# Credit scoring for individuals

## *Credit scoring pentru persoane fizice*

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**Abstract**

Lending money to different borrowers is profitable, but risky. The profits come from the interest rate and the fees earned on the loans. Banks do not want to make loans to borrowers who cannot repay them. Even if the banks do not intend to make bad loans, over time, some of them can become bad. For instance, as a result of the recent financial crisis, the capability of many borrowers to repay their loans were affected, many of them being on default. That's why is important for the bank to monitor the loans. The purpose of this paper is to focus on credit scoring main issues. As a consequence of this, we presented in this paper the scoring model of an important Romanian Bank. Based on this credit scoring model and taking into account the last lending requirements of the National Bank of Romania, we developed an assessment tool, in Excel, for retail loans which is presented in the case study.

**Keywords:** *Credit scoring; credit risk; retail loans*

**Rezumat**

Împrumutarea banilor diferiților debitori este profitabilă, dar riscantă. Profiturile vin din rata dobânzii şi taxele încasate de pe împrumuturi. Băncile nu vor să facă împrumuturi debitorilor care nu le pot rambursa. Chiar dacă băncile nu intenţionează să facă credite neperformante, în timp, unele dintre ele pot deveni neperformante. De exemplu, ca urmare a crizei financiare recente, capacitatea multor debitori de a rambursa împrumuturile lor a fost afectată, multe dintre ele fiind în întârziere cu plăţile. De aceea, este important pentru bancă să monitorizeze împrumuturile. Scopul acestei lucrări este de a se concentra asupra problemelor principale ale credit scoring-ului. Ca o consecinţă a acestui fapt, am prezentat în această lucrare modelul de scoring al unei importante bănci din România. Bazat pe acest model de credit scoring şi ţinând seama de recentele cerinţe de creditare ale Băncii Naţionale din România, am dezvoltat un instrument de evaluare, în Excel, pentru creditele retail, care este prezentat în studiul de caz.

**Cuvinte-cheie:** *Credit scoring; risc de credit; credite retail*

## Introduction

The major risk the bank faces when lending money is the credit risk. Credit risk is the risk of repayment, i.e. the possibility than an obligor will fail to perform as agreed, and adversely affect earnings and the capital. The credit risk applies to loans, derivatives, foreign exchange transactions, and investment portfolio (Dimitriu, 2000). In case of loans, credit risk is referring to the risk that borrowers might default on their loans, causing losses to the lender. The default of a borrower usually happens when the borrower is unable to make the required loan payments or is unable to meet other terms of the loan agreement.

Banks analyze credit risk before and after making loans. Before making loans, the banks evaluate the credit risk of the prospective borrowers and their possibility to repay the loan (Basno, Dardac &Floricel, 1994). They also monitor the borrowers during the life of the loan.

Over the years, the process of credit evaluation changed. The traditional methods include financial analysis of the borrower based on balance sheets and income statements (Avramescu &Dimitriu, 2008). Another technique used in the process of evaluation of a credit request is credit scoring.

## The necessity of credit scoring

Credit scoring is the set of decisions model and their underlying techniques that aid lenders in the granting of loans. These techniques decide who will get credit, how much credit they should get. Credit scoring assesses the risk in lending for a particular borrower and is based on data from credit application, personal financial statements and credit bureau reports. The credit score is a number that is calculated by a bank, a credit bureau or another company, such as Fair Isaac Corporation, known as FICO (*http://www.fico.com/en/Company/Pages/about.aspx*). The result of the credit scoring is completed with the interrogations from the credit bureau which offer a history of the past and present financial obligations (for each lender is presented the type o loan, period of loan and amounts overdue if the case) of the applicants with other lenders. The information provided is both positive when no delays in payment due amounts, and negative when outstanding loans, no of days for outstanding payments.

The history of credit scoring started 50 years ago when Fisher (1936) introduced in statistics an approach for identifying different groups in a population with different characteristics. Durand (1941) was the first one to recognize that one could use the same techniques to discriminate between bad and good loans. After the World War II, a group of economists connected the automation of credit decisions with the techniques developed in statistics in order to develop statistically derived models for making credit decisions. The first consultancy company was formed in San Francisco by Bill Fair and Isaac Earl in the early 1950s; their clients

were mainly finance company, retailers and mail-order firms. The introduction of credit cards in 1960s determined the banks to realize the usefulness of credit scoring (Siddiqi, 2005). Without an automated lending process, it would have been difficult to analyze and process credit applications of the customers. In the years that followed, the banks increased the usage of credit scoring system also for personal loans, home loans but also for evaluating the companies' credit applications.

At present, the main focus on credit scoring is on the changing the objectives from trying to minimize the chance that a customer will default on a certain loan to looking at how the bank can maximize the profit it can make on that customer (Mays, 2003; Thomas, Crook, and Edelman, 2002; Thomas, Edelman, and Crook, 2003).

Credit scoring systems are usually built using statistical or non-statistical methods in which several variables are used jointly to establish a numerical score or ranking for each credit applicant. If the applicant's score exceeds a critical cutoff level, he or she is likely to be approved for credit unless other negative information from credit bureau. Among the most important characteristics used in evaluating loans for individuals are: credit bureau ratings, age, marital status, number of dependants, home ownership, income level, number and type of bank accounts owned, type of occupation, and time at current job. Some of these characteristics may be considered discriminators unless the bank proves that at a statistically significant level, these characteristics separate bad loans from good loans and that the credit scoring system is frequently statistically tested and revised to take into account recent changes in the credit policy.

Credit scoring is a predictor of risk, characterized by pragmatism and empiricism. This implies that any characteristics of the applicant should be used in the scoring system. These characteristics have connections with default risk of the applicant. These characteristics may be classified in 4 categories as they address the following situations: demographic characteristics (age of borrower, marital status, number of dependants, home status, district of address – rural or urban), financial characteristics (total assets of the borrower, net income of the borrower and of the household, monthly expenses of the household), employment characteristics (type of employment, time with the present employer) and behavioral characteristics (products with the bank – current account/debit or credit card/outstanding loans).

The theory of credit scoring is that the bank identifies financial, economic and motivational factors that separate bad loans from good loans by observing a large group of customers (individual and companies) who borrowed in the past. Then, it assumes that these factors that separated good loans from bad loans in the past will be the same in future, with a small acceptable risk of error. This assumption could be wrong if the economy or other factors change significantly, that's why this is the reason for which credit scoring are frequently retested and revised as more sensitive factors are identified. These frequently revisions of credit scoring system is not only mandatory from legal or regulatory point of view, but it

also mitigates the biggest potential weakness of such systems – their inability to adjust quickly the changes in the economy or in the family lifestyle. A not revised credit scoring might conclude in acceptance of bad loans and might bring a higher credit risk to the loan portfolio.

Credit scoring system usually selected a number of key characteristics from the client's credit application; each characteristic is assigned a certain value which is called attribute. Based on their importance, each attribute receives a certain score. For instance, in the case study we presented in this paper, the characteristic "client's locative situation" has the following attributes: owned villa / house, personal apartment, parents' villa / apartment, rent. The better client's locative situation is, the higher the score of the attribute is, respectively: attribute "owned villa / house" receives a score of 3, the attribute "personal apartment" receives a score of 2, the attribute "parent's villa / apartment" receives a score of 1 and the attribute "rent" receives the score 0.

In the example presented in the case study below, the break even point or the cutoff score was established by the bank to be 16 and indicates the greatest net savings in loan losses. At this level of scoring or below, the bank found out that in the past, 40% (1200 credits) of the credits became bad and were written off as a loss and only 10% (300) of credits were good. If we take into consideration that the loss per credit was 1.000 EUR, the total loss for bad loans were 1.200.000 EUR. If the bank accept 16 as cutoff score and approve loans only for applicants with scoring over 16, it will save an estimated amount of 900.000 EUR (1.200.000 – 300000).

The cutoff scores may vary from one lender to another depending on the level of risk they are willing to take. Some lenders have a very strict cutoff policy. If the score is above the cutoff, the loan application is approved; if the score is below the cutoff, the loan application is rejected.

Other lenders might use other cutoff policy. For instance, it is created a variation band of 5 or 10 points above and under the cutoff. Applications falling into this band are subject to a closer look. This closer look might involve seeking further information about the applicant.

Different banks may use different scores and may have override policies (Rose, 2002; Saunders, 2000). After the credit scoring qualifies the applicant for obtaining a loan, the override policy mean that the customer can ask for a loan whose main parameters are modified: the maximum period of the loan, reduced fees and interest rates, type of income. These overrides could be approved taken into consideration the applicant's business relationship with the bank.

The advantage of using credit scoring models is the reduced time and lower costs for processing loans. Another advantage is that the same model is applied to all customers, demonstrating a consistent and accurate credit policy. Also, credit scoring is an effective substitute for the use of judgment among inexperienced loan officers.

In comparison with credit scoring (which is applied mainly for applicant requesting a loan), the behavioral scoring is the set of techniques that help the

lender to assist the decisions related to dealing with existing applicant, including whether to increase the credit limit.

One of the main issues of the credit lending process for a bank is to decide to whom it might give credits and the methods used to determine this (Thomas, 2009). At the beginning of the credit scoring in 1950 – 1960, the only methods used to build up a credit score were the statistical methods and the classification methods. The idea of developing a credit scoring was to use statistical analysis of sample of past customers in order to decide which existing or new customer were likely to be satisfactory. These statistical methods were the only one used till the 1980s, when Freed and Glover realized that finding the linear function of the characteristics that best discriminates between groups can be modeled as a linear programming problem. This was the nonstatiscal approach – nonstatistical methods.

In our opinion, the answer at the question what method to use for building up a scorecard depends on the bank's preferences, data availability and other characteristics.

Below is presented a case study, respective an Excel tool (with focus on maximum indebtedness level) to assess if an individual applicant is qualifying for obtaining a loan from Bank X and how much will be he/she obtain.

## A model of credit scoring for an individual applicant

Bank X offers to retail individuals the following loans: for personal needs, mortgage loans, home loans, loans for buying a car or loans for financing students' expenses for faculties.

For determining these, we based our tool, in Excel, on the credit scoring developed by Bank X analyzing a sample of 5.000 past customers. For building the credit scoring model, Bank X used a statistical method - the linear regression. The characteristics analyzed were the following:

➢ Client's locative situation;
➢ Proximity towards bank X branches;
➢ Marital status;
➢ Age;
➢ Number of dependants;
➢ Working period within the last employer (according with the last mention in the working file);
➢ Loan period;
➢ Own contribution (in case of mortgage loan);
➢ Banking references at bank X;
➢ Monthly net income of the applicant (in RON);
➢ Degree of indebtedness for the applicant family.

Each of these characteristics has several attributes with certain values (scores). In Table 1, is presented the scoring of Bank X which contains the information about the applicant.

**Scoring for applicant**

Table 1

| Criteria | | Scoring |
|---|---|---|
| **Characteristic** | **Attributte** | |
| 1. Client's locative situation | owned vila / house | 3 |
| | personal apartment | 2 |
| | parents' vila / apartment | 1 |
| | rent | 0 |
| 2. Proximity towards bank X branches | bank X branch exists in the residence place of the applicant | 2 |
| | bank X branch does not exist in the residence place of the applicant | 0 |
| 3. Marital status | married | 3 |
| | widow / single / divorced | 1 |
| 4. Age | under 65 | 2 |
| | over 65 | -1 |
| 5. No. of dependants | 0 person | 3 |
| | 1 person | 2 |
| | 2 persons | 1 |
| | 3 or more persons | 0 |
| 6. Working period within the last employer (according with the last mention in the working file) | greater than 5 years | 4 |
| | between 2 and 5 years | 2 |
| | between 1 and 2 years | 1 |
| | up to 1 year | 0 |
| | retired | 2 |
| 7. Loan period | shorter than the remaining period till pension | 2 |
| | higher than the remaning period till pension | 0 |
| 8. Own contribution (in case of mortgage loan) | over 50% of the investment value | 4 |
| | between 25% and 50% of the investment value | 2 |
| | up to 25% (inclusively) of the investment value | 0 |
| 9. Banking references at bank X | deposit and loan | 3 |
| | loan / credit card | 2 |
| | deposit / debit card | 1 |
| | none | 0 |
| 10. Monthly net income of the applicant (in RON) | over 2.000 | 5 |
| | 1.001 – 2.000 | 3 |
| | 751 – 1.000 | 2 |
| | 501 – 750 | 1 |
| | 251 – 500 | 0 |
| | under 250 | -1 |
| 11. Degree of indebtedness for the applicant family | under 10% of the net income | 5 |
| | between 10-20% of the net income | 4 |
| | between 20-30% of the net income | 2 |
| | over 30% of the net income | 1 |

The elements for establishing the maximum indebtedness level are:

✓ The number of family members of the applicant and/or cosigners, if applicable – according to it, it is established the minimum monthly basket of debts for the applicant's family and cosigners; this minimum monthly basket is regulated in the Romanian Government Decision no. 1079/11.09.2003;

✓ The geographical region of the applicant and/or cosigners – 8 geographical regions were established in the country, respective: Vest, Sud-Vest Oltenia, Sud Muntenia, Sud-Est, Nord-Vest, Nord-Est, Centru, Bucuresti Ilfov; these eight regions are the same with the ones defined in the annual Romanian Statistics Book;

✓ The administrative environment of the applicant and/or cosigners – county residence/another city/rural community;

✓ Risk profile of the applicant – the risk class is established as a result of the scoring analysis;

✓ The payment behavior of the applicant and/or cosigners – according to the interrogations made at the Credit Bureau;

✓ All these elements (without the last one) will be part of the excel application that we developed for establishing the maximum indebtedness level of the applicant and/or cosigners – meaning the level of loan they are qualifying to get.

This application will provide a first indicative information referring to the maximum level of the loan that can be received by a customer because the information of the payment behavior of the applicant is not yet implemented in the application and can be obtained from the Credit Bureau. Thus, until the verifications of the payment behavior at the Credit Bureau, the result of the application developed provide information that does not represent a firm offer from the bank towards the customer.

In this Excel application, it will be input the above mentioned elements referring to applicant and/or cosigners; the result will be calculated automatically and will show the maximum indebtedness level and the maximum level of the loan that can be obtained by the customer (taken into consideration the credit type and the currency).

According to last regulations, NBR eliminates limitations referring to:

➢ maximum degree of indebtedness;
➢ categories of loans (consumer / real estate investment loans);
➢ meaning of "family";
➢ minimum advance for real estate investment loans.

Banks can make their own credit policies, in terms of own caution necessary elements.

There are however some conditionings, some clearly included in NBR Regulations no. 3 / 2007, others in further correspondence with banks, respective:

▪ Net income eligible for loans is determined by deducting from the income made by potential clients the following:
  • subsistence expenses;

- other commitments to pay, than the monthly installment of the current loan asked;
  - Maximum degree of indebtedness may be:
    - 70% for banks that send positive information to Credit Bureau (positive information is referring to the positive behavior of a borrower);
    - 65% for banks not yet transmitting positive information to Credit Bureau;
  - Maximum degree of indebtedness has to keep in mind:
    - the risk profile of customers (scoring data);
    - payment behavior of customers (current arrears and/or last registered).

The Bank X proposed a model for determining the maximum level of indebtedness that takes into account the following:

- The number of family members of the applicant and/or cosigners, if applicable
  - statistically, it was proved that the consumer behavior is determined by family size (ex. single people consume more than those coming from a family with two or three members);
  - the family consumption is less than the sum of individual consumption of family members;
- The geographical region in which the applicant and/or cosigners live, if applicable
  - unequal development of different regions of the country determine incomes but also consumption behaviors different from one area to another;
- The administrative environment in which the applicant and/or cosigners live, if applicable: rural / urban (county residence or not)
  - the concentration of economical growth factors around county residence and urban places result in unequal development, even within the same geographical area;
- The applicant's risk profile
  - the scoring analysis helps form a convincing image of a client's potential to become bad payer during the lending period;
- The payment behavior of the applicant and/or cosigners, if applicable
  - current or past arrears of the applicant is a clear indicator of a certain type of customers who can always become bad payers.

Bank X is also redefining the following terms:

- Family:
  - spouse and dependent children;
- Internal cosigner:
  - a member of the borrower family or other person who:
    - ✓ lives and households together with the borrower;

✓ whose income is actually taken into account in determining the repayment capacity;

✓ signs the credit agreement as a cosigner;

o the type of cosigner accepted for all types of loans

o maximum number of internal cosigners permitted is 4

✓ the spouse is considered an internal cosigner;

• External cosigner

o A person who is not a member of the borrower family and is not living and household together with the borrower, but:

✓ whose income is actually taken into account in determining the repayment capacity;

✓ signs the credit agreement as cosigner;

o the type of cosigner accepted only for loans with real estate guarantees

o maximum number of external cosigners permitted is 4.

As a result of the scoring analysis (total scoring achieved), the applicant is put into a certain risk class with a specific degree of indebtedness. If the total scoring is below 16 points, the applicant does not qualify for obtaining a loan.

**The link between the scoring, risk class and degree of indebtedness**

**Table 2**

| Scoring | | Risk class | Degree of indebtedness |
|---|---|---|---|
| Min | Max | | |
| 16 | 17 | E | 52.68% |
| 18 | 19 | D | 57.58% |
| 20 | 21 | C | 58.42% |
| 22 | 23 | B | 63% |
| 24 | | A | 65% |

In Table 2, is presented the link between the scoring, risk class and degree of indebtedness for Bank X. All these elements were established by Bank X in the credit policy.

## The steps of crediting an individual

In Figure 1, the steps of crediting an individual are presented, respective:

### Step 1

This step focuses on the determination of monthly net income based on the source of income. Bank X uses the following coefficient for adjustment the incomes depending on their degree of certainty:

• 0 (this income will be counted at 100%) for:

◆ income from wages, for persons with labor contract on indefinite duration or fixed-term duration higher than the loan period;
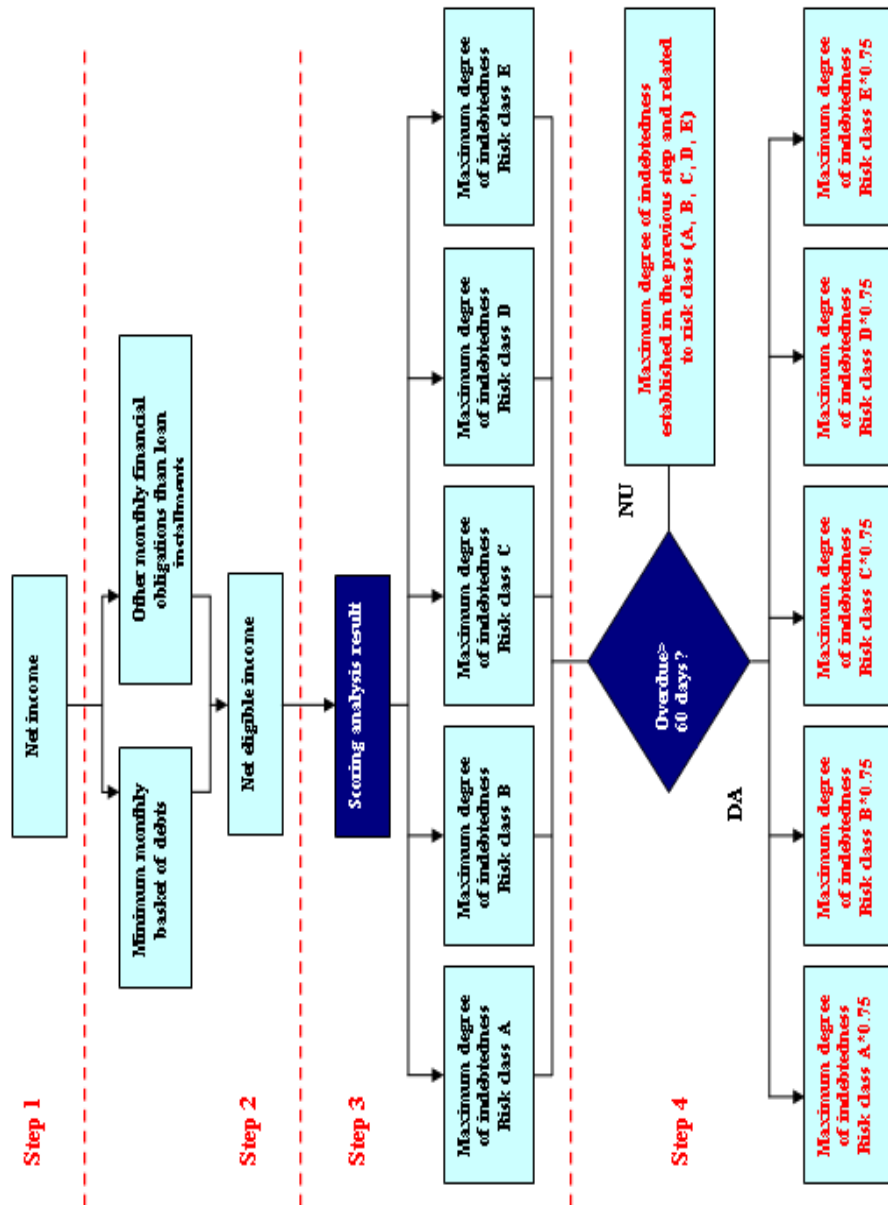
**Figure 1 The four steps of crediting**

- income from deposits and interest paid on such deposits - if the only source of repayment of credit submitted by the applicant is deposit, the applicant shall not perform the associated financial analysis determining the maximum level of indebtedness;
- income from rents, provided that the duration of the rental to be higher than the life of the loan;
- pension incomes

- 0.05 (this will be taken into account at a rate of 95%) for:
  - income from wages, for persons with a fixed-term labor contract, with possibility of extension demonstrated by the continuity in the workplace;
  - income from dividends, for short-term credit.

- 0.1 (this will be taken into account at a rate of 90%) for:
  - income from dividends for medium-term loans;
  - income from independent activities such as: incomes generated from the following professions – doctors, lawyers, notaries, financial auditors, fiscal and real estate consultant, accountants, architect;

- 0.2 (this will be taken into account at a rate of 80%) for:
  - income from dividends, for long-term loans;
  - income from wages, for person in the work contract with determined period shorter than the loan period;
  - income from rents, if the rental duration is shorter than the loan period;
  - income from other sources.

*Step 2*

In this step, we determine the net eligible income by decreasing the net income realized by the client with:
- ➢ minimum monthly basket;
- ➢ other payment commitment (financial installments) according to statements made by the applicant.

The minimum monthly basket represents the minimum monthly expenditure of a family, covering:
- ✓ expenditure on food;
- ✓ expenses on utilities and maintenance;
- ✓ expenditure on medicines, hygiene items;
- ✓ expenditure on basic services (transportation, medicine, communication, information);
- ✓ expenditure on clothing and footwear;

✓ expenditure on household goods, electronics and appliances;
✓ expenditure on taxes.

All the above mentioned expenses included in the minimum monthly basket are set by the Government Emergency Ordinance no. 217 / 2000 up-dated with Government Decision no. 1079/2003. According to this regulation, the value of the minimum monthly basket for debts in the second quarter of 2003calculated using the prices of June 2003 was 5.526.343 lei (Romanian old lei) for a household of average size – 2,8 persons; in the case study herein presented, Bank X established the following values for the minimum monthly basket of debts (calculations were made in 2009, in EUR): 88,71 EUR for 1 person, 177.43 EUR for 2 persons, 266.14 EUR for 3 persons, 354.86 EUR for 4 persons and 443.57 EUR for 5 persons.

Those values of the minimum monthly basket were established by Bank X in the loan policy taken into considerations the following factors:

⇨ The number of family members - there is a minimum monthly basket calculated for a family of 1, 2, 3, 4 and that more than 5 members;

⇨ The geographic region according to the divisions made by the National Institute of Statistics - the adjusting coefficients for the a certain region were determined by the degree of regional development, reflected in GDP / capita;

  o 1.1 for Vest and Bucureşti Ilfov
  o 1.05 for Nord-Vest
  o 1 for Centru
  o 0.9 for Sud-Est and Sud Muntenia
  o 0.8 for Sud Vest Oltenia and Nord-Est

⇨ Residence in the rural or urban, county or other urban areas – in this case, the adjusting coefficients are:

  o 1, if the client lives in an urban county
  o 0.9, if the client lives in an urban community that is not county
  o 0.7, if the client lives in a rural locality.

The minimum monthly basket value is adjusted whenever necessary, but at least once a year and is:

▪ lower for applicants who live in areas with lower development potential;
▪ higher for applicants who live in county residences.

We will present an example of a retail client who applies for a personal loan. The client is part of a household consisting of 2 members with a monthly net income of 500 EUR.

In this case and according to Bank X loan policy, the minimum monthly basket value for 2 persons is 177.43 EUR.

Depending on the geographical region where the client lives and the residence, the net eligible income resulted after deduction the minimum monthly basket adjusted has the values as indicated in Table 3 and Figure 2.

**The net eligible incomes**

Table 3

| Geographical region | The eligible net income | | |
|---|---|---|---|
| | county residence | other urban community | rural community |
| NE | 358.1 | 372.3 | 400.6 |
| SE | 340.3 | 356.3 | 388.2 |
| Sud Muntenia | 340.3 | 356.3 | 388.2 |
| Sud Vest Oltenia | 358.1 | 372.3 | 400.6 |
| Vest | 304.8 | 324.3 | 363.4 |
| Nord Vest | 313.7 | 332.3 | 369.6 |
| Centru | 322.6 | 340.3 | 375.8 |
| Bucuresti Ilfov | 304.8 | 324.3 | 363.4 |



**Figure 2 The geographical regions**

In case the client has other financial obligations to pay (other monthly expenses), there will be decreased from the monthly net income together with the expenses that compose the minimum monthly in order to determine the net eligible income.

The net eligible income of the persons living in areas with lower development potential, or living in rural communities, or do not live in urban areas – county is higher because for these people the minimum monthly basket is lower.

*Step 3*

In this step, the client is put into a risk class (A- E) depending on the outcome of the scoring analysis.

The maximum amount of indebtedness is calculating using the following formula:

*The maximum amount of indebtedness = the net eligible income * the maximum degree of indebtedness, associated to the risk class.*

According to the bank loan policy, the degrees of indebtedness per risk classes have the values presented in Table 4,

**The degrees of indebtedness per risk classes**

Table 4

| Risk class | Degree of indebtedness |
|------------|------------------------|
| E | 52.68% |
| D | 57.58% |
| C | 58.42% |
| B | 63% |
| A | 65% |

In Table 5, it is calculated the maximum amount of indebtedness taken into the geographical region and the residence.

Analyzing the values of Table 5, one can notice that the higher the results of the scoring the analysis, the more the maximum amount of indebtedness.

**The maximum amount of indebtedness**

Table 5

| Geographical region | The eligible net income (county residence) | The maximum amount of indebtedness Risk class A | Risk class B | Risk class C | Risk class D | Risk class E | The eligible net income (other urban area) | The maximum amount of indebtedness Risk class A | Risk class B | Risk class C | Risk class D | Risk class E | The eligible net income (rural area) | The maximum amount of indebtedness Risk class A | Risk class B | Risk class C | Risk class D | Risk class E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NE | 358.1 | 233 | 225.7 | 209.2 | 206.2 | 189 | 372.3 | 242 | 235 | 217 | 214.3 | 196 | 400.6 | 260.4 | 252.6 | 234.1 | 230.7 | 211 |
| SE | 340.3 | 221 | 214.5 | 198.8 | 196 | 179 | 356.3 | 231.6 | 225 | 208 | 205.1 | 188 | 388.2 | 252.3 | 244.7 | 226.8 | 223.5 | 205 |
| Sud Muntenia | 340.3 | 221 | 214.5 | 198.8 | 196 | 179 | 356.3 | 231.6 | 225 | 208 | 205.1 | 188 | 388.2 | 252.3 | 244.7 | 226.8 | 223.5 | 205 |
| Sud Vest Oltenia | 358.1 | 233 | 225.7 | 209.2 | 206.2 | 189 | 372.3 | 242 | 235 | 217 | 214.3 | 196 | 400.6 | 260.4 | 252.6 | 234.1 | 230.7 | 211 |
| Vest | 304.8 | 198 | 192.2 | 178.1 | 175.5 | 161 | 324.3 | 210.8 | 204 | 189 | 186.8 | 171 | 363.4 | 236.2 | 229.1 | 212.3 | 209.2 | 191 |
| Nord Vest | 313.7 | 204 | 197.8 | 183.3 | 180.6 | 165 | 332.3 | 216 | 210 | 194 | 191.4 | 175 | 369.6 | 240.2 | 233 | 215.9 | 212.8 | 195 |
| Centru | 322.6 | 210 | 203.3 | 188.4 | 185.7 | 170 | 340.3 | 221.2 | 215 | 199 | 196 | 179 | 375.8 | 244.3 | 236.9 | 219.5 | 216.4 | 198 |
| Bucuresti Ilfov | 304.8 | 198 | 192.2 | 178.1 | 175.5 | 161 | 324.3 | 210.8 | 204 | 189 | 186.8 | 171 | 363.4 | 236.2 | 229.1 | 212.3 | 209.2 | 191 |

*Step 4*

The maximum amount of indebtedness computed in step 3 is adjusted with a coefficient determined by the behavior of the customer's payment:

⇨ 1, if the client currently has or has had in the past year to pay outstanding obligations within 60 days (standard)

⇨ 0.75, if the client currently has or has had in the past year to pay outstanding obligations between 61 and 90 days (adjusted)

⇨ 0, if the client currently has or has had in the last year remaining payment obligation of more than 91 days (Rejected)

    o Retail Customers who registered remaining payment obligation of more than 90 days (rejected) are not considered eligible, except for those bringing real guarantees such mortgage / collateral deposits / cash certificates etc.. and the remaining amounts are less than RON 100 equiv. in this type of the arrears.

The maximum amount of indebtedness is the sum of all credit installments that the client can sustain. So:

*The maximum credit installment for which the client apply for is = the maximum amount of indebtedness, determined at the end of step 4 – other liabilities for payment (financial installments).*

In the case the applicant is applying for a loan and is presenting cosigners, the following rules should be followed, respective:

- Both internal and external cosigners are treated as independent family
  - o This rule is also valid for cosigners that are living and householding together with applicant;
  - o In case of the spouse having the status of internal cosigner, she/he is treated like family of the borrower;
- The minimum monthly basket for cosigners is calculated using the same model as for the applicant;
- The payment commitments of the applicant and/or cosigner family are declared and taken into account;
  - o for the time being and for technical reasons, the analysis scoring is not done for cosigners, they are directly put in risk class E (except spouse of the applicant which fall into the same class of risk as the applicant);
- The possible maximum installment of a loan = the maximum installment of the applicant + Σ Maximum installments of the internal cosigners + Σ Maximum installments of the external cosigners;

- If the spouse applicant has already monthly payment obligations (financial installments), it may be preferable to bring an internal / external cosigner without such obligations or having reduced ones;
- Moreover, if the spouse of the applicant and / or any of the cosigners has outstanding payment obligations is preferable that he / they are not cosigners;
- The credit application will include all data needed to model, as per statutory declarations of the applicant and, if necessary, of the cosigners:
  - Net income of the applicant and of the cosigners, if the case;
  - The number of family members of the applicant and of the cosigners, if the case;
  - Payment commitments of the applicant, the applicant's family and of the cosigners, if the case;
- The model we proposed (which is an integrated assessment tool for retail loans) will automatically calculate the maximum degree of indebtedness of the customer, depending on:
  - Geographic area;
  - Type of the locality of residence: urban county or other urban community (which is not county), rural locality;
  - Risk class determined as a result of the scoring analysis;
  - Customer payment behavior, based on automated interpretation of risk data, including also the report from Credit Bureau.

The Excel application we proposed will provide only indicative information without taken into consideration the customer's payment behavior.

### Conclusion

As a conclusion, credit scoring can be used for controlling risk selection, managing credit losses, evaluating new loan applications, improve loan approval processing time, ensuring that the existing credit criteria are relevant and applied consistently, improve compliance with the regulation in force and also improve profitability per customer.

As the amount of retail loans increased considerably in the last years and the financial crisis determined banks to reconsider their credit scoring, we believe that the quality and improvements in the methods used for credit scoring are obvious for the banks in order to prevent them and their customers from big losses.

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