

## METHODOLOGY FOR MEASURING NON-PERFORMING CONSUMER LOANS

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Key words: non-performing loans, measurement methodology, payment obligation, liability, income, loan risk management, risk size

**Introduction.** The article deals with practical issues related to the assessment of credit risks. A technique for measuring and assessing the risk of non-repayment of consumer loans of a potential borrower in a commercial bank is proposed, which will help to make the right and quick decision. In order to reduce the risk of non-repayment of loans issued to individuals, banks collect detailed information about the financial situation of a potential borrower.

**Methodology.** The entire study is related to the analysis of the methodology of non-performing consumer loans<sup>1</sup>. We have considered different tools, methods and principles designed by leading experts [Khairi et al., 2021, 366–73]. One of the efficient methods in the management of non-performing loans starts from a comprehensive survey among the main commercial banks and the borrowers [Carpinelli, Cascarino et al., 2017, 157–87]. As a rule, information about the borrower is formed on the basis of the completed "Application Questionnaire" and a set of documents submitted by him for obtaining a loan, a list of which is given in the instructions for providing the appropriate loan product. The credit specialist, in accordance with the established form, submits to the Authorized body of the bank a conclusion on risk assessment. The authorized body considers the conclusion and makes a decision on granting a loan or refuses it.

This technique allows measuring and assessing the risk of non-repayment of consumer loans by comparing various factors, which include an assessment of the intended use of the loan, analysis of the borrower's credit history, assessment of its creditworthiness and solvency, analysis of the composition, liquidity and value of the pledged property, assessment of the reliability of the data provided by the borrower.

**Literature review.** Although the issues discussed in this article are not new, however, there are many different approaches to solve them depending on precise circum-

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<sup>1</sup> When the borrower remains financially healthy and pays the agreed instalments and interest as scheduled, the loan is said to be performing. But there is always the risk that the company or individual will not be able to repay within the agreed timespan. If this happens or looks likely to happen, the bank must classify the loan as "non-performing". Non-performing loans are often called "bad loans". A loan becomes non-performing when there are indications that the borrower is unlikely to repay the loan, or if more than 90 days have passed without the borrower paying the agreed instalments. This may happen when an individual loses their job and therefore cannot repay their mortgage as agreed, or when a company experiences financial difficulties.

tances and financial environment. Currently one of the main topics in this field is to measure economic policy uncertainty [Baker et al., 2016, 1593–636], therefore, the experts attempt to first, understand the relationship between the non-performing loans and macroeconomics factor [Foglia, 2022, 21] and be specific in revealing banking-industry specific and regional economic determinants of non-performing loans [Ghosh, 2015, 93–104]. While some experts examine the key determinants of non-performing loans [Beck et al., 2015, 525–50], taking into consideration peculiarities in North America or in euro-area countries [Dimitrios, 2016, 116–19], questioning the bank market power in non-performing loans [Karadima and Helen, 2020, 72], others use the data analysis for forecasting recovery rates on non-performing loans with machine learning [Bellotti et al., 2021, 428–44], others assess the recovery and reduction of non-performing loans-podgorica approach [Stijepović, 2014, 101], as well as measuring the recovery performance of a portfolio of NPLs [Carleo et al., 2023, 29]. In particular, Konstantakis, Konstantinos N., Panayotis G. Michaelides, and Angelos T. Vouldis have conducted a long-run equilibrium analysis with a real time VEC model for Greece which might be useful also in the case of Armenia [Konstantakis et al., 2016, 149–61].

**Scientific novelty.** We have worked out a technique which assesses the risk of non-repayment of a consumer loan in a commercial bank. The bank must collect detailed information about the financial condition of a potential borrower based on the completed "application-questionnaire" on the CL and the list of documents provided by it. After receiving a loan application, the credit department of the bank should check the integrity of the submitted documents and their validity period, the accuracy of filling out certificates from the place of work (if any) - the validity of the employment contract, form, salary, etc. - by comparing the data specified in the loan application and received during the oral conversation. Further, the unit must determine their reliability, the validity of the monthly income indicated in the certificate from the main place of work, based on the specialty, field of activity by comparing with income paid (received) in similar fields of activity, assess the market position, stability, opportunities and development prospects an organization represented by the borrower, co-borrower (or guarantor) and/or other family members. Based on the results of the verification of the above documents and the response to the request from the credit bureau, the bank's loan officer must substantiate and document his opinion on the approval / refusal of the bank's credit committee in issuing a loan in the form "Report on the results of underwriting". The credit committee of the bank must consider the opinion on the underwriting of the loan and make a decision on granting or rejecting the CL to the borrower.

**Analysis.** The intended use of the loan implies that the loan must be used by the borrower strictly for its intended purpose, except in cases where the loan product does not provide for the designation of the purpose. An analysis of the borrower's credit history makes it possible to determine the borrower's readiness to fulfill the financial obli-

gations assumed by him based on the characteristics of his previous payment obligations indicated in loan agreements and other monetary obligations (including the payment of alimony). The assessment of the creditworthiness of a potential borrower is carried out on the basis of an analysis and assessment of the borrower's personal qualities, his social status and information on the fulfillment of financial obligations by him, and solvency is assessed in terms of the ability to regularly and timely make loan payments, based on the calculation of the borrower's income and expenses. Analysis of the composition, liquidity and value of the pledged property is carried out on the basis of the opinion of the valuation agencies cooperating with the bank or employees of the bank itself. The reliability of the data provided by the borrower is assessed based on the conclusion of the Security Department (SD), verification of the legal consistency of the borrower's title documents and the subject of collateral.

As already mentioned, one of the conditions for granting a loan to individuals for individual consumer lending products is its intended use, that is, it is understood that the bank's money will be used by the borrower strictly for its intended purpose. When evaluating the intended use of the loan, the purpose of obtaining a loan is determined based on the borrower's application, the adequacy of the purpose is determined, the compliance of the purpose of the loan with the bank's credit policy is clarified, the availability of documents on the intended use of the loan (invoices for payment for goods (works, services), a copy of the vehicle registration certificate) is checked, documents for an apartment, etc.). At the same time, it is important to take into account the so-called stop indicators. We are talking about the existence of facts confirming that the loan will not be used for its intended purpose (if the loan product provides for its intended use).

**Table 1.** Determination of risk size

<b>№</b>	<b>Risk category</b>	<b>Criteria</b>	<b>Size of risk</b>
<b>1</b>	Minimal Risk	Transparent, documented consumer goals. The share of non-purpose use is no more than 10%	<b>0% or 10%</b>
<b>2</b>	Medium Risk	Potentially transparent purposes, there is a possibility of providing documents for the stated purpose of the loan.	<b>20% or 30%</b>
<b>3</b>	Above average risk	The share of inappropriate use is from 10 to 25%	<b>50% or 70%</b>
<b>4</b>	<b>High risk</b>	<b>The share of non-purpose use is from 25 to 50%</b>	<b>100%</b>

If there are stop indicators or if information is obtained from other sources about the misuse of the loan, the risk is estimated at 100%. The credit history of the borrower characterizes the fulfillment by him of his previous payment obligations, including obligations arising from loan agreements and other monetary obligations. This indicator is formed on the basis of verification and analysis of the borrower's credit history. Here, among the stop indicators may be compromising information about the borrower, the presence of regular overdue payments on repaid and current monetary obligations, a ne-

gative conclusion of the Security Department (concealment by the borrower of information relating to his reputation and credit history).

**Table 2.** Determination of risk size

N <sup>o</sup>	Risk category	Criteria	Risk size
1	Minimal Risk	No late payments or delay no more than 3 days	<b>0%</b>
		No more than one delay from 4 to 10 days	<b>10%</b>
2	Medium Risk	2 or more overdue payments from 11 to 15 days.	<b>20%</b>
		No more than one delay from 16 to 20 days	<b>30%</b>
3	Above average risk	Regular overdue (21 to 40 days) with a final repayment	<b>50%</b>
		Delay from 41 to 60 days	<b>70%</b>
4	High risk	Past due more than 61 days	<b>100%</b>

**Table 3.** Rating scores

N <sup>o</sup>	Borrower characteristics	Points
1	Borrower age: <input type="checkbox"/> less than 28 years old	<b>5</b>
	<input type="checkbox"/> 28 to 44 years old	<b>8</b>
	<input type="checkbox"/> 45 to 59 years old	<b>6</b>
	<input type="checkbox"/> 60 to 65 years old	<b>3</b>
2	Number of dependents: <input type="checkbox"/> no	<b>4</b>
	<input type="checkbox"/> one	<b>3</b>
	<input type="checkbox"/> two	<b>2</b>
	<input type="checkbox"/> three or more	<b>1</b>
3	Family status: <input type="checkbox"/> married	<b>3</b>
	<input type="checkbox"/> single/unmarried	<b>0</b>
4	Living conditions: <input type="checkbox"/> own apartment	<b>10</b>
	<input type="checkbox"/> rental housing	<b>4</b>
	<input type="checkbox"/> other (dormitory, living space provided by the employer, etc.)	<b>6</b>
5	Vehicle availability: <input type="checkbox"/> car	<b>3</b>
	<input type="checkbox"/> no	<b>0</b>
6	Profession, place of work: <input type="checkbox"/> manager	<b>9</b>
	<input type="checkbox"/> skilled worker	<b>7</b>
	<input type="checkbox"/> unskilled worker	<b>5</b>
	<input type="checkbox"/> pensioner	<b>3</b>
	<input type="checkbox"/> unemployed	<b>1</b>
7	Duration of work (at the current place of work): <input type="checkbox"/> less than 2 years	<b>4</b>
	<input type="checkbox"/> 2 to 5 years	<b>7</b>
	<input type="checkbox"/> more than 5 years	<b>9</b>
8	Borrower's income (if needed, the borrower's family) per month	
	<input type="checkbox"/> less than AMD 100 thousand	<b>3</b>
	<input type="checkbox"/> from 100 to 200 thousand AMD	<b>5</b>
	<input type="checkbox"/> from 200 to 400 thousand AMD	<b>7</b>
	<input type="checkbox"/> more than 400 thousand AMD	<b>10</b>

As can be seen from Table 3, the maximum number of points that a borrower can score in this 8-factor model is 56, the minimum is 16. The lower limit of the rating is set at 30 points, below which the borrower is considered problematic.

**Table 4.** Determination of risk size

<b>№</b>	<b>Risk category</b>	<b>Criteria</b>	<b>Risk size</b>
<b>1</b>	Minimal Risk	More than 52 points	<b>0%</b>
		from 48 –51 points	<b>10%</b>
<b>2</b>	Medium Risk	from 43 - 47 points	<b>20%</b>
		from 40 - 42 points	<b>30%</b>
<b>3</b>	Above average risk	from 36 - 39 points	<b>50%</b>
		from 32 - 35 points	<b>70%</b>
<b>4</b>	High risk	Less than 31 points	<b>100%</b>

Assessment of the solvency of a potential borrower, i.e. his ability to timely and fully repay the loan is made on the basis of an analysis of his income and expenses. If the borrower's income is insufficient to repay the loan, then his income also includes the income received by members of his family.

In the analysis of solvency, banks take into account both documented and undocumented sources of income. When calculating solvency, it is necessary to compare the amount of future expenses with the current ones indicated in the "Application Questionnaire". For example, when purchasing a vehicle, there are expenses for its maintenance, when purchasing real estate, the cost of renting a house disappears, but at the same time, utility costs arise. Before issuing a loan to an individual, banks calculate the following coefficients that determine the probability of loan repayment:

The P/I ratio is equal to the ratio of the amount of monthly payments (including the monthly principal payment and interest payments on the loan) to the amount of monthly net total income.

$$P/I \text{ ratio} = \frac{\text{borrower's monthly loan payment}}{\text{borrower's monthly income}} * 100\% \text{ (1)}$$

This ratio determines the maximum allowable share of loan costs in the borrower's total income, based on the criteria set by the company. Exceeding this ratio indicates an increased risk in providing a loan in terms of the borrower's ability to repay it in a timely and correct manner. At the same time, a deviation of the indicator by 1% point does not become a basis for refusing to subsequently acquire the rights of claim on these mortgage loans by the company. The ratio that determines the share (including certain other mandatory housing costs) of the borrower's total *liabilities* in his *income* (L/I ratio) should not exceed 40% of his total income. In some cases, provided that when paying in

accordance with this indicator for all obligations, each member of the borrower's family accounts for at least 200 US dollars in the equivalent of income, the coefficient can be adjusted up to 50%. The L/I ratio is equal to the ratio of the total amount of liabilities (including monthly loan payments, property taxes, monthly payments for real estate insurance, life of the borrower, contract liability, other regular mandatory payments) to income for the corresponding period.

$$\text{L/I ratio} = \frac{\text{total amount of required monthly payments}}{\text{the total amount of all monthly income}} * 100\% \quad (2)$$

This coefficient determines the maximum allowable share of all liabilities of the borrower in his budget, including expenses related both directly to the repayment of the loan, and with other obligations he has (consumer loans, other debt obligations, alimony and other regular mandatory payments related to the maintenance of dependents, health insurance (additional), as well as movable and immovable property). At the same time, a deviation of this indicator by 1% is not a reason for refusing to subsequently acquire the rights of claim on these mortgage loans by the company.

L/I should not exceed 80% of the total income of the borrower.

When calculating the total amount of all monthly income, other documented unjustified income is reduced by 50%. Stop indicators: the presence of large and unforeseen expenses for the borrower, the lack of stability in employment or business.

**Table 5.** Determining the size of the risk

<b>№</b>	<b>Risk category</b>	<b>Criteria</b>	<b>Risk size</b>
<b>1</b>	Minimal Risk	(100% - L/I) more than 51% (100% - L/I) from 41 to 50%	<b>0%</b> <b>10%</b>
<b>2</b>	Medium Risk	(100% - L/I) from 31 to 40% (100% - L/I) from 21 to 30%	<b>20%</b> <b>30%</b>
<b>3</b>	Above average risk	(100% - L/I) from 16 to 20% (100% - L/I) from 11 to 15%	<b>50%</b> <b>70%</b>
<b>4</b>	High risk	(100% - L/I) less than 10%	<b>100%</b>

If there are stop indicators, the risk is estimated at 100%. One of the important factors is the collateral for the loan. Retail lending is secured by real estate and movable property, guarantees/sureties of legal entities and individuals. It is necessary to assess to what extent the bank can rely on this collateral or guarantees (bail) when the loan is due, when it is no longer possible to use primary sources of repayment. The requirements of banks when issuing a loan to an individual are presented in relation to the fulfillment of the following coefficient that determines the security of the loan:

## Amount of loan

$$L/C = \text{-----} * 100\% \quad (3)$$

Market value of the collateral

L/C - the ratio between the loan amount and the market value of the collateral, when pledging real estate it should not exceed 80%, when pledging vehicles - 70%, when buying a new vehicle - 90%, when buying a used vehicle - 85% , for mortgage lending under international programs - 80% (repair - 70%), for mortgage lending from the bank's own funds - 80%.

**Table 6.** Determining the size of the risk

<b>№</b>	<b>Risk category</b>	<b>Criteria</b>	<b>Risk size</b>
<b>1</b>	Minimal Risk	Highly liquid collateral <input type="checkbox"/> L/C value from 1-35% <input type="checkbox"/> from 36-45%	<b>0%</b> <b>10%</b>
<b>2</b>	Medium Risk	Medium liquid collateral <input type="checkbox"/> L/C value from 46-55% <input type="checkbox"/> from 56-60%	<b>20%</b> <b>30%</b>
<b>3</b>	Above average risk	Low liquid collateral <input type="checkbox"/> L/C value from 61-70% <input type="checkbox"/> from 71-80%	<b>50%</b> <b>70%</b>
<b>4</b>	High risk	Very low liquid collateral <input type="checkbox"/> L/C value over 81%	<b>100%</b>

In order to reduce the risk of non-repayment of the loan, an employee of the credit department of banks or another unit should check the data provided by the borrower, including: place of registration (residence), passport data, place of work, salary, etc. [3].

**Table 7.** Determination of risk size

<b>№</b>	<b>Risk category</b>	<b>Criteria</b>	<b>Size of risk</b>
<b>1</b>	Minimal Risk	All data is confirmed There are reasons to doubt the reliability of one parameter	<b>0%</b> <b>10%</b>
<b>2</b>	Medium Risk	There are reasons to doubt the reliability of 2 parameters There are reasons to doubt the reliability of 3 parameters	<b>20%</b> <b>30%</b>
<b>3</b>	Above average risk	Reasons to doubt the authenticity of appr.50% documents Reasons to doubt the authenticity of appr. 70% documents	<b>50%</b> <b>70%</b>
<b>4</b>	High risk	Data not confirmed, documents forgery, data falsification	<b>100%</b>

When assessing credit risk, additional information about the borrower is important. In particular, the presence of significant assets in the form of movable property and real estate (an apartment, a house, a land plot, a dacha, a car, etc.) is a positive compensating factor, since it indicates the potential borrower's ability to make savings, as well as the ability to repay the loan in the event of a decrease in income. If the borrower, in

addition to monthly income, has additional sources of funds, then they can be used for monthly loan payments. The average age of the borrower (25-45 years), the prospects of his specialty and stable work are also important. The presence of a promising job and the favorable age of the borrower allow us to hope that during the loan period his income will grow, and the pressure of monthly payments on his income will decrease. A positive factor is the legal reliability of title documents for the subject of collateral (based on the conclusion of the legal department of this bank). In the risk calculation procedure, an individual's loan application is evaluated according to 6 criteria. For each criterion, 4 evaluation categories are used. Each category corresponds to a certain level of risk. In order to calculate the final risk indicator for each individual criterion, a certain weighting coefficient is applied corresponding to the significance of the criterion, with a range of values from 0 to 1. The following tables show the types of loans with the respective weighting coefficients W, distributed by criteria.

**Table 8.** Weight coefficients (Car loan):

Characteristic (P)	Weight coefficient W
Intended use (P1)	0,05
Credit history (P2)	0,2
Creditworthiness (P3)	0,15
Solvency (P4)	0,3
Loan security (P5)	0,2
Reliability (P6)	0,1

**Table 9.** Weight coefficients (Secured by property):

Characteristic (P)	Weight coefficient W
Intended use (P1)	0
Credit history (P2)	0,3
Creditworthiness (P3)	0,1
Solvency (P4)	0,25
Loan security (P5)	0,25
Reliability (P6)	0,1

**Table 10.** Weighting coefficients (Mortgage):

Feature(P)	Weight coefficient W
Intended use (P1)	0,05
Credit history (P2)	0,3
Creditworthiness (P3)	0,2
Solvency (P4)	0,3
Loan security (P5)	0,05
Reliability (P6)	0,1



**Table 11.** Weight coefficients (other programs):

Characteristic (P)	Weighting factor W
Intended use (P1)	0,05
Credit history (P2)	0,2
Creditworthiness (P3)	0,05
Solvency (P4)	0,3
Loan security (P5)	0,3
Reliability (P6)	0,1

As a result of the analysis of the application for a given borrower, risk levels are determined for all of the above parameters. The obtained values are assigned a quantitative assessment (percentage) [2].

Risk  $R_c$  is defined as the probability of loan default and is calculated as follows:

$$R_c = \sum P_i * W_i * K \quad (4)$$

$P_i$  is the percentage of risk for each of the parameters;

$W_i$  is the weight coefficient;

$K$  - correction factor, which is determined in accordance with the table below.

Risk value for individual characteristics	K
0-10%	1.3
11-30%	1.2
31-60%	1.1
61-100%	1

Since the weight coefficient  $W_i$  is distributed among a fairly large number of criteria with a small range of values from 0 to 1, the final risk, taking into account the weight of the parameters, decreases as the risk decreases. In this regard, a correction factor is applied, which increases the risk as the percentage of risk for individual parameters decreases, thereby eliminating calculation errors. Based on the results of the obtained  $R_c$  value, the risk rating is determined.

**Table 12.** Risk rating table

Risk value	Rating
0-15%	Minimum
16-20%	Average
21-25%	Above average
26-100%	High

Using the obtained probability, the possible amount of bank losses is calculated:

$$\text{Possible loss amount} = \text{Loan amount} * R_c \quad (5)$$

and recommended loan amount:

$$\text{Recommended loan amount} = \text{loan amount} - \text{loan amount} * R_c \quad (6)$$

**Conclusions and practical recommendations.** In cases where the received value of  $R_c$  ranges from 0 to 25%, the loan can be considered acceptable for the bank. If the value of  $R_c$  is more than 25%, then the borrower is either denied a loan, or it is proposed to increase the security on the loan or the amount of the prepayment (for mortgages and car loans). You can also offer the borrower to find another collateral or add a new collateral to the one already offered (for loans secured by property).

This technique assesses the risk of non-repayment of a consumer loan in a commercial bank. The bank must collect detailed information about the financial condition of a potential borrower based on the completed "application-questionnaire" on the CL and the list of documents provided by it.

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