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Binary Logistic Regression Analysis: The Indicators Underlying the Granting of a High Value Personal Loan

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Abstract

All clients requesting loan for personal needs in credit institutions are included in certain groups with different default risk. In this respect, banks use a number of quantitative and qualitative indicators to categorize credit applicants in risk categories based on prudence, credibility and solvency. However, many institutions do not have a clear picture of the consumer's importance to these indicators, especially in terms of access to high value credits. Therefore, we present the results of a study aimed at identifying consumer opinions on the influence of the indicators underlying the granting of a high value personal credit, which was performed (n = 102) among the population in Brasov, over 18, in June 2019. The study results indicate the type of income, the amount of the customer's and beneficiary's income, the location, the length of residence, the length of service, the age and the field in which they operate are factors taken into account by banks and non-personal needs of high value.

Key words

Bank customers, loan, institution; customer income type; Amount of customer and co-payee revenue; customer's location; residence duration at the same address of the customer; customer seniority; information included in the Credit Bureau (BC) databases

JEL Codes: G21, M31

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1. Introduction

Personal need loan is any consumer credit contracted by an individual to meet his/her personal needs. In this regard, we can say that the purpose of the personal needs loan may fall into one or more of the following situations: the non-nominative personal needs of the applicant or, depending on the case, of the applicant and its co-payers; development of agricultural production in their own households; the marketing of products obtained from agricultural production in their own households; for special events (holiday, traveling, marriage, baptism, etc.); replacement operations of existing exposures (refinancing) related to current consumer credit (s).

Personal needs loans can be granted to applicants for a maximum of 5 years. In lending activity to individuals, credit institutions will pursue the classification of credit applicants into risk categories of default. The use of quantitative and qualitative indicators to categorize and categorize credit applicants in the default risk categories is based on prudence as a fundamental principle characterizing credit institutions as well as the following general principles:

a) Credibility represents the essential moral support, and presupposes knowledge of the credit applicant, through a thorough information and documentation activity, for forming beliefs about:

- the commitments contracted by other credit institutions as appropriate;
- his moral and professional qualities;
- reputation at the workplace and in the applicant's society;
- the material situation of the applicant and his/her family.

b) Solvency represents the ability of the applicant to repay the loan granted and to pay the related interest on the maturity date, according to the obligations assumed by the contract concluded with the credit institution. Credit granting activity is based on identifying and assessing as accurately as possible the applicants' ability to pay as the main source of credit payment. Classification and classification of credit applicants in the default risk categories will be made taking into account some features such as: the nature of the client's income; the amount of the customer/family income; customer's location; residence time at the same address of the customer; the seniority of the client's work; the client's marital status; customer

age; the field in which the client operates; professional training of the client; information recorded in Credit RIU's databases (credit histories worth more than ROL 20,000) and the Credit Bureau.

Following the assessment of the applicant's default risk and score, they are classified as risk classes as follows: class 1: low risk, class 2: medium risk, class 3: high risk. The score obtained by customers in the "low" or "medium" risk class is a necessary first element in the decision to approve the credit, but this is not enough. The target client of any credit institution is represented by natural persons in Class 1 default risk. During the course of the credit, the credit institutions shall review the classification in the customer default risk class if, during verifications, it is found that there are elements that cause a change in the valuation indicators (example: job loss, debtor's death).

2. Literature review

The study of the banking activity and the operations of the credit institutions is an interesting field of research, which is highlighted in the literature by the existence of numerous descriptive (quantitative and qualitative) studies about the credit institutions and the complex activity carried out by them. Constantinescu (2018) points out that the particularities of the credit institution have a significant impact on lending.

Wang (2002) has developed a heteroscedastic SFA model to identify and analyze the determinants of credit institutions' efficiency in the Central European countries, with the consequence that the notion of banking efficiency has become essential through the stability of banking companies. In the models used by Wagner (2015) and Turkes (2019), it is clear that the stability of the banking system, the structural structures and the efficiency of credit institutions and the development of capital markets form a close link. The analysis of the banking system in Romania, its performance and efficiency is of great importance from a microeconomic and macroeconomic point of view (Turkes and Capusneanu, 2018).

3. Methodology of research

The hypothesis of research involves measuring the influence of quantitative and qualitative indicators on customer access to a high value personal credit. In this respect, it was envisaged to model a relation between a set of independent variables (xi, categorical, continuous) and a dichotomic dependent variable (Y, nominal, binary). The purpose of quantitative research is to know the consumer's opinions on the influence of the indicators that underlie the granting of a high-value personal credit. The main objectives of the research were: (1) the importance of variables (quantitative and qualitative indicators) in class differentiation,Classifying an observation in a classroom. In the bivariate logistic analysis the following categories of variables were used:

- An addictive variable - measured with a dichotomous scale determined by access or not to a high value personal needs loan;
- Several independent variables - nominally measured, of which:
    - Institution;
    - Customer income type;
    - Amount of customer and co-payee revenue;
    - Customer's location;
    - Residence duration at the same address of the customer;
    - Customer seniority;
    - Marital status of client;
    - Customer Age;
    - The domain in which the client operates;
    - Professional training of the client;
    - Information included in the Credit Bureau (BC) databases.

Therefore, a quantitative marketing research was carried out among the population of Brasov, over the age of 18. The present research is extremely important, providing banking and non-banking institutions in Romania with a general picture of consumer opinions on the importance of indicators for which a high value personal credit is granted.

The sampling method used in this quantitative research was the telephone survey. In June 2019, the information gathering stage was conducted from the research population. The questionnaire used for data collection included a total of 11 closed queries of the nominal scale type with two or more variants. Different female and male respondents aged over 18

responded to the questions included in the questionnaire. Following the collection process, 102 responses resulted. The collected information was analyzed with the SPPS package using the binary logistic model.

4. Results and discussions

In order to measure the influence of quantitative and qualitative indicators on customer access to a high value personal credit, binary logistic regression was used to model a relationship between several variables. The independent variables were: xi - Institution; Customer income type; Amount of customer and co-payee revenue; Customer's location; Residence duration at the same address of the customer; Customer seniority; Marital status of client; Customer Age; The domain in which the client operates; Professional training of the client; Information included in the Credit Bureau (BC) databases and the dichotomous dependent variable -Y, access or not to a high value personal needs loan. Table 1 shows 102 valid and zero answers.

Table 1. Case Processing Summary

Unweight Cases[a]		N
Selected Cases	Included in Analysis	102
	Missing Cases	0
	Total	102
Unselected Cases		0
Total		102

Source: Authors' computations

Tables 2 and 3 show the encodings of the category variables (including the one dependent). For the 10 of the 11 independent categorical variables there was a recodification considering the reference category, which was recodified with 0.

Table 2. Dependent Variable Encoding

Original Value	Internal Value
No	0
Yes	1

Source: Authors' computations

We note that the constant pattern does a good thing in predicting nodal involvement for not being 100% correct involved, but the model does a great job in predicting nodal involvement for those involved 0% correct. The overall percentage forecast percentage is 50.0%.

Table 3. Classification Table[a,b]

Observed			Predicted	
			Do you want to get a personal loan of higher value?	
			No	Yes
Step 0	Do you want to get a personal loan of higher value?	No	0	51
		Yes	0	51
	Overall Percentage			

Source: Authors' computations

Table 4 shows all prediction variables that have not yet entered the model. This is the last exit of block 0.

Table 4. Variables not in the Equation

			Score	df
Step 0	Variables	INSTITUTIONS	.982	1
		CUSTINCOME	2.540	5
		CUSTINCOME(1)	.729	1
		CUSTINCOME(2)	.578	1
		CUSTINCOME(3)	.122	1
		CUSTINCOME(4)	.210	1
		CUSTINCOME(5)	.210	1
		AMOUNTCUSTOMER	2.432	4
		AMOUNTCUSTOMER(1)	.917	1
		AMOUNTCUSTOMER(2)	.201	1

		AMOUNTCUSTOMER(3)	.343	1
		AMOUNTCUSTOMER(4)	2.040	1
		CUSTOMERSLOCATION	2.234	4
		CUSTOMERSLOCATION(1)	1.639	1
		CUSTOMERSLOCATION(2)	.543	1
		CUSTOMERSLOCATION(3)	1.041	1
		CUSTOMERSLOCATION(4)	.153	1
		ADDRESSCUSTOMER	7.130	4
		ADDRESSCUSTOMER(1)	4.812	1
		ADDRESSCUSTOMER(2)	.000	1
		ADDRESSCUSTOMER(3)	.078	1
		ADDRESSCUSTOMER(4)	.122	1
		CUSTOMERSENIORITY	5.611	4
		CUSTOMERSENIORITY(1)	.403	1
		CUSTOMERSENIORITY(2)	.703	1
		CUSTOMERSENIORITY(3)	.000	1
		CUSTOMERSENIORITY(4)	5.299	1
		MARITALSTATUS	2.909	4
		MARITALSTATUS(1)	.039	1
		MARITALSTATUS(2)	.172	1
		MARITALSTATUS(3)	.122	1
		MARITALSTATUS(4)	2.040	1
		CUSTOMERAGE	2.502	4
		CUSTOMERAGE(1)	1.259	1
		CUSTOMERAGE(2)	1.639	1
		CUSTOMERAGE(3)	.176	1
		CUSTOMERAGE(4)	.025	1
		DOMAINCLIENTOPERATES	7.342	4
		DOMAINCLIENTOPERATES(1)	.788	1
		DOMAINCLIENTOPERATES(2)	2.086	1
		DOMAINCLIENTOPERATES(3)	1.079	1
		DOMAINCLIENTOPERATES(4)	3.169	1
		PROFESSIONALTRAINING	5.224	4
		PROFESSIONALTRAINING(1)	1.765	1
		PROFESSIONALTRAINING(2)	1.774	1
		PROFESSIONALTRAINING(3)	1.259	1
		PROFESSIONALTRAINING(4)	.050	1
		BC	1.639	4
		BC(1)	1.439	1
		BC(2)	.927	1
		BC(3)	.102	1
		BC(4)	.210	1
	Overall Statistics		37.020	42

Source: Authors' computations

For Block1, the first relevant output is provided by the Omnibus Test for the model coefficient table. This table compares the model constantly with the model with all predictors. The model with all predictors is significantly better than the only constant model [Chi-Square = 44.933, df = 42 and p = 0.001 (0.007 <0.05)].

Table 5. Omnibus Tests of Model Coefficients

		Chi-square	**df**	**Sig.**
Step 1	Step	46.933	42	.007
	Block	46.933	42	.007
	Model	46.933	42	.007

Source: Authors' computations

The next relevant output is the Model Summary table. This provides information about the goodness of fit of the model. Two measures are given Cox & Snell R Square and Nagelkerke R Square. Nagelkerke R Square is commonly used as the

former does not scale up to 1. From Nagelkerke R Square it is clear that 49.2% of the variation in the granting of a high-value personal credit is represented by predictors such as: institutions, customer income, customer age and customer status, in which the client operates.

Table 6. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	94.469[a]	.369	.492

Source: Authors' computations

Table 8 informs whether the model matches the data. We can say that the pattern matches the data for Chi-Square = 6.625, df = 8 and p = 0.578 (> 0.05).

Table 8. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	6.625	8	.578

Source: Authors' computations

The next relevant output is the classification table. It compares model predictions with real observations. The model makes reasonable work by specifying that customers who do not want a high-value credit are equal to those who want; ie 78.4%. According to the model, 78.4% of the 102 clients were classified correctly.

Table 9. Classification Table[a]

Observed			Predicted	
			Do you want to get a personal loan of higher value?	
			No	Yes
Step 1	Do you want to get a personal loan of higher value?	No	40	11
		Yes	11	40
	Overall Percentage			

Source: Authors' computations

The indicators shown in Table 10 - Institution [0.025], Customer Income Type [CUSTINCOME] (0.047), AMOUNTCUSTOMER (0.017), Customer's location (CUSTOMERSLOCATION), "Customer seniority" (CUSTOMER SENIORITY) (0.18), "Customer Age" (CUSTOMERAGE) (0.021), and "The domain in which the client operates "[DOMAINCLIENTOPERATES] (0.029) are significant predictors at the 5% level. "Marital status of client" [MARITALSTATUS] (0.429); "Professional training of the client" [PROFESSIONALTRAINING] (0.578); "Information included in Credit Bureau (BC) databases" [BC] (0.397) have p values greater than 0.05 and are not significant predictors of nodal involvement at the 5% level.

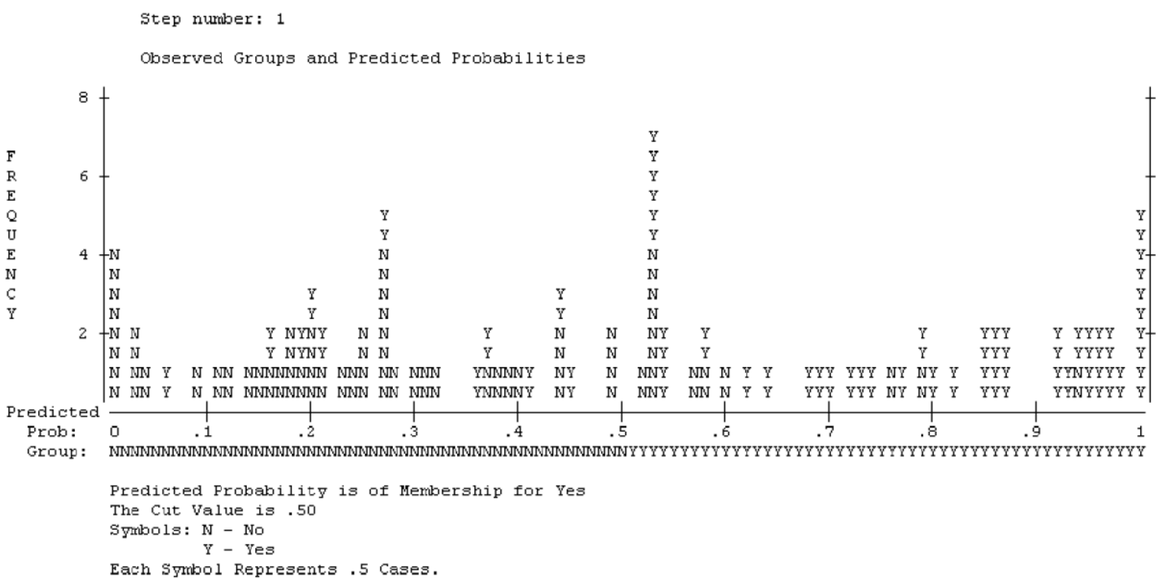
Table 10. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower
Step 1[a]	INSTITUTIONS	1.141	.648	3.096	1	.038	3.128	.008
	CUSTINCOME			1.795	5	.047		
	CUSTINCOME(1)	-1.154	1.709	.456	1	.049	1.316	.011
	CUSTINCOME(2)	-1.772	2.240	.626	1	.029	1.170	.002
	CUSTINCOME(3)	-.838	1.805	.216	1	.042	1.432	.013
	CUSTINCOME(4)	-.580	2.074	.078	1	.028	1.560	.010
	CUSTINCOME(5)	-2.373	2.076	1.307	1	.035	2.093	.002
	AMOUNTCUSTOMER			.562	4	.017		
	AMOUNTCUSTOMER(1)	-.401	2.972	.018	1	.023	.670	.002
	AMOUNTCUSTOMER(2)	.831	3.269	.065	1	.019	2.295	.004
	AMOUNTCUSTOMER(3)	2.218	1.971	.000	1	.019	6.036	.001
	AMOUNTCUSTOMER(4)	2.937	2.834	.000	1	.022	1.238	.003
	CUSTOMERSLOCATION			3.343	4	.025		
	CUSTOMERSLOCATION(1)	-.486	1.038	.219	1	.046	.615	.081
	CUSTOMERSLOCATION(2)	.955	1.810	.278	1	.098	2.597	.075
	CUSTOMERSLOCATION(3)	2.436	1.946	1.567	1	.011	11.431	.252
	CUSTOMERSLOCATION(4)	.268	1.398	.037	1	.048	1.307	.084
	ADDRESSCUSTOMER			4.317	4	.036		
	ADDRESSCUSTOMER(1)	-2.219	1.170	3.601	1	.058	.109	.011

	ADDRESSCUSTOMER(2)	-1.301	1.293	1.012	1	.014	.272	.022
	ADDRESSCUSTOMER(3)	-.181	1.294	.020	1	.189	.834	.066
	ADDRESSCUSTOMER(4)	-1.251	1.536	.663	1	.215	.286	.014
	CUSTOMERSENIORITY			5.781	4	.018		
	CUSTOMERSENIORITY(1)	1.147	1.149	.997	1	.018	3.148	.331
	CUSTOMERSENIORITY(2)	.538	1.068	.254	1	.115	1.712	.211
	CUSTOMERSENIORITY(3)	-.277	1.035	.072	1	.289	.758	.100
	CUSTOMERSENIORITY(4)	-2.322	1.496	2.408	1	.121	.098	.005
	MARITALSTATUS			3.174	4	.429		
	MARITALSTATUS(1)	-2.563	1.742	2.166	1	.241	.077	.003
	MARITALSTATUS(2)	-3.139	1.825	2.959	1	.385	.043	.001
	MARITALSTATUS(3)	-1.997	1.983	1.014	1	.414	.136	.003
	MARITALSTATUS(4)	-1.945	1.932	1.311	1	.135	.157	.007
	CUSTOMERAGE			.927	4	.021		
	CUSTOMERAGE(1)	-.630	2.479	.065	1	.008	.533	.004
	CUSTOMERAGE(2)	.364	2.493	.021	1	.084	1.440	.011
	CUSTOMERAGE(3)	-.270	2.385	.013	1	.110	.763	.007
	CUSTOMERAGE(4)	.178	2.761	.004	1	.249	1.194	.005
	DOMAINCLIENTOPERATES			1.692	4	.029		
	DOMAINCLIENTOPERATES(1)	.898	1.201	.559	1	.045	2.454	.023
	DOMAINCLIENTOPERATES(2)	.903	1.295	.486	1	.048	2.467	.195
	DOMAINCLIENTOPERATES(3)	.463	1.312	.125	1	.124	1.589	.100
	DOMAINCLIENTOPERATES(4)	1.456	1.184	1.514	1	.219	4.290	.422
	PROFESSIONALTRAINING			2.881	4	.578		
	PROFESSIONALTRAINING(1)	-.031	1.551	.000	1	.984	.970	.046
	PROFESSIONALTRAINING(2)	-1.012	1.318	.589	1	.443	.364	.027
	PROFESSIONALTRAINING(3)	.732	1.192	.377	1	.539	2.079	.201
	PROFESSIONALTRAINING(4)	-.565	1.065	.281	1	.596	.569	.071
	BC			4.066	4	.397		
	BC(1)	-.338	1.229	.075	1	.784	.713	.064
	BC(2)	-1.409	1.413	.994	1	.319	.244	.015
	BC(3)	.755	1.773	.181	1	.670	2.127	.066
	BC(4)	-2.349	2.124	1.223	1	.269	.095	.001
	Constant	4.746	4.909	.935	1	.334	115.145	

Source: Authors' computations

Figure 1. Classification diagram



Source: Authors' computations

As can be seen in Figure 1, the classification diagram consists of the predicted probability (from 0 to 1) shown on the X axis. Under this axis the differentiated classification areas are identified by the symbols that encode the group 1 (Yes) and the group 2 (No) and the threshold of 0.5 that changes the classification. The Y axis indicates the number of cases and the columns are made up of the marks that represent the observed case classification.

The data in the diagram indicates, for the most part, predictions correctly predicted by the model that the Y-signs correspond to Y-values on the OX axis and the N-signs corresponding to N-values on the OX axis) represent the correctly predicted classifications of the model. For values of -2 and -4 on the OX axis, the Y-signs corresponding to N-values and the N-signs corresponding to Y-values represent incorrectly classified cases, so the estimated model does not work.

5. Conclusions

The purpose of quantitative research has been reached, in the opinion of most of the variable clients, such as: institutions, customer income, client and seniority, client age and customer status, in which the client operates are significant predictors that underlie a high-value personal credit. For banking institutions, knowledge of consumer opinion and behavior is a real asset in designing and selling personal needs loans, but also for emphasizing the importance of other predictors such as: the marital status of the client, the professional training of the client, and the information included in the Credit Bureau BC) databases. The limiting conditions of the study are given by the reduced sample size and analysis

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