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# Corporate qualitative and quantitative assessment from credit risk perspective

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## Abstract

Until a few decades ago, the decision power to deny or grant a loan laid in the hands of a single individual: the credit analyst. Some of the bad experiences of banks losses or even failures were attributed to bad decisions made by credit analysts, who based their decision on personal knowledge, their information about the potential customer and the trust placed in the customer.

After the financial crisis, two key concerns have been raised regarding banks' activities: "too little, too late" provisioning for loan losses and "too big to fail". The credit risk management subject became not only a compliance exercise for banks, but also a key item considered when establishing the strategy and execution path. Our intention within this paper is to discuss some of the specific issues related to credit risk management, considered by commercial banks when analysing a corporate client. The result of this research is a web application named CISS (Credit Institution Scoring System), which represents a proof of concept for a bank credit scoring system. The application was developed using HTML, MySQL and PHP solutions.

**Keywords:** Credit risk, scoring, multidimensional model, database, application, corporate clients.

**JEL Classification:** G21.

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## Introduction

The banking sector has a strategic importance in national and international economies and contributes heavily to the global financial stability. It is easy to understand why top decision-makers like ministries of finance, supervisory authorities or central banks are interested in setting international policies and regulations for the banking sector, with the intention to achieve cooperation and consistency within the financial sector.

Lending is an ongoing concern of a bank, as it is the main operation which allows banks to place their resources and it is also the most profitable activity of banks. Through lending, banks contribute, on one hand, to the creation of resources for companies who need to finance investment projects and, on the other hand, they support fund holders to invest in order to obtain profit. But in order to achieve high profitability, banks must assume some risks. In the recent years, especially after the global financial crisis, focus was set on adapting the business models in order to allow financial institutions to develop an effective risk assessment framework, without endangering profitability. Therefore, performance and risk in lending activities become key components of the market mechanism.

Credit risk is one of the main risks faced by a bank and it is generated by the lending activity to clients (individuals or societies).

Investors are compensated for assuming credit risk by way of interest payments from the borrower or issuer of a debt obligation ([www.investopedia.com](http://www.investopedia.com)). Credit risk is closely linked to the potential return of an investment, meaning that the rate of interest that investors will demand for lending their capital is proportional to the perceived credit risk.

Developing and applying credit risk management techniques has been a concern for many years, and it has evolved from traditional techniques such as exposure assessment, to limiting excessive concentration on the debtor, business sector or industry level, to new management techniques, such as transactions with swaps and options, adapted to this type of risk.

The global financial crisis, along with a structural increase in the number of bankruptcies, increased disintermediation by the most credit-worthy borrowers, more-competitive margins on commercial loans, and

growth in off-balance-sheet lending put credit risk management into the regulatory spotlight ([www.sas.com](http://www.sas.com)). As a result, regulators began to demand more transparency from credit institutions. The regulators understand the necessity of banks to obtain a thorough knowledge of customers and their associated credit risk, so they introduced the new Basel III regulations which are meant to create an even bigger regulatory burden for banks. Even before Basel III is fully implemented, some regulators have already begun to impose requirements that emerge towards Basel IV.

After the financial crisis, two key concerns have been raised regarding banks' activities: "too little, too late" provisioning for loan losses and "too big to fail".

In respect of the first one, the International Accounting Standard Board (IASB) introduced a new standard on financial instruments' accounting, IFRS 9 *Financial Instruments* (IASB, 2015) defining the new expected credit loss model for the recognition and measurement of impairment. The main focus of the new IFRS 9 is to accelerate the recognition of losses by requiring provisions to cover both already-incurred losses and some losses expected in the future. This will have a major impact on the way banks account for loan provisioning and the expectation is that the impairment for bad debts will be higher and more volatile. This exercise will require a lot of time, effort and money.

The new "too big to fail" regulations come with a new set of requirements for banks. The European Union (EU) is establishing a Europe-wide bank union, including the adoption of a Bank Recovery and Resolution Directive (BRRD). The BRRD contains provisions relating to recovery and resolution planning, intragroup financial support, early intervention, resolution tools and powers, cross-border group resolution, relations with third countries and financing arrangements (IASB, 2015).

However, focusing on credit risk management should not only be a compliance exercise for banks, but also a way of improving the overall performance and secure a competitive advantage.

A valid scoring system eases the credit risk management process for banks at the granting date, being also an important tool for subsequent monitoring activity. We used HTML, MySQL and PHP solutions in order to create a prototype of a corporate scoring system. Our intention was to bring into discussion some specific issues related to credit risk management scoring

systems and to point out the advantages of such a system for banks and other credit institutions.

## 1. Literature review

According to Kealhofer (2003), “until the 1990s, corporate credit analysis was viewed as an art rather than a science because analysts lacked a way to adequately quantify absolute levels of default risk. In the past decade, however, a revolution in credit-risk measurement has taken place”.

Many authors propose solutions for better credit risk management and many regulations include guidance on how to deal with borrower analysis. In the following paragraphs, we will discuss some of these solutions, as a starting point for the developed application.

### Credit risk is the primary cause of bank failures.

Credit risk generally represents the risk of losses of the value of a credit exposure arising from an unexpected change of the counterparty’s credit quality.

In a wider sense, credit risk can also be defined as “potential losses arising either from a default of the borrower/issuer or a decrease of the market value (or mark-to-model value) of a financial obligation due to a deterioration in its credit quality” (www.unicreditgroup.eu).

Risk management is the process of adjusting both the risk of large losses and the firm’s vulnerability to them.

In order to be effective, the credit risk management must begin with gaining a complete understanding of a bank’s overall credit risk by viewing risk at the individual, customer and portfolio levels.

Usually, creditworthiness of a client is analysed from six different perspectives (Rose, 2002).

#### 1. Character

The loan officer must be convinced that the customer has a well-defined purpose for requesting a bank loan and a serious intention to repay. In other words, the loan officer must assess the borrower’s responsibility, truthfulness, the serious and legal purpose of the funds and must determine if these are consistent with the bank’s current lending policy.

#### 2. Capacity

The loan officer must be sure that the customer requesting the loan has the authority to do so and the legal standing to sign the binding loan agreement.

#### 3. Liquidity

The credit analyst must determine, based on serious documentation, if the client has the ability to generate enough cash, in the form of cash flow, to repay the loan. The main sources of money for debtors are: cash flows generated from sales or income, the sale of or liquidation of assets or funds collected by issuing debt or equity securities. Current borrower’s income and borrower’s income history are important pieces of evidence in loan officer’s evaluation.

#### 4. Collateral

In assessing the collateral aspect, the loan officer must determine if the borrower possesses adequate net worth or own enough quality assets to provide adequate support for the loan. The credit analyst will primarily focus on features such as age, condition and degree of specialization of the borrower’s assets.

#### 5. Conditions

The loan officer/credit analyst must be aware of recent trends in the borrower’s line of work or industry and how changing economic conditions might affect the loan.

#### 6. Control

This last factor in assessing a borrower’s state of solvency focuses on questions such as whether changes in law and regulation could adversely affect the borrower and whether the loan meets the bank’s and the regulatory authorities’ standards for loan quality.

### Credit scoring

Credit scoring, one of the most successful applications of data mining, is traditionally assessed from a binary classification perspective. Credit scoring is a process whereby information provided is converted into numbers that are added together to arrive at a score.

Credit scorecards are mathematical models which attempt to provide a quantitative measurement of the probability that a customer will display a defined behaviour (e.g. loan default) with respect to his current or proposed credit position with a lender ([https://en.wikipedia.org/wiki/Credit\\_scorecards](https://en.wikipedia.org/wiki/Credit_scorecards)). A scorecard is a means of assigning importance to pieces

of data so that a final decision can be made regarding the underlying account's adequacy for a particular strategy. The main approach is separating the data into its individual characteristics and then assigning a score to each characteristic based on its value and the average risk represented by that value.

Credit scoring typically uses observations or data from clients who have defaulted on their loans plus observations on a large number of clients who have not defaulted ([https://en.wikipedia.org/wiki/Credit\\_scorecards](https://en.wikipedia.org/wiki/Credit_scorecards)). Therefore, the objective of credit scoring is to forecast future performance (of a customer) from past behaviour.

Scorecards' main purpose is to replace the human judgment (the credit analyst's subjectivity) with objective and statistically valid measures.

Typically, during the scorecard building process, some quantitative and qualitative characteristics and indicators are considered one-by-one based on a training data set of previous applicants with known quality characteristics (e.g., whether or not the loan was repaid). The result of this process is a set of variables that enter into subsequent predictive modelling.

Scorecard model development will be divided in several parts:

- Data extraction: all application data (for example for an individual borrower: education level, marital status, monthly family income, monthly payments, residential status, time at current address, Credit Bureau information) is extracted for the maximum available history. For all extracted application data, the default history must be assessed and the data is submitted to a qualitative validation process.
- Univariate analysis: this phase usually includes the following activities: analysis of discriminatory power of individual factors, analysis of all factors, analysis of correlation within the factors, pre-filtering, discussion with experts regarding the preliminary results, a short list of factors to be considered for the development of the model.
- Multivariate analysis: analysis of discriminatory power for all factors selected (regression analysis).
- Model design: this phase involves the development of several alternative models, discussions with experts regarding the optimal structure of model design and the final definition of the scoring function.

- Model testing: in this phase the following results must be considered: scoring function distribution, impact of rejected applications (score ranges), performance of the new model (considering the Gini index and model stability).

Dataset calibration: the calibration of the extended dataset (maximum available dataset) and the definition of the average probability of default, including the prudential margin.

- Logistic: logistic regression to estimate probability of default.
- Cluster analysis: logistic regression of the complete dataset.
- Rating scale: cluster aggregation in order to create the rating scale.
- Probability of default: calibration of loan default probability determined by the scoring system based on the real and subsequently collected data.

## 2. Research methodology

Credit assessment process has two dimensions: a quantitative and a qualitative one. The quantitative dimension of credit analysis is based on specific activities such as collecting, processing and interpreting all information regarding a debtor that a financial institution can access. A bank will use, for the financial data analysis, forecasts of future developments of a borrower's activity, its repayment capacity assessment through analysis and forecast of future expected flows of revenues and expenses, evaluation debtor's ability to withstand shocks. The results of these activities are relatively easily quantifiable. Qualitative analysis involves gathering and updating information relating to the financial responsibility of the debtor, determining the real purpose of the loan, identifying what risks the borrower may face and estimating the debtor's reliability and commitment.

The result of our research is a web application named **CISS** (*Credit Institution Scoring System*), which represents a proof of concept for a bank credit scoring system.

**CISS** is an IT system designed with the purpose of supporting credit decisions, which carries out some of the features of a credit scoring system used by banks when rating corporate loan applicants. Use of this

system will increase the speed and quality of lending decisions, with direct impact in the quality of financial services and cost of credit.

We developed **CISS** as a dynamic web application using *HTML* supported by PHP language interacting with a MySQL database server. **CISS** is a well-structured application, easy to develop and maintain and has a user-friendly interface.

We extracted information from the database according to specific user needs and then formatted it, in order to be displayed properly. **CISS** also allows the user to insert relevant information into the database, which is stored on the server.

**CISS** main feature is its responsiveness to the needs of credit institution in terms of qualitative lending decisions. Also, the system allows fast and reliable processing of large volumes of data and easy access to preconfigured reports, which give a good image about the borrower's past performance.

### 3. Results and discussions

Contrary to commercial rating systems that are intended to distinguish between companies in a general sense, the rating systems used by banks intend to support the loan officer in making the decision to grant a loan, with the purpose to predict the loan probability of default.

Until a few decades ago, the decision power to deny or grant a loan laid in the hands of a single individual, the credit analyst. Some of the bad experiences of banks losses or even failures were attributed to bad decisions taken by credit analysts, which based their decision on their personal knowledge, how well they know the potential customer and how much trust had in it. Supervisors' pressure on banks to develop an adequate risk assessment framework, forced banks to extend this practice to a less personal appreciation, but still a subjective one.

Nowadays, banks want all the convenience of digitization and started to invest heavily in technology. IT Risk management systems were developed with the main purpose to assist the loan officer/credit analyst in making the decision to grant or deny a loan and to monitor the evolution of a client during the lifetime of a loan. A good risk management system will use knowledge from past periods about the client in order to be able to accurately forecast its development and future performance.

The "debtor's file" will contain, aside from the financial analysis prepared on the basis of the latest financial statements of the client, as much information as possible from authorized sources about the applicant's management and marketing activity.

A valid scoring system is one created based on historical data about existing clients and which is validated periodically. A good scoring system should be aligned with the business plan, risk profile, risk appetite and strategy development of the financial institution. The size and complexity of scoring systems depends on the dimension and characteristics of the bank.

The **CISS** system was developed in order to assess loan applications based on a combined credit score obtained from the followings:

- A quantitative score (a number from 0 to 100) with a weight of 50% in the final combined score;
- A qualitative score (a number from 0 to 70) with a weight of 30% in the final combined score;
- A Loan-To-Value score (a number from 0 to 100) with a weight of 20% in the final combined score.

Thus, the combined score of a loan applicant will be a number between 0 and 91, with the average being a score of 46.

The financial scoring is determined by computing the following financial indicators:

- Working Capital Ratio;
- Long Term Debt to Working Capital;
- Quick Ratio;
- Return on Assets;
- Return On Sales;
- Inventory turnover;
- Receivables Turnover in sales days;
- Payables Turnover (days);
- Cash Turnover;
- Interest Coverage Ratio;
- Gross Profit Margin;
- Total Debt to Assets;
- Capitalization Ratio;
- Debt to Equity Ratio.



These financial ratios will be computed based on the most recently approved set of financial statements of the loan applicant.

The assessment also takes into account some qualitative criteria, related to the management education, experience and competence, the attitude of the debtor in terms of willingness to provide information to the bank, the quality of planning and controlling and the validity of the results of the budgetary process, the state-of-art of equipment, the market development and the market position of the company.

Loan-To-Value (LTV) represents the ratio between the loan amount requested by a potential borrower and the mortgage value. This indicator is relevant, because it reveals if the guarantee brought by the client is sufficient to repay the loan, in case of default and foreclosure.

A loan applicant obtaining less than 45 present high credit risk and the credit institution will deny its credit application. A loan applicant obtaining a combined score between 46 and 75 still present important credit risk and loan officer should request additional collateral (i.e. increase its Loan-To-Value) and, if the borrower will be able to fulfil these new conditions, the assessment should be re-performed. A loan applicant obtaining a score above 76 should not be considered risky and the lending will be approved.

When designing the application, we have used some scoring intervals defined based on our interpretation of financial and non-financial data related to financial statements of corporate clients. However, credit institutions will calibrate their scoring intervals based on their risk assessment and statistical analysis of default probabilities for different categories of clients.

## Conclusions

The research conducted was intended to gain a good understanding of the characteristics considered by a bank in assessing the credit risk of a corporate client. Also, we understand the importance of technology in easing the internal processes of banks and we have provided a detailed overview not only from a theoretical, but also from a practical perspective of a scoring system used by banks in their day-to-day activities.

The web application presented is a *proof of concept* intended to fulfil some of the features of a credit scoring system used by banks or other credit institutions when rating the loan applications of corporate clients.

In order to meet all the characteristics of a scoring system used in day-to-day activities by any large credit institution, we plan to further develop the application in order to assist also the analysis of private individual clients. In order to be fully adapted to the new regulatory and accounting requirements imposed to the banks after the financial crisis, a credit risk system will contain both an application scoring and a behavioural scoring. Application scoring in consumer credit risk assessment is a static phenomenon, because it involves assessing the client's characteristics on application and afterwards their creditworthiness at some later date, based on realized performance. On the other hand, behavioural scoring involves an ongoing assessment with better response to changes, because it involves updating the assessment of consumer credit risk in the light of the current and most recent performance of the consumer, also considering changes in the economic environment which are not directly linked with the client, but which will affect its repayment behaviour.

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