# The impact of modern credit risk management methods on loan reduction Troubled Banking

# أثر الأساليب الحديثة لإدارة مخاطر الائتمان على خفض القروض

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## *Abstract:*

*This study aims to identify the various risks faced by financial institutions so that credit risk is currently one of the significant concerns of banks and the main risk to banks in non-performing bank loans. One of the most important findings of the study was that the Bank's internal classification approach could be applied to credit risks, and the study found that the method could be applied in such a way as to reduce potential risks. The study also demonstrated that this method produces very encouraging results that reduce potential risk.*

***Keywords:*** *risk management; Non-performing loans, credit risk.*

***Jel Classification Codes*** *: M29, M49*

**ملخص:**

تهدف هذه الدراسة الى معرفة مختلف المخاطر التي تواجهها المؤسسات المالية بحيث تمثل المخاطر الائتمانية في الوقت الراهن أحد أهم اهتمامات البنوك ويمثل الخطر الرئيسي للبنوك في القروض البنكية المتعثرة، ومن أهم النتائج التي توصلت إليها هذه الدراسة بالإمكان تطبيق منهج التصنيف الداخلي بالبنك فيما يخص المخاطر الائتمانية، كما توصلت الدراسة الى محاسن تطبيق هذه الطريقة بحيث تساهم في الحد من مخاطر المحتملة. وكذلك أثبتت الدراسة أن هذه الطريقة تعطي نتائج مشجعة جدا من شأنها أن تقلل من حدة المخاطرة المحتملة.

**الكلمات المفتاحية:** ادارة المخاطر؛ القروض المتعثرة، المخاطر الائتمانية

**تصنيف JEL**: M49, M29

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***Introduction***

*Credit risk is the most severe risk facing the banking, especially in continuous technological development and deregulation of banking activities.*

*Although the risk is a potential event that can be achieved suddenly without the will of the enterprise or the individual borrowing, resulting in losses for both parties and perhaps not materialized, In any case, these risks must be done because they have severe effects on banks that could lead to collapse and bankruptcy.*

*Besides, these risks' failure must be hardened assessed are among the first reasons why some bank clients have failed and have stopped paying .it is part of a wide range of reasons that fall within the framework of credit-grant controls and controls.*

*It requires banks to take action and measures to manage and control bank risk in the best manner, to reduce non-performing loans and thus reduce losses.*

***The Research Problem:*** *The problem of the study revolves around the following:*

***How have modern risk-management methods affected NPLs?***

1. ***Study hypotheses:*** *The hypotheses of the study are:*
   - *There is a moral relationship between the non-accounting variables and the risk of loan failure at the bank in question;*
   - *Studying whether there are significant differences between the averages of the accounting variables for the healthy and deficient institutions in the bank under study;*
   - *A revised form can be built on accounting and non-accounting variables at the bank in question;*
   - *The primary internal classification curriculum can be applied to the bank in question.*
2. ***Previous studies:***
   a. ***The study of Samir Ait Akkash 2013****: The study aimed to identify the precautionary rules that reduce credit risks, compare them to those issued by the Basel Committee, and determine the most critical modifications available Algerian banking system. Basel Committee standards to reduce banking risks are applied. The study was at the level of the banking sector.*

*One of the researcher's actual results is that the Algerian banks use the Cock Rate, which covers only the loan risk without the other dangers. The study also found that the rewards offered on financial, market activities have contributed to an increase in the degree of risk and that international credit rating agencies have contributed to the realization of risk and the occurrence of crises for failing to assess the real risk. (Akash)*

b. ***Fatima Bin Shana 2010 Study**: Through the study, the researcher aimed to highlight risk management's general framework and its role in activating financial and credit analysis tools to reduce banks' distressed debts. The study also aimed at attempting to understand and analyze the Basel Committee's standards and its contribution to supporting the procedures and measures needed to control risk management, and the extent to which they influence the activation of supervisory mechanisms in bank supervision and strengthening their ability to face the risks of bank loan faltering. Based on BEA-a-Work by files from 2004-2008 for 10 SME files.*

   *Using the results obtained from the discriminatory analysis, the researcher has assessed the basic parameters of the internal classification method: Estimating the probability of stumbling, estimating the losses caused by the stumbling, estimating the value of the loan at the stumbling, and thus managing the expected losses and classifying the borrowing institutions. (Shana, 2010.)*

c. ***Yousef Suwar's 2008 study:** The study aims at studying the modern tools that allow banks to control the operation of the loan risk by studying the extent of the help of the modern methods through the drip loan and the technology of artificial neural networks. One of the most important results achieved by the researcher is the possibility of generalizing the technique of artificial neural networks in Algerian banks; to run the risk of a loan that reached 100%, and to facilitate and accelerate the decision-making process regarding the granting of loans, and the same thing as the way of the drip loan, as the model accuracy of the latter reached 96.2%. The model was built on two non-accounting variables: The age of the enterprise and the age of its dealings with the bank, as well as 04 accounting variables. (Souwar)*

d. ***Study of Faris Mahmoud Abu Mu'ammar 2006:** This study aimed to identify one of the most dangerous banking phenomena that banks operating in the Palestinian banking system are exposed to, namely, the phenomenon of defaulting credit*

*facilities. The study concluded that there is a commitment by banks operating in the Gaza Strip to the instructions of the Palestinian Monetary Authority regarding the formation of allocations to face stumbling and that they carry out a periodic inspection on all bank records and files. (Mu'ammar, 2006.)*

e. ***Study of Jamal Hussein Abu Obeid; 2003:*** *The study aims to analyze the development of this problem in commercial banks and analyze the relationship between non-performing loans' problems on the one hand and the macroeconomic indicators and some banking indicators on the other. One of the most important findings of the study was that the stumbling rates during the researcher's study (1993-2001) were increasing and increasing, reaching 8.3 in 1995, reaching 22.7 in 2001. (Jamal Hussein Ahmad Abu Obeid)*

*f.* ***Study Altman Edward, 1994:*** *Studying whether there are significant differences between the averages of the accounting variables for the healthy and deficient institutions in the bank under study. Financial ratios were based on model construction, several neural networks were tested in different ways, and 800 Italian institutions were studied. The rating findings for industrial neurons were 97% for institutions with deficits and 97.7% for good institutions. (Altman Edward I, May 1994.)*

*Past studies are questioned in terms of similarities and differences, as well as the valuation of strengths and the extent to which they benefit from them, and the presentation of weaknesses:*

*The Jamal Hussein Abu Obaid 2003 study and the Fares Mahmoud Abu Muammar 2006 study were similar to the reality and causes of non-performing bank loans, although the studies were in different Arab countries. The Samir et Akash 2013 study did not differ. The only point of difference was to address the topic in its general descriptive framework but under the decisions of the Basel Committee.*

*Each of the previous studies formed a building block for a perception of the theoretical structure of the subject.*

*For the Taman Study 1994, it differed from the Yusuf Sawar Study 2008 at another point; that is when he compared the drip loan with the industrial neural networks, which Yusuf Zawar 2008 tried to do, but small sample size compared to the Taman 1994 sample.*

*Although the classification ratios in the Yusuf Swarw8 study are similar and even more so than in the Altman 1994 model, these ratios in Yusuf Swarwar may be misleading because of the small size of the sample.*

*We note that the variables involved in the models are different depending on the type of loans processed, the input of the variables, the nature of the variables, and the extent to which they are linked to each other.*

*The studies mentioned above on the drip loan were a valuable tool in building the discrimination function model. However, it was not so much the primary objective as a step towards applying the basic internal classification approach to the bank in question, which corresponds to the Fatima Ben Shinnah study of 2010, with differences in the number of files studied, of which 55 were valid, and ten were impotent.*

## 3. First axis: The theoretical framework of credit risk

The expansion and diversification of credit supply have resulted in complications and an increase in the risks associated with its granting. To deal with this change and the associated risks, it has become necessary to pay attention to credit risk management. It has been proven in many studies that there is no credit without risk, regardless of the guarantees presented, as the risk is inherent to it and does not leave it. (Bouguerra, 6-7 June 2005)

In recent years, repeated bank failures and crises have underscored the importance of managing credit risk, so the Bank is obliged to face and manage it in a good, sound, and effective manner.

**3.1 The credit risk concept:** The banking literature identifies the risk of the bank being exposed to unexpected and unexpected losses and / or fluctuating revenues expected from a particular activity. This definition reflects the view of internal auditors and the Bank's management about the negative effects of potential future events on the Bank's achievement of the objectives outlined and the successful implementation of its strategies. (Al-Karasanah, 2006, )

As far as credit risk is concerned, it may be defined as potential losses due to customers' failure or inability to repay in full or on time what they owe to the bank. (Amin, 2002)

Credit risk is a potential loss resulting from the customer's inability to pay the principal amount and its interest to the bank on the maturity date specified in terms of the credit contract; such risks include in-budget items such as loans and bonds and extra-budgetary items such as letters of guarantee and documentary credits. (Meftah walid)

Credit risk is also defined as a potential loss to be affected by its insured conduct and not to be faced by the debtor. It affects the grantor of credit, not only the credit submission process but continues until the full amount agreed upon has been collected and is the principal cause of

the debtor for its failure or inability to return the asset and its benefits. (Hamza Mahmoud al-Zubeidi)

**4.2 The effects of credit risk**

Among the effects of credit risk realization are:

**a) Credit faltered:** As the risk is intended to be that the debtor may not repay its loans to the bank under the terms of the contract between the parties, credit failure is the debtor's failure to repay its loans.

Therefore, the risks that might have occurred have already occurred, and the problem of non-payment already exists, as if all banks, without even the successful ones, are at risk that the bank limits to the calculation of bad debt.

**b) Bank failure:** Bank studies have shown that the most factors leading to a growing number of failed banks are the credit risk transactions that the bank provides to its customers, and if we want to put in place reasons for banks' failure, these are the same reasons for credit failures. (Hussein, 17-18 April 2007,)

**4.3 Types of credit risk**

Credit risk can occur because of unforeseen circumstances and variables arising from the customer's inability to pay and total incapacity, with adverse effects on the bank and its various transactions, and overall the crucial credit risk can be found in:

**a. The risk of default:** The risk of default is the possibility of a default which is the failure of a payment obligation; breach of an agreement, legal process, economic default; the default, is declared when no scheduled payments are made less than three months after the date of payment and a breach of an agreement. (Hammad, 2007)

This is the most damaging risk because it expresses a final or partial deficit for the customer after all the nice collection and judicial appeals have been exhausted, which in turn causes a total or partial loss to the credit-giving bank. (Brouziane, 1994)

The risk of default is measured by the likelihood that a default will occur during a specific period and depends on the customer's credit position. Several factors and the probability of default cannot be measured directly but by default cases' historical statistics.

Such data are collected internally or obtained from rating agencies or central authorities, and from observable default statistics, the proportion of default cases can be derived over a period to the total sample of borrowers.

The default definition is vital in estimating the probability of payment from historical records. for example, the rating agencies consider that a default occurred when there was no payment

for at least three months. Different default events do not necessarily lead to an immediate loss but increase the likelihood of a final default (bankruptcy). (Brouziane, 1994,)

**b. The risk of exposure:** The prevailing uncertainty about future risks generates the risk of exposure or so-called exposure risk. For some types of credit, there is no supply risk soon; Credit is payable within a contractual time-frame so that future outstanding balances are known in advance, except in the case of advance payment; for all credit lines with a pre-payment schedule, exposure risks can be considered small or minor.

Project funding implies a lack of certainty in the schedule of outflows and payments; in general, all non-balance-sheet items and future exposures can be generated; In some cases, the likelihood of future exposures is not significant, also when the bank is committed to providing credit up to an absolute ceiling according to the customer's needs. (Brouziane, 1994,)

**c. Recovery risk:** Recovery in the event of a default cannot be entirely determined, Depending on the guarantees received from the customer requesting credit and their quality at the time of the default, which can be the warranty risk or the third-party warranty risk:

d. **Warranty risk:** The existence of collateral minimizes credit risk if it can be easily disposed of and sold at a great value - the possibility of liquefaction of the warranty - a common way of mitigating credit risk. There are many types of guarantees of monetary guarantees, the security of financial assets, security of property..

When using the warranty, the risk becomes twofold; first, there is a lack of certainty as to the ability to access and dispose of the warranty at the sale and the costs required, and secondly, there is uncertainty about its value, which depends on the market and the nature of the warranty, which can be easy or difficult to sell. The security risk is zero in monetary guarantees and derived from market risks when assets transferred to securities, which are traded in a market and derived from assets' nature in other cases. In essence, using security to mitigate credit risk converts credit risk into a recovery risk plus the risk of security value. (Hammad, 2007)

e. **Third-party warranty risks**: Guarantees are emergency expenses given to the bank by a third party other than the bank and the customer. The head of a group can commit to paying instead of one of its subsidiaries because the latter cannot pay. When the third-party warranty is easily enforceable, it converts the client's credit risk to credit risk on the guarantor.

## 4. Second axis: A field study

In this regard, we are trying to apply one of the modern methods of managing credit risk, the primary internal classification method. The first step in this approach is to estimate the risk of stumbling for each organization that wants to obtain credit from the studied sample.

The Basel Committee has left banks free to choose the appropriate mechanism for assessing stumbling prospects, either by experience, historical information or through statistical models for predicting stumbling. In our study, we relied on the drip method to estimate the likelihood of institutional stumbling.

However, before starting to estimate the drip model by relying on financial ratios (accounting variables*), we examine whether there are significant statistical differences between incompetent institutions (the risk of loan failure) and sound institutions attributable to non-accounting variables.

We note that the sample size of the bank's files in question is 55 institutions (n=55), of which 45 are sound, and ten are powerless.

### 4.1 First, a descriptive study of the non-accounting variables and the risk of loan impairment.

A detailed descriptive analysis of the risk of loan impairment and some non-accounting variables are concerned in this element.

#### a. Study the risk of stumbling and the age of the institution

**Table 1. Distribution of sound and infirm institutions by age variable**

| Statement | Less than 15 years | | more than 15 years | | Total | |
|---|---|---|---|---|---|---|
| Organization | f1 | % | f2 | % | N | % |
| Incompetent institutions | 04 | 7.2 | 06 | 10.8 | 10 | 18,2 |
| Sound institutions | 08 | 14.4 | 37 | 66.6 | 45 | 81,8 |
| Total | 12 | 21.6 | 43 | 77.4 | 55 | 100 |

**Source:** Schedule set up based on program output (SPSS.22). fi: Actual iterations

According to the results described above, we note that enterprises under 15 have recorded a stumbling rate of 7.2% of total enterprises and 40% of those in trouble. As for enterprises over 15 years old, the ratio of distressed enterprises to entire enterprises reached 10.8%, and 60% among the distressed enterprises, which contradicts the reality that the higher the

enterprise's life, the lower the risk the loan's failure to reflect the young enterprises. This incompatibility could be attributed to the small size of the sample of incompetent institutions.

To ensure that there is a moral relationship between the life of the borrowing enterprise and the risk of loan failure, we use a test (KHI-Deux) *, based on the following hypotheses:

- $H_0$: There is no moral relationship between the life of the enterprise and the risk of a loan failure;
- $H_1$: There is a moral relationship between the institution's life and the risk of a loan failure.

To verify the validity of the hypothesis, we extract the probability value from the Statistical Analysis Program (SPSS) based on a test (khi-Deux), and compare it to the α morale level of 5%; if this value is more significant than 0.05, accepts the equation H0, which means that there is no relationship, and in the opposite case we accept H1, which indicates that there is a relationship between the variables. The results are in the following table:

**Table 2. Test Results (Khi-Deux) for the relationship between the organization's statement and its age**

| Significance level | Degree of freedom | Value | |
|---|---|---|---|
| 0,124 | 1 | 2,369 | Quai Pearson test |

**Source:** Schedule set up based on program output (SPSS.22).

The results shown in the table show that SIG=0.124>0.05, so we accept the zero hypothesis, i.e., there is no relationship between the enterprise's age and the risk of loan failure.

**b. Examining the risk of stumbling and the legal shape**

**Table 3. Distribution of sound and infirm institutions by legal form**

| Statement | SARL | | EURL | | SNC | | SPA | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| Organization | f1 | % | f2 | % | f3 | % | f4 | % | N | % |
| Incompetent institutions | 07 | 12,7 | 00 | 00 | 01 | 1,8 | 02 | 3,6 | 10 | 18,2 |
| Sound institutions | 21 | 38,2 | 04 | 7,3 | 01 | 1,8 | 19 | 34,5 | 42 | 81,8 |
| Total | 28 | 50,9 | 04 | 7,3 | 01 | 3,6 | 21 | 38,2 | 55 | 100 |

**Source:** Schedule set up based on program output (SPSS.22). fi: Actual iterations

The results shown in the table above show that incompetent institutions are more concentrated in limited liability companies, with 70% of non-performing loans and 12.7% of total loans.

To examine whether there is a relationship between the legal form and the risk of loan failure, we also adopt a test (KHI-Deux), but since the number of theoretical (expected) iterations, in

this case, is less than five (with a significant rate of 62.5%), we have not been able to ascertain the meanings of this relationship.

**c. Examine the risk of stumbling and the number of partners**

**Table 4. Distribution of sound and infirm institutions by changing the number of partners**

| Statement | ]3-1] | | 3 and over | | total | |
|---|---|---|---|---|---|---|
| Organization | f1 | % | f2 | % | N | % |
| Incompetent institutions | 03 | 5.4 | 07 | 12.6 | 10 | 18,2 |
| Sound institutions | 37 | 66.6 | 08 | 14.4 | 42 | 81,8 |
| Total | 40 | 72 | 15 | 27 | 55 | 100 |

**Source:** Schedule set up based on program output (SPSS.22). fi: Actual iterations

Through the results described above, we note that non-performing loans are more concentrated in organizations with more than 03 partners, 70% of non-performing enterprises, and 12.6% of total enterprises, Followed by organizations with between one owner and three partners with 5.4% of total institutions and 30% of distressed institutions.

To see if there is an honest relationship between the changing number of partners and the risk of loan failure, we note the following table:

**Table 5. Test Results (KHI-Deux) for the relationship between the organization's statement and the number of partners**

| Significance level | Degree of freedom | Value | |
|---|---|---|---|
| 0,002 | 1 | 11,250 | Quai Pearson test |

**Source:** Prepared by researchers based on program output (SPSS.22).

With the results shown in the table above, we note that SIG=0.002 less than 0.05, and therefore, we infer the validity of the alternative hypothesis, which means that there is a relationship between the variable number of partners and the risk of loan failure.

**d. Study the risk of stumbling and activity**

**Table 6. Distribution of sound and infirm institutions by activity sector variable**

| Statement | Industrial sector | | Commercial sector | | Service sector | | total | |
|---|---|---|---|---|---|---|---|---|
| Organization | f1 | % | f2 | % | f3 | % | N | % |
| Incompetent institutions | 09 | 16,4 | 00 | 00 | 01 | 1,8 | 10 | 18,2 |
| Sound institutions | 41 | 74,5 | 03 | 5,5 | 01 | 1,8 | 42 | 81,8 |
| Total | 50 | 90,9 | 03 | 5,5 | 02 | 3,6 | 55 | 100 |

**Source:** Schedule set up based on program output (SPSS.22). fi: Actual iterations

We note the concentration of distressed enterprises in the industrial sector at 90% of distressed enterprises in the sample and 16.4 enterprises through the results shown. The rest of the distressed institutions were in one institution's service sector, with 10% of non-performing loans.

We were unable to ascertain the meanings of the relationship between the activity sector variable and the risk of a loan stumbling as the percentage of the cells with a theoretical number of iterations less than five by 66.7%.

**e. Triage and seniority risk study ***

**Table 7. Distribution of sound and infirm institutions by seniority variable***

| Statement | Less than 15 years | | more than 15 years | | Total | |
|---|---|---|---|---|---|---|
| Organization | f1 | % | f2 | % | N | % |
| Incompetent institutions | 06 | 10.8 | 04 | 7.2 | 10 | 18,2 |
| Sound institutions | 15 | 27 | 30 | 54 | 45 | 81,8 |
| Total | 21 | 37.8 | 34 | 61.2 | 55 | 100 |

**Source:** Schedule set up based on program output (SPSS.22). fi: Actual iterations

Through the results of the schedule, we note that the most stumbling loans are loans granted to institutions with seniority of fewer than 15 years with 60% of non-performing loans and 10.8% of the total sample size through the schedule results. Followed by the other category with seniority over 15 years, with 40% of non-performing loans and 7.2% of total loans.

The Moral relationship's existence was tested for the seniority variable and the risk of a loan's failure, and the results were according to the following table:

**Table No. (08): Test Results ( KHI-DEUX) for the relationship between the enterprise statement and the seniority variable**

| Significance level | Degree of freedom | Value | |
|---|---|---|---|
| 0,116 | 1 | 2,465 | Quai Pearson test |

**Source:** Prepared by researchers based on program output (SPSS.22).

From the table results, we note that the value of SIG=0.116>0.05 and therefore accept the lentil hypothesis, which means that there is no meaningful relationship between this variable and the risk of loan failure.

**5.2 Estimates the drip form function**

Our use of the drip method (discriminatory analysis) is intended to assess the risk of stumbling for each of the institutions in question; We have used a set of accounting variables: 13 accounting*2 extracted from the documents obtained from the bank in question, which is shown in table (09):

**Table 9. Accounting variables approved in the study*3**

| Ri | Ratio | How they are calculated | Ratio Type |
|---|---|---|---|
| R1 | Working capital | (Permanent funds/fixed assets) x 100 | Treasury ratios |
| R2 | Working capital needs | (Tradable – ready values) / (Short-term debt - Disorders Treasury) x 100 | |
| R3 | Treasury ratio | (Working capital/working capital needs) X 100 | |
| R4 | Asset owning allowance ratio | (Depreciation / Total assets) x 100 | Ratios of the financial structure |
| R5 | Financial independence | (Private funds/medium- and long-term debt) x 100 | |
| R6 | Public liquidity ratio | (Current assets/short-term debt) x 100 | |
| R7 | Ratio Liquidity risk | (Net assets / raw Total assets) x 100 | |
| R8 | Exploitation risk ratio | (Working capital/ inventories +realized) x 100 | |
| R9 | Percentage of user expenses | (User expense / value added) x 100 | Activity ratios |
| R10 | Percentage of expenses Finance | (Fee/value added) x 100 | |
| R11 | Financial rate of return | (Net score/Special funds) x 100 | Yield ratios |
| R12 | The general rate of return | (Net Score/Business number) x 100 | |
| R13 | The economic rate of return | (Total utilization surplus/ (total assets + current deductions) x 100 | |

**Source:** The schedule was prepared based on documentation provided by the bank.

[2] These percentages were not randomly selected, but we chose these percentages after we surveyed the Bank of Agriculture and Rural Development level represented by the M'sila Agency, which is also supported by two other banks, the Algerian Foreign and the Local Development Bank.

[3] For the accounting variables adopted in the study, the loan files we have had three-year financial lists for use in the study are weighted as follows: Year N-1 is a weighted factor of 50%, year N-2 is a weighted factor of 30%, and year N-3 is a weighted factor of 20%.

**1- Verify the assumptions underlying the discriminatory analysis method**

This method is based on a set of assumptions that must be met by accounting variables (independent variables) to start the analysis, and these assumptions are:

- The sample should be a random sample rather than a sample mean, and this assumption is not verified in the sample (files for the 55 institutions);
- That the variables under consideration be independent and have varied to varying degrees, and that assumption is in the sample;
- Each view in each sample can be described and determined by a set of measures, all variables measured by specific values, and this assumption is satisfied with the sample, as shown in table N°. (09);
- The sample in question represents statistical communities of natural distribution, where any variable is typically distributed in each sample. However, the independent variables' results indicated that not all variables follow the normal distribution, using a test (Shapiro-Wilk) because the number of vocabulary in the sample is less than 50 (45 sound institutions and 10 faltering institutions). We note that, beyond some of the assumptions of this method, this will not significantly affect the results since the construction of the differentiation function model is not sensitive to these conditions;
- The variables in question vary by looking at the averages (assuming they are not equal). To verify this condition, we use the Mann-Whitney**4 test, based on the following hypotheses:

**Table 10. The hypothesis is equal to the average for sound and ineligible institutions**

| **Ri** | | **Sig.** |
|---|---|---|
| R1 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R1.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R1. | 0,443 |
| R2 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R2.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R2. | 0,445 |
| R3 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R3.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R3. | 0,861 |
| R4 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R4. | 0,029 |

*Compares two separate groups and is used if the two groups do not follow the normal distribution or one of them.

| | | |
|---|---|---|
| | $H_1$, there are differences of statistical significance Between the right and infirm institutions in R4. | |
| R5 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R5.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R5. | 0,176 |
| R6 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R6.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R6. | 0,896 |
| R7 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R7.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R7. | 0,014 |
| R8 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R8.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R8. | 0,844 |
| R9 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R9.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R9. | 0,381 |
| R10 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R10.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R10. | 0,006 |
| R11 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R11.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R11. | 0,045 |
| R12 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R12.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R12. | 0,239 |
| R13 | $H_0$ there are no statistically significant differences between sound institutions, And the independence is in R13.<br>$H_1$, there are differences of statistical significance Between the right and infirm institutions in R13. | 0,001 |

**Source**: Schedule set up based on program output (SPSS.22).

The decision rule for this test is a comparison (SIG) with the significance level of 0.05, where **if**

0.05> (SIG). We accept the hypothesis H0, which is equal to the mean of the two groups and vice versa.

To determine whether the two groups have differences, we note the value of Mann-Whitney and the corresponding level of morale, and from the results of this test, we note that the value of SIG for rational R12, R9, R8, R6, R5, R3, R2, (R1 is greater than the level of the certified

significance (0.05). Therefore, we accept the zero hypothesis that there are no statistically significant differences among the average sound and infirm institutions.

While the R4, R7, R10, R11, (R13) were statistically significant among the healthy and insignificant enterprise averages because they are Sig <0.05, we accept their alternative hypotheses and reject the zero.

- There is no correlation between ratios (independent variables) in the differentiation function's composition to interpret the results and determine the relative contribution of each ratio to the overall discriminatory force. To ensure that the ratios do not relate to the correlation matrix between the ratios in which the assumption that the averages are not equal is R4) R7, R10, R11, (R13) through the findings, we note that there is a weak correlation between ratios, as well as nonsense except the link between R7 and R11. However, it remains weak, which means that all these ratios have abandoned the correlation problem and thus say that this assumption is correct in the sample.
- Differentiation analysis function assumes matrix homogeneity of common variances because the log determinant values are assumed to be relatively equal to all groups. To verify this, we observe Box's test used to test the homogeneity of the hypothesis of common variation matrices, and the results are shown in Table 11:

**Table 11. Box testing of the Uniformity of the common variations Matrix**

| Sig. | ddl2 | ddl1 | Approx | Box Test |
|---|---|---|---|---|
| 0.000 | 3465,505 | 3 | 32,797 | 107,403 |

**Source:** Schedule set up based on program output (SPSS.22).

We note from the table that SIG=0.00, which means that there are differences between the two sets of differences, but this test is susceptible when the variables are not naturally met, and it is known that this method is not sensitive to heterogeneity, so that we can proceed with the analysis.

In sum, we say that we can build the differentiation function based on the drip method to satisfy the assumptions needed to perform analysis in a set of ratios (R4, R7, R10, R11, R13).

**2- Select the differentiation function**

The differentiation function is used to classify the distinct function sums and the classification of new cases, and here we note that this formula has been reached based on the step-by-step analysis. Before adopting the function model and using it to estimate the probability of

stumbling, Lambda de Wilks must be tested for the model's effectiveness. The results of this test are shown in table (12):

**Table 12. Test results (Lambda de Wilks) for model effectiveness**

| Significance level | Degree of freedom | K 2 | Lambda of Wilks | Test Function |
|---|---|---|---|---|
| 0,000 | 2 | 17.053 | 0.720 | 1 |

**Source:** Schedule set up based on program output (SPSS.22).

Since Wilks Lambda's value takes a relatively small value (less than 0.9) and is based on the level of morale of the explained variation, we note the value that SIG. Therefore, model's value can be judged by the high discriminatory strength of the function, i.e., there is a divergence between the centers of the groups, reflecting the importance of the differentiation function found in the analysis of the differentiation between sound and weak institutions.

By using SPSS.22 and by entering the accounting variables in which the conditions were met (R4, R7, R10, R11, R13), in addition to the non-accounting variable, the number of partners that have a significant relationship to the risk of loan failure, the most significant ratios are found to be the following:

R4: The ratio of ownership allocations to total assets, the rise of this ratio indicates the care and interest of enterprises in the renovation of production-related equipment, as it continuously renews this equipment, indicating that it is in a position to develop and improve its activity and thus increase its revenues.

R11: The ratio of financial profitability is the net result obtained using the private funds of the enterprise, which measures the profitability of private funds, and demonstrates the enterprise's effectiveness in using these funds and the course's efficiency in making private capital more profitable.

The function was as follows:

$$Z= 1.431\ R_4 + 1.165\ R_{11} - 0.625$$

After reaching the differentiation function and calculating the point for each Z institution, the Z* critical point that allows for a distinction between sound and incompetent institutions can be calculated with the following relationship:

Where: $Z^* = \dfrac{n_0\overline{Z}_0 + n_1\overline{Z}_1}{n_0 + n_1}$

n0: Number of incompetent institutions;

n1: The number of sound institutions;

$\bar{Z}_0$: average N0 points is a helpless institution;

$\bar{Z}1$: the average points of N0 are profitable enterprises.

Through numerical application:

$$Z^*= \frac{10(-1.297) + 45(0.386)}{10 + 45}$$

We find that z*=0.0805, so organizations can be classified as follows:

– if $Z > 0.0805$: An institution is considered sound;

– if $Z \leq 0.0805$: An organization is considered powerless.

The results of the classification were as follows:

**Table 13. Results of the differentiation function classification**

| Original set | Customization group | | | | Total | |
|---|---|---|---|---|---|---|
| | Incompetent institutions | | Sound institutions | | | |
| | Number | Ratio | Number | Ratio | Number | Ratio |
| Incompetent institutions | 04 | %60 | 06 | %40 | 10 | %100 |
| Incompetent institutions | 03 | %08.9 | 42 | %91.1 | 45 | %100 |

**Source:** Schedule set up based on program output (SPSS.22).

The sample consists of 55 institutions, including 45 sound and 10 incompetent institutions, and we note from the findings that of the 45 healthy organizations in the original group, 42 were intact, and 03 were inefficient.

Of the 10 incompetent institutions in the original group, the model found that 40 deficient institutions in the original group were classified as incompetent institutions and 60 classified as sound, even though they were incapable.

The total correct rating of the model is calculated as follows:

$$\frac{4 + 42}{55} = 83.6\%$$

The correct overall rating for the model is 83.6%, which is high.

Apply the reached form to some of the files under study At Bank (Badr).

Considering that the drip method is one of the ways to predict the stumbling of loans, and using the results of this study, we are trying to predict the success or the stumbling of a set of loan applications that are still under consideration and have not yet been decided upon at BADR, which is five (05) loan applications. Using the drip model, we were able to reach the results shown in the following table:

**Table 14. Forecast results according to the drip method model**

| Organization | Point Z | Status |
|---|---|---|
| 01 | 0,324555 | Loan success |
| 02 | -0,042795 | Loan stumble |
| 03 | 0,679789 | Loan success |
| 04 | -1,873521 | Loan stumble |
| 05 | 0,152346 | Loan success |

**Source:** Schedule set up based on program output (SPSS.22).

By comparison with the critical point (z =0.0805), the model predicted the success of three loans from among the institutions in question and predicted that two institutions would stumble: The number (02) and the number (04).

## Third: Basic internal classification

In this approach, we focus on the components (determinants) of credit risk in the three main variables of the internal rating method; the probability of stumbling (PD), estimation of losses due to stumbling (PCD), and value of the loan at a breakaway (ECD).

### 1- An estimate of the probability of a stumbling PD.

The Bank's Basel Committee decisions are entirely free to adopt the method it sees appropriate to estimate the likelihood of stumbling, and in our study - as we mentioned earlier - we adopted the drip method, which, based on its results, estimated the probability of stumbling for each institution from the sample study, using the statistical program (SPSS.22).

The results of the trip-probability estimate for each organization were as follows:

**Table 15: The probability of a trip for each organization**

| Organization | Possibility of stumbling | Organization | Possibility of stumbling | Organization | Possibility of stumbling |
|---|---|---|---|---|---|
| 1 | 0,21906 | 20 | 0,18995 | 39 | 0,11658 |
| 2 | 0,33433 | 21 | 0,50248 | 40 | 0,1172 |
| 3 | 0,13772 | 22 | 0,55834 | 41 | 0,29952 |
| 4 | 0,14539 | 23 | 0,42816 | 42 | 0,13718 |
| 5 | 0,16535 | 24 | 0,19638 | 43 | 0,33298 |
| 6 | 0,90148 | 25 | 0,26005 | 44 | 0,16907 |
| 7 | 0,26932 | 26 | 0,1452 | 45 | 0,35648 |
| 8 | 0,17011 | 27 | 0,15638 | 46 | 0,37328 |
| 9 | 0,18478 | 28 | 0,18612 | 47 | 0,28202 |
| 10 | 0,18478 | 29 | 0,33274 | 48 | 0,48687 |
| 11 | 0,17348 | 30 | 0,0008 | 49 | 0,20547 |
| 12 | 0,59322 | 31 | 0,19651 | 50 | 0,44594 |
| 13 | 0,59322 | 32 | 0,24369 | 51 | 0,99967 |
| 14 | 0,31809 | 33 | 0,28336 | 52 | 0,39528 |
| 15 | 0,26219 | 34 | 0,30003 | 53 | 0,43159 |
| 16 | 0,13566 | 35 | 0,3336 | 54 | 0,99358 |
| 17 | 0,18597 | 36 | 0,32765 | 55 | 0,47921 |
| 18 | 0,26576 | 37 | 0,1321 | | |
| 19 | 0,64123 | 38 | 0,33439 | | |

**Source:** Schedule set up based on program output (SPSS.22).

We note from the table that there are institutions that have the potential for bank loans to falter at rates of about 01, i.e., the occurrence of the stumbling situation has become almost t inevitable, especially for institutions 51 and 54, and we also note that there is no institution with a probability of less than 0.03%*5. We, therefore, adopt all of these possibilities.

## 2- Assessment of losses incurred in the event of a stumbling

This is where the rate of loss is calculated when a trip occurs, where the amount of losses that the bank will suffer when the debtor is unable to pay is measured, and the rate is related to the guarantee provided by the customer to the bank. However, there is a difference in the estimation of losses due to the stumbling in the case of a guarantee and its absence.

However, through field visits to the agency and the interview with the agency's credit analyst, the guarantee assessment does not take place periodically but only evaluates the guarantee once during the loan file study stage.

Since the loans in question are significant loans to companies, not joint loans, we consider the loans as collateral-free loans and use the corresponding rate of 45%.

[5] The Basel Committee set the minimum risk of stumbling at 0.03 percent.

## 3 - The value of the loan at a trip (ECD)

This is the actual loss value at the time of the breakdown; according to this method, the Basel Committee has defined the loan-guarantee clearing process, but because of the non-periodic evaluation of the collateral, loans are considered as non-collaterals as were the case in estimating losses resulting from the occurrence of the stumbling. We show the value of non-performing loans in the following table:

**Table 16. Loan value at a trip** **Unit: Million dinars**

| Organization | Loan value | Organization | Loan value | Organization | Loan value |
|---|---|---|---|---|---|
| 1 | 38,297 | 20 | 34 | 39 | 320 |
| 2 | 240 | 21 | 134 | 40 | 290 |
| 3 | 200 | 22 | 130 | 41 | 200 |
| 4 | 192 | 23 | 40 | 42 | 192 |
| 5 | 105 | 24 | 15 | 43 | 163 |
| 6 | 299,0078 | 25 | 10,693 | 44 | 150 |
| 7 | 547,976 | 26 | 180 | 45 | 300 |
| 8 | 331 | 27 | 100 | 46 | 30,18223 |
| 9 | 384 | 28 | 76,2 | 47 | 15,314 |
| 10 | 30 | 29 | 206,82 | 48 | 110 |
| 11 | 200 | 30 | 200 | 49 | 47 534 |
| 12 | 172,3 | 31 | 150 | 50 | 95 |
| 13 | 200 | 32 | 783,581 | 51 | 37 |
| 14 | 68 | 33 | 208,714 | 52 | 188,1854 |
| 15 | 520 | 34 | 550,133 | 53 | 830,07548 |
| 16 | 120 | 35 | 350 | 54 | 10,52032 |
| 17 | 200 | 36 | 179 | 55 | 34,03176 |
| 18 | 237,0155 | 37 | 324 | | |
| 19 | 114,275 | 38 | 600 | | |

**Source:** Schedule set up based on program output (SPSS.22).

After calculating critical variables for the underlying internal rating method, the expected losses of credit exposures are measured in the following relationship.

$$EA = (PD)\ (PCD)\ (ECD)$$

The results of measuring the expected losses for each organization are shown in the following table:

**Table 17. Measuring expected losses for each organization Unit: Million dinars**

| Organization | expected losses | Organization | expected losses | Organization | expected losses |
|---|---|---|---|---|---|
| 1 | 3,775203 | 20 | 2,906235 | 39 | 17,83674 |
| 2 | 36,10764 | 21 | 30,29954 | 40 | 15,2946 |
| 3 | 12,3948 | 22 | 32,66289 | 41 | 26,9568 |
| 4 | 12,5617 | 23 | 7,70688 | 42 | 11,85235 |
| 5 | 7,812788 | 24 | 1,325565 | 43 | 24,42408 |
| 6 | 121,2973 | 25 | 1,251322 | 44 | 11,41223 |
| 7 | 66,4114 | 26 | 11,7612 | 45 | 48,1248 |
| 8 | 25,33788 | 27 | 7,0371 | 46 | 5,06989 |
| 9 | 31,92998 | 28 | 6,382055 | 47 | 1,943484 |
| 10 | 2,84877 | 29 | 30,96778 | 48 | 24,10007 |
| 11 | 15,6132 | 30 | 0,072 | 49 | 4,395065 |
| 12 | 45,99531 | 31 | 13,26443 | 50 | 19,06394 |
| 13 | 16,7202 | 32 | 85,92788 | 51 | 16,64451 |
| 14 | 9,733554 | 33 | 26,61354 | 52 | 33,47366 |
| 15 | 61,35246 | 34 | 74,27538 | 53 | 16,13455 |
| 16 | 7,32564 | 35 | 52,542 | 54 | 4,703751 |
| 17 | 16,7373 | 36 | 26,39221 | 55 | 7,338761 |
| 18 | 28,34515 | 37 | 19,26018 | | |
| 19 | 32,97445 | 38 | 90,2853 | | |

**Source:** Schedule set up based on program output (SPSS.22).

– **Enterprise classification:** In this element, we categorize the lending institutions from the bank by categorizing them by eight (08) categories; seven categories indicating loan risk and eight indicating stumbling states; this risk division has agreed to the Standard and poor's division and therefore adopt the agency's rating, and the rating is based on the following table:

**Table 18. How organizations are classified.**

| Classification | Probability | Classification indication |
|---|---|---|
| AAA | ]12.5-0] | Highest levels of capacity to pay |
| AA | ]25-12.5] | Power High on payment |
| A | ]37.5-25] | Significant capacity to pay |
| BBB | ]50-37.5] | Capacity to pay |
| BB | ] 62.5-50] | Payment not confirmed |
| B | ]75-62.5] | High risk |
| CCC | ] 87.5-75] | Poor capacity to pay |
| D | [100-87.5] | Trip status |

**Source:** Based on agency standards.

Based on our findings and the rating method shown in the table, we can classify the institutions borrowed from the BADR Bank as follows:

**Table 19. Classification of institutions under consideration**

| Organization | Possibility of stumbling | Classification | Organization | Possibility of stumbling | Classification | Organization | Possibility of stumbling | Classification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0,21906 | AA | 20 | 0,18995 | AA | 39 | 0,11658 | AAA |
| 2 | 0,33433 | A | 21 | 0,50248 | BB | 40 | 0,1172 | AAA |
| 3 | 0,13772 | AA | 22 | 0,55834 | BB | 41 | 0,29952 | A |
| 4 | 0,14539 | AA | 23 | 0,42816 | BBB | 42 | 0,13718 | AAA |
| 5 | 0,16535 | AA | 24 | 0,19638 | AA | 43 | 0,33298 | A |
| 6 | 0,90148 | D | 25 | 0,26005 | A | 44 | 0,16907 | AA |
| 7 | 0,26932 | A | 26 | 0,1452 | AA | 45 | 0,35648 | A |
| 8 | 0,17011 | AA | 27 | 0,15638 | AA | 46 | 0,37328 | A |
| 9 | 0,18478 | AA | 28 | 0,18612 | AA | 47 | 0,28202 | A |
| 10 | 0,18478 | AA | 29 | 0,33274 | A | 48 | 0,48687 | BBB |
| 11 | 0,17348 | AA | 30 | 0,0008 | AAA | 49 | 0,20547 | AA |
| 12 | 0,59322 | BB | 31 | 0,19651 | AA | 50 | 0,44594 | BBB |
| 13 | 0,59322 | BB | 32 | 0,24369 | AA | 51 | 0,99967 | D |
| 14 | 0,31809 | A | 33 | 0,28336 | A | 52 | 0,39528 | BBB |
| 15 | 0,26219 | A | 34 | 0,30003 | A | 53 | 0,43159 | BBB |
| 16 | 0,13566 | AA | 35 | 0,3336 | A | 54 | 0,99358 | D |
| 17 | 0,18597 | AA | 36 | 0,32765 | A | 55 | 0,47921 | BBB |
| 18 | 0,26576 | AA | 37 | 0,1321 | AA | | | |
| 19 | 0,64123 | B | 38 | 0,33439 | A | | | |

**Source:** Schedule set up based on program output (SPSS.22).

Through the table (15), 04 out of the 55 institutions in question had the AAA rating, the highest rating, the AA rating of 19, the A rating of 16, the 06 institutions classified as BBB, and the four BB institutions; A single institution is classified as B, whereas no organization is classified as CCC, and 03organizations classified as D.

## Conclusion:

Credit risk management in commercial banks has become one of the most important topics for the time being, as we have seen through the study, given the damage caused by credit risks to these banks in particular and the national economy in general. Algeria is considered one of the countries that tried, in a tight and late way, compared to the other countries to keep up with the openness to the world economy and keeping up with the new trends. As it prepared reforms that affect the bank side, especially the management of credit risks, because of the importance of credit, but it remained late without getting ready.

As the volume of non-performing loans in commercial banks has increased, this has called into question their adopted methods to detect the stumbling phenomenon before it occurs and try to provide a better alternative than the methods currently adopted at the Bank for Agriculture Rural Development. . The aim was to highlight modern credit risk management methods in general and the internal rating approach in particular. After discussing the topic in its main aspects, the following were reached:

### – Results

1- The first hypothesis: This hypothesis was partially established: "There is a moral relationship between the non-accounting variables and the risk of loan failure," as follows:

- The first partial hypothesis, which is that: "There is a moral relationship between the enterprise's life variant and the risk of loan failure," is incorrect; this is different from the study of (Yousef Souar, 2008) and (Fatma Bin Shana, 2010).
- Proving the validity of the second partial hypothesis, which is that: "There is a moral relationship between the changes in the number of partners and the risk of the loan failure";
- The third partial hypothesis states that; "There is a moral relationship between the seniority variable and the risk of the loan stumbling," is incorrect. This is different from what a study found: (Yousef Souwar, 2008).

2- The second hypothesis: "There are significant differences between the average accounting variables of the sound and incapacity institutions at the bank in question. This hypothesis has been partially confirmed, as the meanings of these variances have been established for the following percentages:

Asset acquisition (R4), liquidity risk ratio (R7), capital consolidation ratio (R10), financial return ratio (R11), and economic return ratio (R13), while the differences

between other variable averages (represented in other financial ratios R12), R9, R8, R6, R5, R3, RR1) were no significant.

3- The third hypothesis: A mental retouching model can be built on the accounting and non-accounting variables in the bank under consideration; through the stages, we did in the field class, we were able to establish this hypothesis in part, we were able to build a revised model based on two financial ratios, the drip function was as follows:

Z= 1.431 R4 + 1.165 R11 – 0.625

In other words, the most critical and significant ratios are asset ownership (R4) and financial return ratio (R11), and the correct overall rating of the function was 83.6 percent, which is a good percentage.

The internal rate of return is also one of the most significant ratios in the model of the discrimination function found in a study (Youssef al-Suwar 2008).

4- The fourth hypothesis is that: "The primary internal rating approach of the bank in question can be applied." depending on the findings, the validity of the hypothesis is confirmed, as it is based on the differentiation function achieved by calculating the underlying variables of the primary internal classification method:

- The probability of stumbling,
- the estimation of the losses caused by the stumbling,
- the calculation of the loan value at the stumbling,
- the expected losses of the credit exposures were measured,
- The institutions in question were classified according to the Standard and poor's rating.

We found that 04 out of the 55 institutions in question had the AAA rating, the highest credit rating, 19 AA-rated, 16 ranked a, 06 BBB-rated, and 4 BB-rated institutions. A single institution was classified as B, whereas no institution was classified as CCC, and 03 institutions classified as D.

## Proposals

- ✓ Given that the model reached can correctly be rated at 83.6, we suggest that the bank in question be considered (Akash, 2013) (Brouziane, 1994,) a modest attempt by us to adjudicate the loan files currently under consideration.
- ✓ Seek to build mining models under the Bank of Algeria's supervision, relying on larger, more accurate, and more databases that are complete.

- ✓ To create the conditions for adopting Basel II and Basel III regulations - shortly - by activating internal control at the bank level and activating the centrality of risk.
- ✓ Ensure that conditions are created for access to transparent and high-quality information, as the primary source of risk assessment in general and credit risk in particular.
- ✓ To train staff of credit facilities in banks to do their business effectively by providing them with frequent and specialized courses, and to participate in seminars and conferences on aspects of their work and to inform them of what is new in the banking industry in general and how to manage risks, especially credit.

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