

## Study on the Dynamics of Bank Loans According to the Level of the Interest Rate and the Incomes of the Households

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### Abstract

*In this paper we have deepened the analysis, opting for the use of statistical-econometric models, more precisely a multifactorial regression model that uses as explanatory variables "Population-Loans in lei (expressed in euros)" as a dependent variable and "Average total income per household (expressed in euros) and Interest rate on lending facility (Lombard)" as factor variables.*

*In this study we opted for a multifactorial regression model that represents a generalization of the simple linear regression model, which is based on the processing and analysis of the statistical data sets during 2004-2018.*

**Key words:** population loans in lei, total average incomes per household, interest rate at the lending facility (lombard), factor variables

**J.E.L. classification:** G21, G23, C10

### 1. Introduction

If we start from the origin of the credit concept from the Latin "creditum" - "belief", which means "to believe" or "to trust", we capture the psychological element of the existence of a credit operation, namely trust. According to the Banking Dictionary, the term credit means "making a sum of money available to a person".

The term bank credit knows many definitions in the specialized literature:

"Credit, in general, represents the exchange of a present monetary value against a future monetary value" (Dedu, 1999).

A comprehensive definition of bank credit is found in the documents of the European Central Bank: "... the monetary relationship between a natural or legal person called a creditor, who grants to another person called a debtor, a loan in money or who sells goods / services on debt, generally with an interest set depending on the risk the creditor assumes or the debtor's reputation" (Kiritescu, Dobrescu, 1998)

"Credit is the operation by which resources are immediately taken over, in exchange for a promise of future repayment, normally accompanied by the payment of interest that is paid to the borrower" (Basno et al, 1999)

Credit creates the impression of wealth, and the greatest danger is its abusive and improper use.

## 2. Theoretical background and methodology

Given the complexity of the investigated phenomenon, in this study we opted for a multifactorial regression model that represents a generalization of the simple linear regression model. In our model we opted for two factor variables,  $x_1$  = Total average incomes per household (expressed in euro) and  $x_2$  = Interest rate at the lending facility (Lombard).

Often, there is a need to explain and control, as far as possible, the phenomena and processes in the economy, which may reflect more or less favorable situations. Therefore, a number of effective tools are elaborated with the help of explaining the existing situations and eliminating (or possibly mitigating) the undesirable effects that may occur in a certain economic context. In this way, one can verify the assumptions of economic theory, one can give up some that have not proved viable or one can develop new ones, thus contributing to the enrichment of the information system regarding a certain phenomenon or economic process. The model thus becomes an intermediate link between theory and practice, a synthetic, simplified mirror of economic reality, whose main components are synthetically expressed through a set of variables, as well as through the relationships, the interconditions between these variables. The model can consist of one or more equations that express the dependence of the complex variables on a set of main and secondary factors, systematic and random, which act in the same or different senses, system that expresses in a mathematical, abstract, the problem to be solved. In order to solve this system, a series of rational hypotheses are stated, in accordance with the economic theory, and the solutions must be obtained under conditions of maximum likelihood, based on a sample of data on the evolution of the factorial variables and the resultant variables.

The links between two statistical variables can be studied using two techniques: regression and correlation. The correlation will show how strong the link is, the dependence between the variables, while the regression will help in explaining and predicting one factor based on the value of another (others), which obviously will reduce the uncertainty regarding important but random phenomena. (Voineagu, 2007).

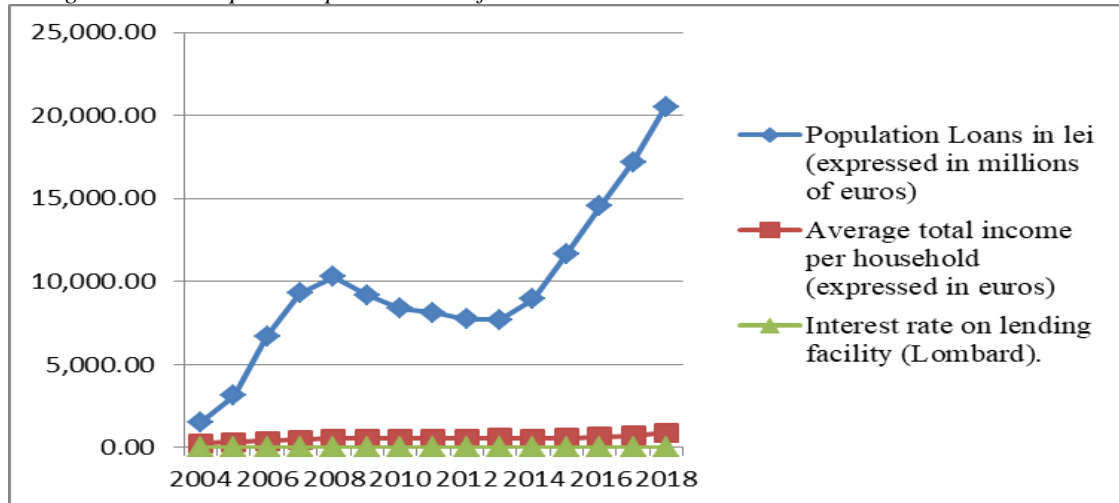
For the variables "Population-Loans in lei (expressed in millions of euros) and Interest rate at the lending facility (Lombard)". The work is based on the processing and analysis of the statistical data sets offered by the National Bank of Romania.

*Table no. 1 The value of the variables used in research*

| <b>Years</b> | <b>Population Loans in lei<br/>(expressed in millions of euros)</b> | <b>Average total income per<br/>household (expressed in euros)</b> | <b>Interest rate on<br/>lending facility<br/>(Lombard).</b> |
|--------------|---|--|---|
| 2004         | 1,489.00  | 273.75   | 30.00   |
| 2005         | 3,141.35  | 329.66   | 14.00   |
| 2006         | 6,694.69  | 409.95   | 14.00   |
| 2007         | 9,299.67  | 467.22   | 12.00   |
| 2008         | 10,273.04   | 534.90   | 14.25   |
| 2009         | 9,180.57  | 547.75   | 12.00   |
| 2010         | 8,382.69  | 537.78   | 10.25   |
| 2011         | 8,110.77  | 559.59   | 10.00   |
| 2012         | 7,749.55  | 558.86   | 9.25  |
| 2013         | 7,713.88  | 570.62   | 7.00  |
| 2014         | 8948.58   | 557.93   | 5.25  |
| 2015         | 11624.00  | 593.83   | 3.25  |
| 2016         | 14553.33  | 648.43   | 3.25  |
| 2017         | 14,264.35   | 727.87   | 2.75  |
| 2018         | 14,617.91   | 911.52   | 3.50  |

*Source:* Own processing of data taken from the website of the National Bank of Romania <http://www.bnr.ro> and from the website of National Institute of Statistics) <http://statistici.insse.ro/>

Figure no. 1. Graphical representation of the variables used in research



Source: The data presented in Table no. 1

### 3. Processing results

The statistical description of the analyzed variables was made, in table 1, using the mean and standard deviation indicators. The variables introduced in the study are:  $y$  = Population-Loans in lei (expressed in euros),  $x_1$  = Average total incomes per household (euros) and  $x_2$  = Interest rate at the lending facility (Lombard).

Table no. 2 Statistical description of variables

#### Descriptive Statistics

|   | Mean        | Std. Deviation | N  |
|---|-------------|----------------|----|
| Population-Loans in lei (expressed in euros)            | 9659.001253 | 4879.9033922   | 15 |
| Average total income per household (expressed in euros) | 548.644167  | 152.6652509    | 15 |
| Interest rate on lending facility (Lombard)             | 10.660356   | 7.1396782      | 15 |

Source: Table processed in the SPSS programme

The correlation coefficients whose estimation is presented in Table no. 3, are partial correlation coefficients that measure the influence of the average total incomes on a household ( $x_1$ ) on the level of credits in lei of the population ( $y$ ), as well as the influence of the interest rate on the credit facility ( $x_2$ ) on the level of credits of the population ( $y$ ).

Table no. 3 Calculation of Pearson correlation coefficients

#### Correlations

|                     |   | Population Loans in lei (expressed in millions of euros) | Average total income per household (expressed in euros) | Interest rate on lending facility (Lombard) |
|---------------------|---|--|---|---|
| Pearson Correlation | Population-Loans in lei (expressed in euros)            | 1.000  | .950  | -.811                                       |
|                     | Average total income per household (expressed in euros) | .950   | 1.000   | -.849                                       |
|                     | Interest rate on lending facility (Lombard)             | -.811  | -.849   | 1.000                                       |
| Sig. (1-tailed)     | Population-Loans in lei (expressed in euros)            | .  | .000  | .000  |

|   |   |      |      |      |
|---|---|------|------|------|
|   | Average total income per household (expressed in euros) | .000 | .    | .000 |
|   | Interest rate on lending facility (Lombard)             | .000 | .000 | .    |
| N | Population-Loans in lei (expressed in euros)            | 15   | 15   | 15   |
|   | Average total income per household (expressed in euros) | 15   | 15   | 15   |
|   | Interest rate on lending facility (Lombard)             | 15   | 15   | 15   |

Source: Table processed in the SPSS programme

The positive value of the first coefficient and its size,  $r_{y/x1} = 0.950$ , indicates a strong, positive influence of the income on the loans. This means that as incomes grow, loans grow. The correlation between the interest rate and loans, expressed by the coefficient  $r_{y/x2} = -0.811$ , indicates a partially negative influence, of high intensity. This means that as the interest rate drops, so does the level of population loans.

In order to measure the intensity of the connection between the dependent variable (y) and the two factorial variables (x1 and x2) included in the model, we calculated (in table 4) the multiple correlation coefficient R (0.848) which shows the weight of the total variation of the dependent variable that could be explained by the simultaneous variation of the independent variables included in the model. The result shows a strong connection between these variables.

Table no. 4 Calculation of the multiple correlation coefficient

**Model Summary<sup>b</sup>**

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1     | .950 <sup>a</sup> | .902     | .885              | 1652.6624499               |

Source: Table processed in the SPSS programme

- a. Predictors: (Constant), Interest rate on the lending facility, Average total incomes per household (expressed in euros)
- b. Dependent Variable: Population-Loans in lei (expressed in euros).

Table no. 4 also calculates the ratio of multiple determination (R squared) which shows that the variation of the population credits could be explained in a proportion of 90.2% of the simultaneous variation of the variables "Interest rate on the credit facility" and "Total average incomes per household (euro)". The rest of up to 100%, ie 9.8%, represents the influence of other factors not included in the model.

The multiple determination report does not take into account the number of degrees of freedom or the number of parameters that appear in the model. Therefore, in assessing the intensity of the link between variables, an adjusted determination coefficient is used which takes into account this number of parameters. The result (Adjusted R Square) of 0.885 indicates that 88.5% of the variation of the dependent variable could be explained by the two factorial variables.

For multiple regression models, several tests can be constructed, in order to test the model parameters, the regression model and the marginal influence of a variable.

The parameters of the multiple linear regression model were tested using the Student test (Table no. 5), considering the estimators obtained by the method of the least squares and the law of their distribution.

Table no. 5 Calculation of the parameters of the regression model and their testing

| Coefficients <sup>a</sup>                               |                             |            |                           |        |      |                         |       |
|---|-----------------------------|------------|---------------------------|--------|------|-------------------------|-------|
| Model   | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. | Collinearity Statistics |       |
|   | B                           | Std. Error | Beta                      |        |      | Tolerance               | VIF   |
| (Constant)  | -6652.910                   | 4141.094   |                           | -1.607 | .134 |                         |       |
| Average total income per household (expressed in euros) | 29.935                      | 5.478      | .937                      | 5.464  | .000 | .279                    | 3.585 |
| Interest rate on lending facility (Lombard)             | -10.490                     | 117.137    | -.015                     | -.090  | .930 | .279                    | 3.585 |

Source: Table processed in the SPSS programme

a. Dependent Variable: Population-Term deposits in lei (expressed in euros).

In SPSS, the decision is made based on the significance of the test; if  $\text{Sig } t < \alpha$ ,  $H_0$  (the independent variable  $i$  has no partial linear influence on the dependent one) is rejected with the specified confidence level, and if  $\text{sig} > \alpha$ , the null hypothesis is accepted. It is observed that for parameter of variable  $x_1$  the condition  $\text{Sig } t < 0.05$  is respected and for the parameter of variable  $x_2$  this condition is not met. In conclusion, with a probability of 95% the parameter of the first variable is statistically significant, while for the second parameter it is not. We can appreciate the fact that, in terms of the level of loans accessed by the population, the interest rate is not an essential variable, but other factors, not included in the model.

Testing the multiple linear regression model was performed, in Table no. 6, using the F. test.

Table no. 6 Testing the multiple linear regression model ANOVA<sup>a</sup>

| Model        | Sum of Squares | df | Mean Square   | F      | Sig.              |
|--------------|----------------|----|---------------|--------|-------------------|
| 1 Regression | 300612881.563  | 2  | 150306440.782 | 55.031 | .000 <sup>b</sup> |
| Residual     | 32775518.081   | 12 | 2731293.173   |        |                   |
| Total        | 333388399.644  | 14 |               |        |                   |

Source: Table processed in the SPSS programme

a. Dependent Variable: Population-Loans in lei (expressed in euros),

b. Predictors: (Constant), Interest rate on lending facility (Lombard), Average total incomes per household (expressed in euros)

Since  $\text{Sig} = 0.000 < 0.05$ , the null hypothesis with a probability of 95% is rejected, ie the model significantly explains the dependence of the variable present in the model.

#### 4. Conclusions

From the study carried out using a multifactorial regression model we can calculate the ratio of multiple determination (R squared) which shows that the variation of the population credits could be explained in proportion of 90.2% of the simultaneous variation of the variables "Interest rate at the credit facility "And" Average total income per household (euro) ". The rest of up to 100%, ie 9.8%, represents the influence of other factors not included in the model.

In conclusion, with a probability of 95% the parameter of the first variable is statistically significant, while for the second parameter it is not. We can appreciate the fact that, in terms of the level of loans accessed by the population, the interest rate is not an essential variable, but other factors, not included in the model.

Bank credit is the main source of supplementing the resources for any household.

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