determining the model's good value, and in this model, $R^2$pseudo is used. This is because the rate of change of the dependent variable per unit of change in the explanatory variable is limited. For example, in this study, the dependent variable has four classes or four levels.

If one of the explanatory variables changes by one unit, the dependent variable changes only between these four values and cannot be changed more. Therefore, the interpretation of the coefficient of determination in models with the limited dependent variable is different from ordinary models. Correct classification accuracy is

**Table 4.** Parallel regression test results

| Variable | $\chi^2$ Statistics | Significance level |
|---|---|---|
| Whole model | 6.4 | 0.53 |
| Altman's Z | 8.2 | 0.47 |
| The period of repayment | 1.93 | 0.381 |
| Total amount of customer obligations | 0.3 | 0.861 |
| The history of CEO activity | 3.35 | 0.187 |
| Providing raw material abroad | 5.38 | 0.68 |
| The branch controls the granting of facilities | 0.47 | 0.792 |
| Combined index of interest on facilities and crimes | 0.85 | 0.653 |

* Source: Research Findings

**Table 5.** The marginal effects for different facility repayment groups

| Variable | The marginal effect of Timely received facilities | The marginal effect of Expired facilities | The marginal effect of Deferred facilities | The marginal effect of Facilities that may not be paid |
|---|---|---|---|---|
| Altman's Z | 0.331 | 0.66 | -0.892 | -0.099 |
| The period of repayment | -0.0007 | -0.0013 | 0.0188 | 0.0021 |
| Total amount of customer obligations | 4.764 e14 | 9.476e14 | -1.218e-13 | -1.431e-14 |
| The branch controls the granting of facilities | 0.0511 | 0.0615 | -0.1023 | -0.0102 |
| Providing raw material abroad | -0.035 | -0.069 | 0.094 | 0.107 |
| The history of CEO activity | 0.002 | 0.0399 | -0.0054 | -0.0006 |
| Combined index of interest | -3.77e12 | -7.507e12 | 1.015e11 | 1.133e12 |

* Source: Research Findings

another indicator for a useful review of the sequential logit pattern's value, which shows the percentage of correct and incorrect predictions of the dependent variable. Regarding the interpretation of coefficients, it should be said that in this model, the interpretation of coefficients is not made directly, and only the sign of the interpretation coefficient is used. That is, if the coefficient is positive, the probability of being in one class increases and decreases in another. For this purpose, we must go to the interpretation of the final effects (Astawa, 2018).

Calculating the final effect of a variable shows the amount of change in the explanatory variable $x_k$ on the probability of being in class j, which is shown below (Astawa, 2018).

$$(8)\ \frac{\partial p(y_i=j|X_i)}{\partial x_k} = \left[\frac{\partial y(M_j-\hat{\beta}X_i)}{\partial x_k} - \frac{\partial y(M_{j-1}-\hat{\beta}X_i)}{\partial x_k}\right] = [\lambda(M_j-\hat{\beta}X_i) - \lambda(M_j-\hat{\beta}X_i)]\beta_k$$

$$\text{Where in } M_j = +\infty, M_0 = -\infty, \lambda_j(X_i) = {\partial y_j(X_i)}\Big/{\partial X_k}$$

Given that this final effect depends on all the explanatory variables' values, the decision to use the estimated variables' values is significant. Typically, the final effect is calculated on the mean values of the variables. Given that the probabilities' sum is always equal to one, the sum of each variable's final effects will be zero. The calculation of the final effects for binary variables is not done directly. In this case, the final effect is calculated as the difference between the probabilities in the two possible cases (Oreski, 2012)

The required data were collected by referring to the Melli Bank and reviewing the granting agricultural facilities' files to legal beneficiaries. In this study, legal facilities with financial statements have been selected because it is assumed that the financial ratios extracted from the financial statements are critical in carefully examining the company's financial situation. In this study, 286 agricultural companies receiving Bank Melli facilities from Razavi, North and South Khorasan provinces have been selected. For this purpose, using stratified random sampling method, which is the studied attribute in each of the classes of facilities received by borrowers with a statistical population of 3000 and a sample size of 286 people including four timely connected groups of 84 people, past maturity of 52 people, claims Arrears of 64 people, suspicious access of 86 people during the years 2012 to 2017 were collected from the information of legal borrowers (companies) in Bank Melli.

## RESULTS AND DISCUSSION

### Sample features

The average amount of fines taken from the study sample was 93,5 million rials; the average repayment period was 18,4 months, the average activity of the companies was 20,28 years, the average amount of the total liabilities of the companies before acquiring the facility was 46002,5 million rials, the average history of operations of the manager Operating companies: 13,11 years, the combined

index of liabilities of the companies before acquiring the facility was 46002,5 million rials, the average history of operations of the manager.

**Customer classification**

As shown in Table 2, customers who have paid their facilities on time are classified as the first class; the customers who have not been in debt for more than two months and have not exceeded six months from the date of maturity of the debt or the date of termination of their instalments are classified as the second class; the customers who have been in debt for more than six months and have not exceeded 18 months from the due date of the debt are classified as the third class, and whom the date of termination of their instalments exceeds 18 months are classified as the fourth class.

**The pattern for Default**

Table 3 shows the results of the estimation of the logit model. Based on the R2pseudo statistics calculated in Table 3, it can be said that a high level of good fit was met by the sequential logit model and the independent variables used in the model explain the high number of factors affecting the likelihood of default at different levels of repayment status of the facility. The accuracy of the classification that shows the percentage of the pattern's correct prediction is also given. Moreover, it was proposed as an alternative to the R2pseudo, indicating the proposed template classification's high accuracy. Accordingly, nearly 72 per cent of the likelihood of default changes at different facility repayment status levels is correctly shown by the completed sequential logit model. The positive and negative coefficients indicate the desired independent variable's effect on the dependent variable levels since the coefficients are not interpreted in this model, and only their signs are considered. This means that if a variable's sign is positive, it indicates that the likelihood of being in higher classes increases with the independent variable's increase.

Table 3 shows that the repayment time, supply of raw materials from abroad, branch supervision of granting facilities and average account turnover variables have a positive coefficient, which shows that increasing the value of these variables increases the likelihood that the variable Y dependent is in higher classes. The probability of default is affected positively by these variables. Furthermore, the total amount of customer liabilities, the activity history of the applicant and the combined profit index have negative coefficients according to the Altman z variables table, which shows that as the value of these variables increases, the probability that the dependent variable y is in the lower classes increases.

Table 4 shows the parallel regression test results, which evaluates the rationality of the equality of the parameters. According to this table's results, it is clear that this hypothesis of equality of parameters for all groups in the fulfilled model is logical. Considering the level of significance of the $^{2}$statistic in the parallel regression test, it can be concluded that:

The hypothesis that the coefficients of all groups of dependent variables are the same is confirmed, and in this respect, the sequential logit model has a solid basis.

As noted, the coefficient marks indicating the direction of the independent variable's impact on the probability of the dependent variable (default levels) indicate the default group to which the borrower belongs. In order to evaluate and infer more results from the estimated model, the final effects should therefore be calculated for each of the dependent variable groups, including timely paid facilities, past due facilities, deferred facilities, and doubtful access facilities. The final effect illustrates how the probability of being at various default levels is affected by a unit of change in the independent variables.

Therefore, each of the variables' final effects is calculated for the timely, past due, delinquent and doubtful payment groups. The sum of each variable's final effects for different levels (sum of rows) is zero. This is because the sum of the probabilities for the different classes of default must be equal to one, so the sum of the change in these probabilities is zero in the sense that increasing the probabilities in one category of default means decreasing it in another class. The final effects of Altman z in the group of timely payment of facilities, past due, overdue and doubtful receipts have been calculated equal to 0.331, 0.66, -0.892, -0.099, respectively, which indicates that with increasing z Altman probability The fact that the borrower is placed in the payment classes on time and past due date increases. Moreover, by decreasing Altman z, the borrower's probability will fall into the delinquent and doubtful classes increases. If Altman z is added, the borrower's probability will be in the timely payment group will increase by 0.331 units, and the probability that the borrower will be in the past due group will increase by 0.66 units, and the probability will be in the delinquent and doubtful groups. The decreases of 0.892 and 0.099, respectively. In fact, increasing the Altman z, which is a combination of financial ratios, increases the probability of timely payment of the facility, and decreasing the Altman z reduces the facility's timely payment.

The final effects of the facility's repayment period in the group of timely payment of past due, deferred and doubtful facilities have been calculated as -0.0007, -0.0013, 0.0188, and 0.0021, respectively. It indicates that increasing the facility's repayment period reduces the probability that the borrower will be in the timely and past due classes. As the facility's repayment period increases, the probability that the borrower will be in the delinquent and doubtful classes increases.

If the facility's repayment period increases, the probability that the borrower will be in the facility's timely payment group will decrease by 0.0007 units, and the probability that the borrower will be in the past due group will decrease

by 0.0013 units. The probability will be in the delinquent and doubtful groups. The increases are 0.088 and 0.0021, respectively. Increasing the facility's repayment period reduces the probability of timely payment of the facility and decreasing the facility's repayment period increases the probability of timely payment of the facility.

The final effects of the total amount of the borrower's liabilities before granting the facilities in the group of timely payment of past due, deferred and doubtful receivables facilities are calculated as $4.764e^{14}$, $9.476e^{14}$, $-1.281e^{-13}$, $-1.431e^{-14}$, respectively. It indicates that with increasing the total amount of the borrower's liabilities, the probability that the borrower's facilities will be in the timely and past due categories increases, and with the increase of the borrower's total liabilities, the borrower's likelihood of being in the delinquent and doubtful classes decreases.

If the total amount of the borrower's liabilities increases, the probability that the borrower will be in the timely payment group will increase by $4.764e^{14}$ points, the probability that the borrower will be in the past maturity group will increase by $9.476e^{14}$ units, and the borrower will be in the delinquent and suspicious groups. Access will be reduced by $1.281e^{-13}$ and $1.431e^{-4}$, respectively. Increasing the total amount of the borrower's liabilities increases the probability of timely payment of the facility and decreasing the total amount of the borrower's liabilities reduces the facility's timely payment.

The final effects of supplying raw materials from abroad by the recipient in the group of timely payment of facilities, past due, overdue and doubtful receivables have been calculated as -0.035, -0.069, 0.094, 0.107, respectively, which indicates That is, if the supply of raw materials from abroad increases, the probability that the borrower will be in the timely and past payment classes will decrease. With the increase in the supply of raw materials from abroad, the borrower's probability will be in the delinquent and doubtful classes will increase.

If the activity history of the CEO of the borrowing company increases, the probability that the borrower will be in the timely payment group of the facility will increase by 0.002 units, the probability that the borrower will be in the past due group will increase by 0.0399 units and the probability that the borrower will be in the suspended group. Suspicious access is reduced by 0.0054 and 0.0006, respectively.

The final effects that the facility paying branch has supervised the granting of facilities in the group of timely payment of facilities, past due, deferred and doubtful receipts have been calculated as 0.0511, 0.0156, -0.1023 and -0.102, respectively. This means that with increasing branch supervision on granting facilities, the probability that the borrower will be in the payment and past due classes will increase and with increasing branch supervision on granting facilities, the probability that the borrower will be in the delinquent and doubtful classes will decrease.

The final effects of the combined index of interest on facilities and default penalties in the group of timely payment of facilities, past due, delinquent and doubtful receipts have been calculated equal $-3.77e^{12}$, $-7.507e^{12}$, $1.015e^{11}$, $1.133e^{12}$, respectively. It indicates that by increasing the interest rate of facilities and default penalties, the probability that the borrower will be in the timely and past due classes will decrease, and by increasing the interest rate of facilities and default penalties, the probability that the borrower will be in the delinquent and doubtful classes will increase.

Suppose the interest in the facility and the default fines increase. In that case, the probability that the borrower will be in the timely payment group of the facility will decrease by $3.77e^{12}$, the probability that the borrower will be in the past maturity group will decrease by $7.507e^{12}$, and the probability of the borrower in the delinquent and suspicious groups will decrease. The gain increases to $1.015e^{11}$ and $1.133e^{12}$, respectively. Increasing the interest and penalties for defaulting of the facility reduces the possibility of timely payment of the facility and decreasing the interest and penalties for defaulting the facility increases the probability of timely payment of the facility.

## CONCLUSIONS AND RECOMMENDATIONS

Since the problem of non-payment on time and default of banking system facilities has been increasing in recent years, and the above problem causes credit risk in the banking system, it is necessary to pay more attention to managing credit risk and select lower-risk customers for factors that increase probability. Eight characteristics of borrowers were analyzed in this study, namely z-Altman, the repayment period of the facility, the total amount of customer obligations before granting the facility, the history of the borrower, the supply of raw materials from abroad, the supervision of the paying branch Facilities for granting facilities, the combined facilities interest and default penalties index, the average interest rate and the default penalties. This study also classified the variables into four groups: timely payment of facilities, past due facilities, deferred facilities, doubtful facilities, which according to the statistics in the banking system, almost 70 per cent of past due facilities eventually lead Paid and 30 per cent of past due facilities enter the overdue and doubtful classes. The conduct of past due facilities is closer to the conduct of timely payment.

The sequential logit model results show that the borrower's probability will be in the timely and past due classes increasing Altman z. With decreasing z Altman, the borrower's probability will be in the delinquent and questionable classes increases. Therefore, it is suggested that financial experts pay close attention to the financial ratios that make up Altman z before granting the facility to banks and branch managers because the low ratios of these ratios increase the probability that the customer will

be in the suspicious and delinquent categories. Also, if the facility's repayment period increases, the borrower's likelihood will be in the timely payment group or past due date will decrease, and the likelihood that the borrower will be in the delinquent and questionable groups will increase. Furthermore, to avoid granting as much as possible to long-term facilities for 4 or 5 years. Besides, increasing the total amount of the borrower's liabilities before the facility's granting increases the likelihood of timely payment of the facility and decreases the likelihood of timely payment of the facility by decreasing the borrower's total amount liabilities before the granting of the facility. This seems logical because customers with more credit capacity and better credit status have succeeded in obtaining facilities and have increased their obligations, so it is suggested that it should be a priority for the bank to grant facilities to customers with more credit capacity.

The results of the model show that increasing the facility recipient's activity history increases the probability of timely payment of the facility and decreasing the activity history of the facility recipient reduces the probability of timely payment of the facility. Recipients of grant facilities. Also, increasing the supply of raw materials from abroad reduces the possibility of timely payment of facilities and reducing the supply of raw materials from abroad increases the possibility of timely payment of facilities. The result seems logical given that Iran, despite the currency fluctuations and international sanctions, is facing a de facto restriction on the process of opening a foreign exchange LC and financial dealings with the outside world. Therefore, it is suggested that granting facilities to producers with domestic raw materials be a priority. Besides, increasing the branch's supervision over the granting of facilities increases the probability of timely payment of the facility and decreasing the branch's supervision over the granting of facilities reduces the possibility of timely payment of the facility. Therefore, branch supervision on the provision of various facilities is recommended. Also, increasing interest and penalties for defaulting facilities reduces the possibility of timely payment of facilities, and reducing interest and penalties for defaulting facilities increases the probability of timely payment of facilities. Therefore, it is suggested that to improve the situation of banks' claims, the Central Bank and the Ministry of Economic should reduce the rate of bank facilities while reducing inflation, thereby reducing part of the overdue bank claims. Finally, a higher average balance of the borrower's account before granting the facility increases the facility's likelihood of timely payment. A lower average balance of the borrower's account before granting the facility reduces the facility's likelihood of timely payment. Therefore, it is suggested that the borrower's account's average balance be commensurate with the number of facilities requested by the bank decision-makers in granting the facilities.

## REFERENCES


Agbeko D., Blok V., Omta SWF., and Van derVelde G. (2016). Entrepreneurial and businessskills and loan repayment rates ofmicrofinance debtors in Ghana. *Journal ofDevelopmental Entrepreneurship*. 21(4):12.

Al Mamun, A., Abdul Wahab, S., Malarvizhi, C.A. and Mariapun, S. (2011). Examining the critical factors affecting the repayment of microcredit provided by AmanahIkhtiar Malaysia. *International Business Research*, 4(2):93-102.

Altman E.I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of finance*, 23(4):589-609.

Angaine, F., and Waari, D. N. (2014). Factors influencing loan repayment in Micro-Finance Institutions in Kenya. IOSR *Journal of Business and Management* (IOSR-JBM), 16(9): 66-72.

Akmal, M., and Saleem, M. (2008). Technical efficiency of the banking sector in Pakistan. SBP Research Bulletin, 4(1):61-80.

Asadi G.H. (2012). Factors affecting the credit risk of customers of commercial banks (case study of Tejarat Bank, Neka, Mazandaran).Master Thesis. Faculty of Economics, Mazandaran University. (in Persion with English abstract)

Astawa, I. (2018). The Impact of Harmonious Culture and Entrepreneurship Training on Loan Repayment Performance at Microfinance in Indonesia. APMBA (Asia Pacific Management and Business Application), 6(3): 137-148.

Ayuso, M. and Santolino, M. (2007). Predicting automobile claims bodily injury severity with Ordered orderedlogit models. Insurance: Mathematics and Economics, 41(1):71-83.

Bahrami A.H., and Bagheri M. (2013). The legal relationship between the founder and the publisher in the leases, Murabaha and Mudaraba.Bi-Quarterly Journal of Civil Rights Science, 2(1):50-62. (in Persion)

Chizari A.H. and Zare A. (2001). Investigation of the effects of credits allocated to the agricultural sector of Mazandaran province by Melli and Keshavarzi banks. *Journal of Agricultural Economics and Development*, 8(32):69-92. (in Persian)

Dolatkhah, R., and Badie A. (2016). The study of the factors affecting the possibility of non-repayment of Mehr housing facilities (a case study of the Maskan Bank of West Azerbaijan). The Third International Conference on Management Challenges and Solutions, Shiraz, Iran. (in Persion with English abstract)

Elahi N., Mahdavi M., Komijani A., and Dadjooy T.A. (2019). The Effects of real and monetary-financial variables on bank deposit interest rates. Financial Economics, 13(46): 1-24. (in Persion with English abstract)

Ghadermazy H. (2015). Strategic employment development planning in rural areas of Javanrood city. *Quarterly*

*Journal of Space Economy and Rural Development*, 4(11):109-130. (in Persion)

GhahramanZade M., Pishbahar E., Einelahi M., and Ferdowsi R. (2016). Identifying the factors influencing the receipt of charges of Keshavarzi Bank in Maragheh city: Ordered Logit model approach. *Iranian Journal of Agricultural Economics and Development Research*, 47(1):47-55. (in Persion)

Hakimi pour N. (2018). Assessing how influential banking factors affect non-current claims of Iranian banks) Dynamic panel model approach. Financial Economics, 12(42), 99-120. . (in Persion with English abstract)

Hayati, B., Pishbahar, A. and Haghjoo, M. (2012). Analyzing determinants of consumers' willingness to pay a premium for pesticide-free fruit and vegetables in Marand city. Agricultural Economics & Development, 25(4):469-479. (in Persion)

Karimi M.Z., Asadi G.H., and Gilak H.M. (2016). Factors Affecting Credit Risk of Customers of Commercial Banks (Case Study: Tejarat Bank, Neka – Mazandaran). Monetary, Financial Economic research, 22(10):206.(in Persion)

Koopahi M. (2002). Factors Affecting Agricultural Credit Repayment Performance: Using of Discriminatory Analysis Function. *Iranian Journal of Agriculture Science,* 33(1):11-19. (in Persion with English abstract)

Lin, S. L. (2009). A new two-stage hybrid approach of credit risk in banking industry. Expert Systems with Applications, 36(4):8333-8341.

Maddala, G. S. (1991). Introduction to econometrics. 2nd edition. New York: Macmillan.

Mehae A. (2017). Using AHP in identifying and ranking factors affecting overdue receivables in Melli Bank of Iran in Mazandaran. Master Thesis. Faculty of Human Science of Amol Institute of Higher Education. (in Persion with English abstract)

Mehrara M., Tavakolian H., and Rahmani A. (2017). The role of economic fluctuations on bank lending facilities through the bank's additional capital channel. Financial Economics, 10(37): 1-16. (in Persion with English abstract)

Moshiri S., and Nadali M. (2013). Identification the factors influencing the banking crisis in the Iranian economy. *Journal of Economic Research*, 13(48):1-27. (in Persion)

Naji E.A, and Rastegar M.A. (2019). Estimation of credit risk of customers using multi-dimensional analysis of preferences (Case study: a commercial bank in Iran). *Journal of Economic Modeling Research,* 4(44): 143-161. (in Persian)

Oreski, S., Oreski, D., and Oreski, G. (2012). Hybrid system with genetic algorithm and artificial neural networks and its application to retail credit risk assessment. Expert systems with applications, 39(16):12605-12617.

Pai, C. W. and Saleh, W. (2008). Modeling motorcyclist injury severity by variouse crash types at T-junctions in the UK, safety Science, 46(8):1234-1247.

Psillaki, M., Tsolas, I. E., and Margaritis, D. (2010). Evaluation of credit risk based on firm performance. *European Journal of Operational Research*, 201(3): 873-881.

Ravanbakhsh M. (2014). The study of the factors affecting the deviation of bank facilities and the effect of this deviation on the creation of overdue receivables; (Case study: Saderat Bank branches in Zahedan). Master Thesis. Faculty of Management and Economics, Sistan and Baluchestan University. (in Persion with English abstract)

Shahnoushi, N., Firouzzareh, A., Zhalerajabi, M., Daneshvar, M. and Dehghanian, S. (2012). The use of the order logit model in an investigation of the effective factors on bread waste. *Journal of Economics Research,* 46(3):111-132. (in Persian)

ShirinBakhsh Sh., Yousefi N., and GhorbanZad J. (2012). Studingthe factors affecting the probability of non-repayment of bank credit facilities (Case study of legal customers of Iran Export Development Bank). Financial Knowledge of Securities Analysis, 4(12):111-137. (in Persion)

Yadollahzade T.N., Memarian E. and Nasiri A. (2014). Identification The Factors Affecting The Probability of Non- repayment of Bank Credit Facilities. *Journal of Economics and Business Research*, 5(7):15-28. (in Persion with English abstract)

Yousefi N. (2010). Studingthe factors affecting the probability of non-repayment of credit facilities of banks; (Case study: Legal customers of Export Development Bank of Iran). Master Thesis. Faculty of Economics and Accounting, AlZahra University.(in Persion with English abstract)