

Econometric Models for Quantifying the Impact of Macroeconomic Variables on the Configuration of Banking Assets and Liabilities

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Abstract. *The management of banking assets and liabilities is one of the most important processes in a banking system, and this shows that everything must be done very clearly and very efficiently, being very large amounts and underlying this process that would not must be wrong and not allowed to lead to errors, as they could translate into significant losses for banks in the system and sometimes into insolvency, which could even lead to destabilizing the banking system in a country. Thus, it is necessary for the process of managing banking assets and liabilities to be carried out efficiently, and for the back models to be rigorously constructed. Taking into account these aspects, I tried to build several econometric models that could be used to manage assets and liabilities in the Romanian banking system. Thus, for the management of banking assets or liabilities, I consider it necessary to know which are the variables that can influence their dynamics and which are the elements that must be taken into account. I mention that the analysis will be performed at the level of the entire banking system in Romania to form an overview, the built models can be used even by decision makers in commercial banks to substantiate decisions on the management of banking assets.*

Keywords: banking assets, banking liabilities, econometric model, macroeconomic variables

JEL Classification: G14, G21

1. Introduction

It is well known that for a sound banking system it is necessary to maintain a healthy growth rate of assets, a growth rate that is positive but does not lead to overheating of the economy. In this sense, it is necessary for the decision-makers within the National Bank and within the commercial banks to calibrate the lending and credit demand stimulation policies to the evolution of the essential variables in the economy that can influence their dynamics.

In order to substantiate any empirical analysis and, in particular, to substantiate such an important analysis for understanding how certain variables in the economy influence bank loans, it is necessary to analyse the literature in advance, and I did the same in this study. I noticed that there are many papers that address the issue of determinants for the evolution of the credit stock and that there are many papers that can be used as a starting point for conducting such research as the one I set out to do in this endeavour. I emphasize that I wanted my work to be as practical as possible and as close as possible to the requirements that bank decision-makers might have for making an informed decision on the management of banking assets and liabilities.

Before starting a case study on lending in Romania, it was necessary to document which are the most relevant works in this regard in the literature and what are the methods of analysis that could help me in the sense of the work I want to realize it.

Taking into account the fact that the banking market in Romania for the last 15 years has been very integrated at regional level, currently having strong banks in the region and in Europe such as Erste Bank, Raiffeisen Bank, ING, UniCredit, we considered that to conduct a study it is important to start from what other authors have identified for the banking and lending market in the European Union and in Central and Eastern Europe. At the same time, we aimed to ensure that the articles and research we considered were as recent as possible in order to capture the behavior on the banking market, in the post-economic period of 2008-2009, both for the case of Romania and in the European Union and in Central and Eastern Europe (CEE), being a crisis that has generated profound changes in the fundamentals and in the way the banking system is organized.

It is in this sense of the changes that the economic crisis of 2008-2010 brought to the banking system in the region that we have identified several relevant articles that address the issue. Thus, Jovanovic, Hani and Georgievska (2017) signal the slowdown in credit growth in Eastern and Southern Europe, suggesting that this could in fact return to normal and that the pre-crisis period was a period of overcrowding warming of the banking system in this region, a period in which lending has accelerated too much and could not have been sustainable.

The lending activity in a country and the stability of the banking system is also dependent on the banks that are part of the system, their type and the way in which the market share is divided, but also on the fact that these banks have foreign shareholders or not. Thus, lending policy in Central, Southern and Eastern European countries has been largely influenced by foreign-owned banks, most of which are from Western Europe and which have bought local banks or set up subsidiaries that they have capitalized. The article published by Allen et al. (2017) presents in detail exactly these changes that have occurred in recent years in the banking system of Central, Eastern and Southern Europe, focusing on changing the shareholding structure of the largest banks in these markets and addressing a lending strategy aggressive.

In this context, and corroborated by the fact that the ratio between loans and deposits was in most states in the supra-unitary region, the banking system in Central, Southern and Eastern Europe was dependent on financing from parent banks, lacking a viable local alternative and failing to attract enough deposits from the population to meet the aggressive growth of lending. This has been a hotly debated issue in the literature, and articles such as those by Smaga and Witkowski (2018) or Peric, Smilijanic and Aljinovic (2018) have been very helpful in understanding this phenomenon and how it has influenced development of the banking system in this region, but especially the development of the banking system in Romania where banks with foreign shareholders hold over 60% of the market share, and the dependence on financing from the parent banks was obvious. In recent years, as has happened in other states in the region, and in the case of Romania, the loan / deposit ratio has become sub-unitary, the subsidiaries of Romanian banks are not currently dependent on financing from parent banks.

The evolution of lending in Romania, but also in the region was influenced, as we showed above based on relevant articles, by the management decisions of banks that entered these markets, by the high demand for loans on the local market, but and a number of other macroeconomic and microeconomic variables, and these influences could be an important issue to discuss, especially since there are many papers in the literature that analyse the problem of credit determinants. Thus, the determinants of the growth rate of lending for Central and South-Eastern European countries were studied by Novokmet and Bojic (2016) which identified exactly the problem of credit determinants: quantitative factors (related to the economy) or qualitative factors, which they depend on the decisions of the people in charge of the banks or shareholders, ie the strategic interests they express in terms of the direction in which they want to go in

the future. The article published by Kouretas et al. (2017), where it is debated whether the structure of the banking market in different countries of the European Union decisively influences the growth of lending or the demand for a certain credit product. At the same time, the authors also take into account the cultural differences between states that could affect the thinking of consumers, but also of the decision-makers in the respective financial-banking institutions.

On the other hand, we must not neglect the role that lending has had and has in stimulating economic growth and development, both in Romania and in other countries in Central and South-Eastern Europe. This topic was also addressed in the literature, and works such as that of Drozdowska-Iwanicz et al. (2019) contributed to the debate of the subject, exploring the role of credit in economic growth.

2. Connections between macroeconomic variables and the configuration of banking assets and liabilities

Given all these elements and all the research that I had in mind and used as a basis when I decided to conduct this study, I specify that I will first build two models that will explain the change in the balance of loans granted to individuals and loans granted to legal entities, these being two of the most important components of the evolution of total loans granted in Romania. Given all these elements and all the research that I had in mind and used as a basis when I decided to conduct this study, I specify that I will first build two models that will explain the change in the balance of loans granted to individuals and loans granted to legal entities, these being two of the most important components of the evolution of total loans granted in Romania.

A dynamic analysis will be considered, this being the most relevant to show the level of financial intermediation and how consumer preferences and market supply have changed. It should be noted that the analysis will be performed for the overall situation of loans in Romania, and subsequently, on the three categories of loans mentioned above:

- Loans for legal entities (companies).
- Loans for individuals (households).
- Loans for government entities, state institutions, town halls or county councils.

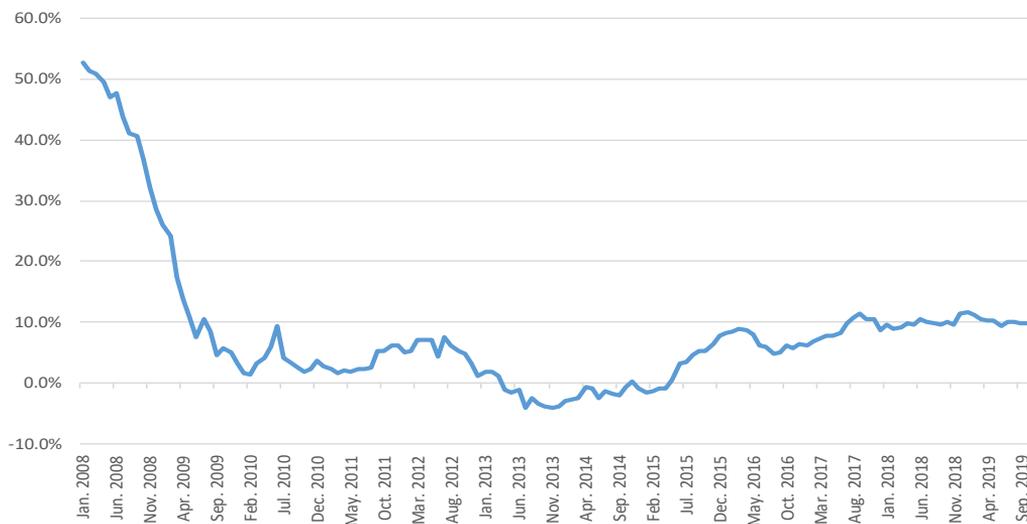
I will also consider an analysis according to the currency in which the loans were granted, both for companies and for individuals (loans in local currency vs. loans in foreign currency). This analysis will highlight the market trend in terms of demand and supply of foreign currency loans, compared to the one for national currency.

I will choose the entire analysis to be carried out for the period January 2008 - November 2019, so that a complete economic cycle is included and that more trends and more influencing factors can be observed. Furthermore, as I said at the beginning of this approach, the first step that will be taken in the analysis will be the one related to the analysis of the evolution of the total credit stock in Romania. In this sense, we made the following chart that shows how the annual growth rate of the credit stock in Romania has evolved in the period considered as a reference: January 2008 - November 2019.

Chart no. 1 highlights two distinct periods: 2008 and post-2008. Thus, we are talking about a period before the economic and financial crisis when the growth rate of lending was unsustainable, reaching 50% in certain periods, but we are still talking about a low starting point, a pre-2008 period in which many people they were not in debt, and access to credit became much easier.

Chart no. 1

**The evolution of the annual growth rate of the credit stock granted in Romania
(January 2008 - November 2019)**



Source: Processing based on data from the NBR Report, 2019

This euphoria was followed by a period of crisis and prolonged correction in the stock of loans, which were off-balance sheet loans due to default or loan repayments which led to a decrease in the balance, the volume of new loans being insufficient to cover loans coming out of portfolios. This period started in September 2009 and lasted until the end of February 2015, but there was a short period in 2011-2012 when the lending rate accelerated slightly to 6% per year.

After 2015, there was an increase in the credit stock, the annual rate reaching 10% for a good period of time, banks managed to recover their stock and become profitable again, amid growing demand, driven by significant improvement in the outlook economic growth, the increase in wage income and the return of public confidence, and subsequently, the increase in the confidence of companies that have started to invest again. This gap in the return of the appetite for loans from the population and companies will be observed in the following graphs, where the credit for legal entities passed into the positive territory later than the credit for individuals.

After analysing the evolution of the balance of total loans in Romania, I will go further to make a brief analysis of the evolution of lending on the three major components I mentioned earlier: loans for individuals, loans for legal entities and loans for public administration. Thus, I will further address the situation of loans granted to companies (legal entities).

Subsequently, using the data provided by the National Bank of Romania through the public database, I made Chart no. 2.

It can be seen that the growth rate of the stock of loans granted to legal entities had a similar evolution to the total stock of loans, being an important component of it, but the return on growth was much slower, the strong return being achieved starting with April 2017. Thus, the demand for loans from companies was more apathetic, their confidence was lower, and private investment was much lower than in previous years. All this has contributed to a weaker dynamics of the stock of loans granted to companies.

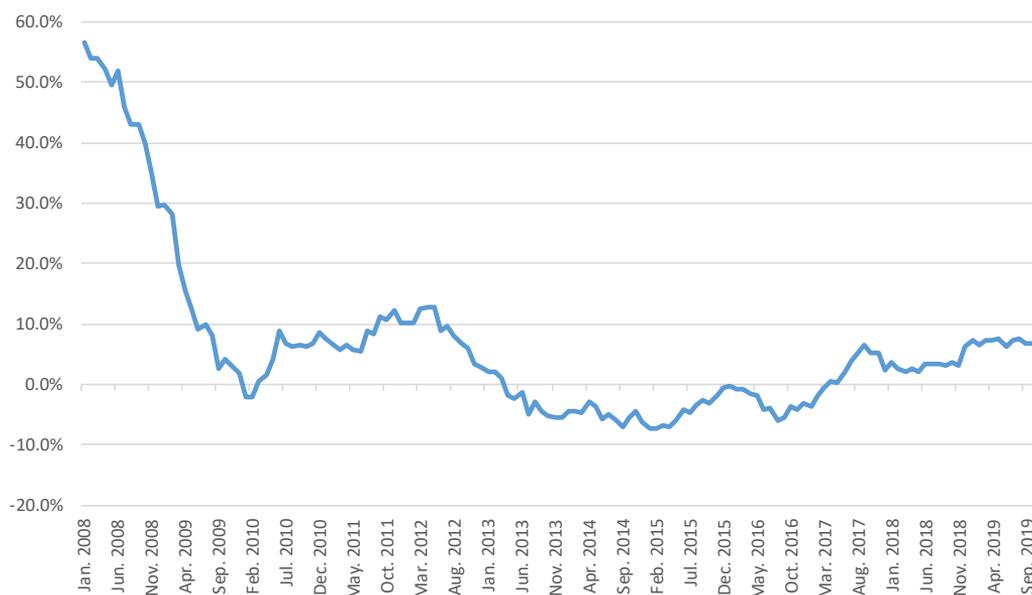
On the other hand, the weak dynamics of the stock was also determined by the repayments of existing loans, being a process of indebtedness of companies, they

sometimes prefer to work on commercial credit to the detriment of financing lines. Moreover, the off-balance sheet in 2013-2016 of large non-performing loans to companies had a strong impact on keeping the stock of loans to legal entities under pressure. Next, I will go to the analysis of the evolution of the balance of loans granted to the public administration, and the following graph will highlight the annual dynamics of their balance. At the same time, I will present the evolution of the share of credit granted to the public administration in total loans, in order to show the importance of this type of credit for the banking system. It should be noted that only for this chart we used a shorter period (January 2013 - November 2019), and we made this decision only to make the chart more suggestive and to better highlight the recent reduction in the share of credit granted public administration in total loans granted in the Romanian banking system.

As previously mentioned, the share of loans granted to public administration has decreased over time, reaching somewhere around 3.5% of total loans, i.e. it is a very small part. This category of loans has had a small influence on the total dynamics of the loan balance in Romania, especially in recent years. On the other hand, regarding the dynamics of the balance of loans granted to the public administration, it can be seen that in the last 6 years this category of loans had a largely negative dynamics, the balance decreasing in most months of the analysed period.

Chart no. 2

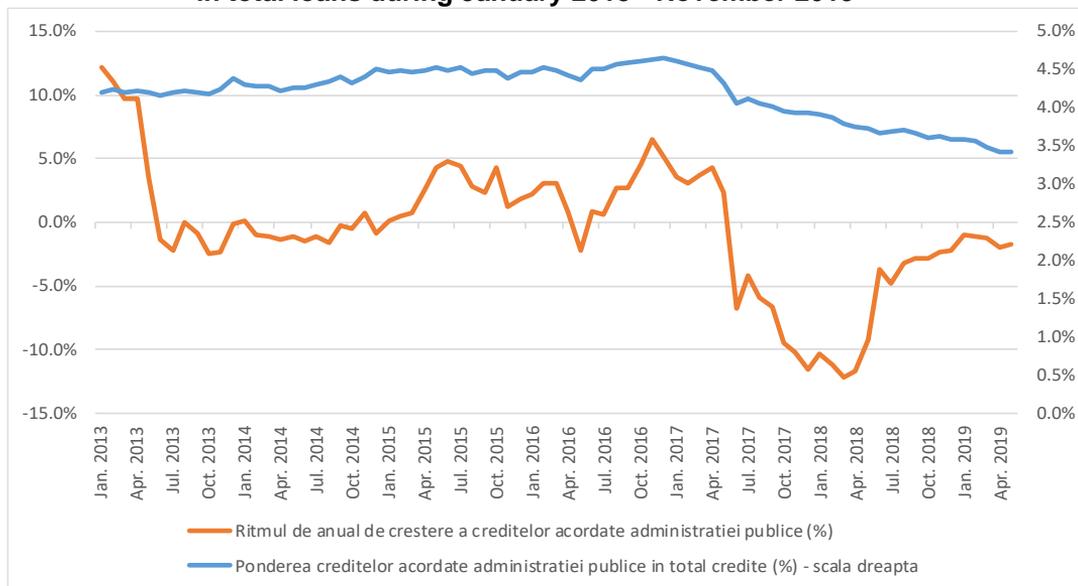
The evolution of the annual growth rate of the stock of loans granted to persons in Romania (January 2008 - November 2019)



Source: NBR annual reports

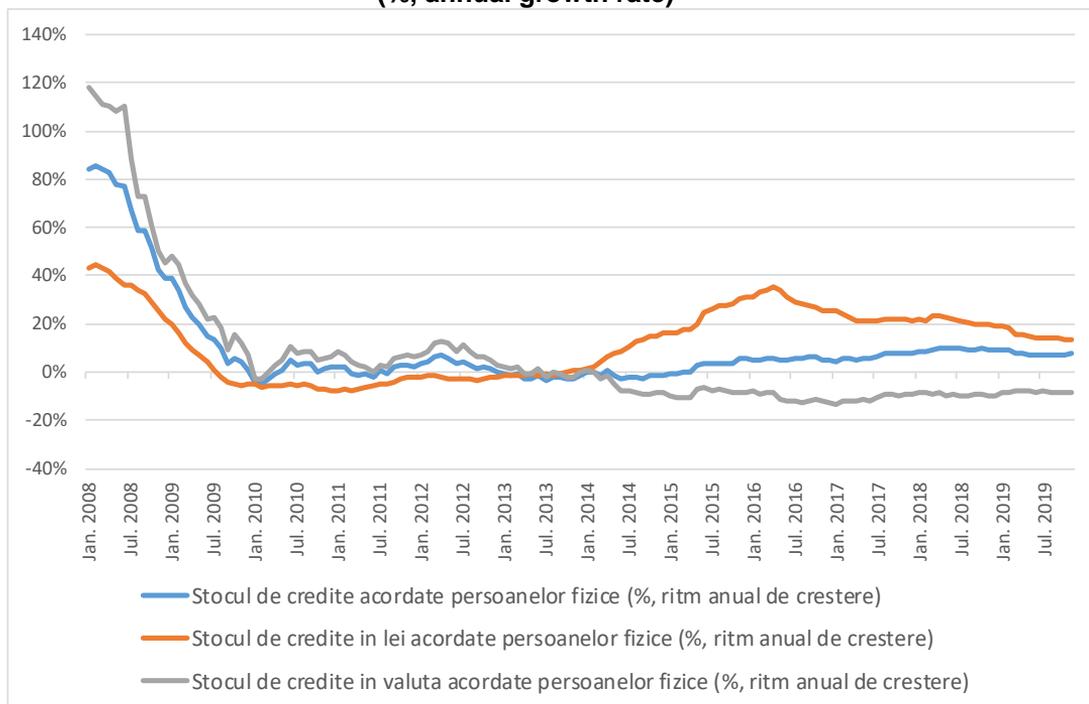
Next, I will go to the last category of loans that I will analyse, according to the NBR classification, loans granted to individuals (households), and at the level of this category I will consider a division by currency of the credit stock, in order to note how demand and supply for credit products have evolved according to the currency in which they were granted.

Chart no. 3. Evolution of the balance of loans granted to public administrations and their share in total loans during January 2013 - November 2019



Source: Processing based on NBR data

Chart no. 4. Evolution of the stock of loans granted to individuals (% annual growth rate)



Source: Processing based on data from the NBR annual reports

Chart no. 4 highlights the dynamics of the stock of loans granted to households, in total, but also divided according to the currency in which it was granted: lei versus

currency. As expected, in the case of loans to individuals, there was a very rapid growth rate in the pre-financial crisis, and this rate was largely supported by the increase in the stock for loans denominated in foreign currency, and here we are talking mainly about euro loans. Subsequently, a period followed in which the stock of loans granted to the population decreased, in the period 2009-2013, in order to gradually return to the positive zone and tends to an average annual threshold of 12-13% in the last 3 years.

It should also be noted that in recent years, the increase in the stock of loans granted to the population has been mainly due to loans granted in lei, the stock of loans granted in euro continuing its decline. This was mainly determined by the amendment of the legislation regarding the credits granted through the governmental program "Our First Home", through which all the credits granted were to be denominated in Romanian national currency. Moreover, the conditions for foreign currency lending have been drastically tightened, given that a large proportion of non-performing loans in the past have been denominated in foreign currency, the depreciation of the leu against the single European currency leading to an increase in insolvency debtors in euros.

Therefore, through the NBR's interventions to tighten lending conditions in euro, by amending the legislation applicable to the Prima Casa program and by increasing customers' aversion to euro loans, a steady reduction in the balance of loans to the euro and a rapid increase in loans in Romanian national currency. Therefore, the main growth engine for the balance of loans to individuals were loans denominated in national currency, thus eliminating the high sensitivity of Romanians to exchange rate fluctuations. However, there was a greater sensitivity to changes in interest rates in the interbank market, many of the loans contracted being with variable interest rates and, implicitly, dependent on the evolution of interest rates on the interbank market (ROBOR, and currently IRCC calculated index).

3. Econometric models aimed at optimizing the structure of banking assets and liabilities

Given these dynamics and the explanations that can be given for the potential determinants in terms of the evolution of the balance of loans to individuals and legal entities, I will go further, as mentioned, to build econometric models to analyse whether a series of macroeconomic variables, but also microeconomic ones influence the dynamics of the credit stock, but also the manner in which this influence was achieved. Therefore, a series of dependencies will be studied, following the meaning and intensity of the relationships that were considered for the study. I expect that the results will be in line with economic expectations and theory and can be used in making economic interpretations and in substantiating decisions on asset management in the Romanian banking system by decision-makers.

According to those presented so far, to finalize the research approach I will perform an econometric analysis whose purpose will be to highlight the determining factors for the dynamics of loans to individuals and loans to legal entities in Romania in the last 20 years, these being the two most important categories of loans in Romania, totalling over 90% of the total balance of loans granted at some point in the economy. The results of this study could be used for both academic and business purposes, even by decision-makers in commercial banks in Romania so that they can calibrate their sales strategies.

As we mentioned in the introductory part, the purpose of the quantitative analysis will be to highlight how certain variables specific to the Romanian economy have influenced the dynamics of loans to individuals and legal entities. In this regard, the knowledge of econometric analysis accumulated over the years of the bachelor's

degree will be used and two multifactorial regression models will be used. Multiple regression analysis is a statistical method used to predict the value of a dependent variable based on the values of two or more independent variables. The expected value is called a dependent variable because its outcome or value depends on the behaviour of other variables.

The general form of a multiple regression is as follows:

$$Y = a + b_1 \cdot X_1 + b_2 \cdot X_2 + \dots + b_n \cdot X_n, \quad (1)$$

where:

- y is the expected value;
- x_i are distinct predictive variables;
- b_1, b_2, \dots, b_n are the estimated regression coefficients;
- a shows the value of y when all predictor variables are equal to zero.

Before going to the estimation of the mode and to the presentation of the data series it is necessary to know the principles underlying a well-constructed model, and for this purpose Brooks (2019) and Gujarati (2009) were used as bibliography. Thus, in a model, a series of hypotheses must be observed:

- the data series to be used must be stationary;
- model errors must not be affected by autocorrelation;
- the data series that will be used must not be affected by the phenomenon of seasonality;
- the errors must be homoscedastic, i.e. the following conditions must be observed ($cov(\varepsilon_t, \varepsilon_{t-1}) = 0$ și $var(\varepsilon_{1t}) = ct$);
- errors must follow a normal distribution;
- multicollinearity must not be present, i.e. there must be no correlations between the explanatory variables.

The estimation of the model parameters will be done using the method of Ordinary Least Squares (OLS).

Time series stationarity testing will be performed by applying the Augmented Dickey Fuller (ADF) test. The results will be interpreted according to the test hypotheses:

- Null hypothesis (H0): The series used is not stationary;
- Alternative hypothesis (H1): The series used is stationary.
- **Dependent** variables: the balance of loans granted to individuals or legal entities in Romania in the period considered for analysis;
- **Independent** variables: economic growth, evolution of the average net salary in RON, inflation rate, evolution of the EUR / RON exchange rate, unemployment rate.

I remind that two multifactorial regression models will be estimated, so as to capture both the effect on the balance of loans to individuals and on the balance of loans to legal entities. The shape of each of these models will be presented below using the equations:

$$soldcred_{pf} = \alpha_0 + \alpha_1 \times creștereec + \alpha_2 \times \frac{EUR}{RON} + \alpha_3 \times salmediu + \alpha_4 \times ratasomaj + \alpha_5 \times ratainfl + \varepsilon_t \quad (2)$$

$$soldcred_{pj} = \alpha_0 + \alpha_1 \times creștereec + \alpha_2 \times \frac{EUR}{RON} + \alpha_3 \times salmediu + \alpha_4 \times ratasomaj + \alpha_5 \times ratainfl + \varepsilon_t \quad (3)$$

This methodology will be used to estimate the relationships, and then the data set to be used will be presented. To finalize the analysis I proposed, data on Romania will be used for the period 2007 Q4-2019 Q4, being a period of 10 years. The longest period for which there were common data for all desired data series was chosen and the aim was to take into account both a pre-crisis period and a post-crisis period, in order to capture a cycle complete economic. Data will be used quarterly, this being the

highest frequency for which there are common data for all 7 variables chosen: balance of loans for individuals, balance of loans for legal entities, inflation rate, exchange rate EUR / RON, average net salary, unemployment rate and economic growth. Thus, data will be used starting with the first quarter of 2007 and until the end of the fourth quarter of 2019. The sources for these data are represented by the NBR database and by the database of the National Institute of Statistics.

Next, I will explain the processing we have done in order to be able to bring the data series to a common frequency and to be able to use them in the analysis. I will also test the stationarity of these data series (using the ADF test) so as to avoid getting wrong conclusions, and finally, for the final form of the series that I will use in the case study, I will perform a summary table with descriptive statistics for them, along with a series of graphs showing the evolution of variables over time and to achieve the necessary interpretations from an economic point of view.

The data series that were used are the following:

- **Unemployment rate** - according to data published by the National Institute of Statistics of Romania - quarterly frequency, being taken the observation related to the last month of each quarter;

- **The average net salary per economy** - according to the data published by the National Institute of Statistics of Romania - quarterly frequency, being taken the observation related to the last month of each quarter;

- **Quarterly economic growth** - according to Eurostat, calculated on the basis of real GDP as a change from the previous quarter;

- **Inflation rate** - calculated on the basis of price indices published by Eurostat, being a change in prices in a quarter compared to the previous quarter. Thus, it is a cumulative inflation rate for the entire quarter, an inflation rate for three months;

- **Individual loans** - the quarterly growth rate compared to the previous quarter will be used, and the raw data are those obtained by querying the database of the National Bank of Romania;

- **Loans to legal entities** - the quarterly growth rate compared to the previous quarter will be used, and the raw data are those obtained by querying the database of the National Bank of Romania;

- **Quarterly exchange rate of the EUR / RON exchange rate** - was calculated based on the exchange rates on the last working day of the quarter and represents a percentage change.

Next, as I mentioned, we will go to the presentation of descriptive statistics for the data series that I will use for the model. In this way, certain specificities can be observed for them, which could be commented on and put in an economic context.

Based on the table presented below, it can be seen that the unemployment rate in the period considered was on average 6.3%, with a maximum value of 13.4% and a minimum value of 3.9%, which shows a large amplitude of the data series, but it is at the same time one in which the average is quite close to the median, showing a good symmetry. Also, the value of kurtosis is close to that of a normal distribution (3), as is the case for the series on the dynamics of the balance of loans for legal entities and the inflation rate.

For these, it can also be seen that the value of skewness is very close to that for a normal distribution (0), the same level being recorded for the quarterly change in the balance of loans to individuals, where the calculated skewness was 0.06, extremely close to the threshold of 0 corresponding to a normal distribution.

Table no. 1
Descriptive statistics on the data series used

	Unemploy ment rate	Net salary	pf Credit s	Pj Credit s	Inflation rate	Increase Ec	Rand_ EURR ON
Average	0.06	2018. 61	0.9%	0.5%	0.7%	0.8%	0.3%
Median	0.06	1818	0.9%	0.5%	0.6%	1.1%	0.4%
Maximu m	0.104	3340	6.0%	5.7%	3.4%	2.4%	3.0%
Minimum	0.041	1340	-4.0%	-3.5%	-1.6%	-6.4%	-3.5%
Kurtosis	4.19	2.54	4.08	3.13	3.19	21.65	5.02
Skewnes s	1.03	0.87	0.06	0.43	0.20	(3.69)	(1.03)
Observat ion Number	41	41	41	41	41	41	41

Source: INS, Eurostat, BNR, own calculations

On the other hand, we have the series of data on quarterly economic growth, where it can be seen that the maximum growth rate was 2.4% and the minimum reached was -6.4%, exactly at the beginning of the period considered for analysis, ie in the 4th quarter of 2009. Moreover, it can be seen that the data series is far from a normally distributed one, with values for skewness and kurtosis extremely far from the specific values of such a distribution: zero and three, respectively for kurtosis. These differences are also highlighted by the different values of the median from the average, showing that the series is not symmetrical. After presenting these aspects related to the specifics of the data series, I will perform the testing of the data series in order to identify the stationarity, this being an essential condition for the correct estimation of an econometric model. In this regard, as mentioned above, I will use the ADF test (Augmented Dickey Fuller), and the results for this were interpreted based on the probability calculated by default.

Following the application of the ADF test, it was observed that the probability for most data series is less than 5%, which shows that the series can be considered as stationary. The only series for which the probability obtained was higher than this chosen threshold was the series for the average monthly net salary. In this regard, a test will be performed using the difference of order 1 and it will be identified if the series is now stationary. The result is presented below:

Null Hypothesis: PF_CREDITS has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.571640	0.0110
Test critical values:		
1% level	-3.610453	
5% level	-2.938987	
10% level	-2.607932	

Null Hypothesis: PJ_CREDITS has a unit root

Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.690443	0.0005
Test critical values: 1% level	-3.605593	
5% level	-2.936942	
10% level	-2.606857	

Null Hypothesis: INCREASE_EC has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.613750	0.0000
Test critical values: 1% level	-3.605593	
5% level	-2.936942	
10% level	-2.606857	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INFLATION_RATE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.339575	0.0001
Test critical values: 1% level	-3.605593	
5% level	-2.936942	
10% level	-2.606857	

Null Hypothesis: UNEMPLOYMENT_RATE has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.634125	0.0454
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

Null Hypothesis: NET_SALARY has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
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Augmented Dickey-Fuller test statistic	2.061405	0.9998
Test critical values:		
1% level	-3.632900	
5% level	-2.948404	
10% level	-2.612874	

Null Hypothesis: RAND_EURRON has a unit root
 Exogenous: Constant
 Lag Length: 1 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.336450	0.0000
Test critical values:		
1% level	-3.610453	
5% level	-2.938987	
10% level	-2.607932	

Following the application of the ADF test, it was observed that the probability for most data series is less than 5%, which shows that the series can be considered as stationary. The only series for which the probability obtained was higher than this chosen threshold was the series for the average monthly net salary. In this regard, a test will be performed using the difference of order 1 and it will be identified if the series is now stationary. The result is presented below:

Null Hypothesis: D(NET_SALARY,1) has a unit root
 Exogenous: Constant
 Lag Length: 3 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.051552	0.0000
Test critical values:		
1% level	-3.632900	
5% level	-2.948404	
10% level	-2.612874	

This time, the probability is less than 5%, and the series is therefore stationary. The result indicates that it will be possible to use the series of differences of order 1 in the model, the changes from one quarter to another of the average monthly net salary per economy in the analysed period will be used.

Next, we will go to the presentation of the results obtained after estimating the multifactorial regression model which tries to explain the way in which the growth rate of the credit stock for individuals varied, but also for legal entities in Romania during 2009 Q4 - 2019 T4.

As I said before, in the empirical analysis based on econometric models, I will present the results of estimating the multifactorial regression model. The first of the two models to be estimated is for loans to individuals, and the form of the original model was as follows:

$$soldcred_{pf} = \alpha_0 + \alpha_1 \times creștereeec + \alpha_2 \times \frac{EUR}{RON} + \alpha_3 \times salmediu + \alpha_4 \times ratasomaj + \alpha_5 \times ratainfl + \varepsilon_t$$

Starting from this form, estimates were made in Eviews. In order for the results to be closer to reality, lag variables were also considered, ie variables that take into account what happened 1, 2 or 3 quarters ago. Thus, starting from the idea that certain variables can have a delayed impact on the dependent variable, we made several estimates choosing the best option (with the highest degree of determination) to explain the variation of the stock of loans granted to individuals based on variables dependent chosen.

Dependent Variable: CREDITE_PF
 Method: Least Squares
 Date: 04/05/20 Time: 21:25
 Sample (adjusted): 2010Q2 2019Q4
 Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRESTERE_EC(-1)	0.547387	0.200686	2.727583	0.0101
RATA_INFLATIEI	-0.100824	0.244526	-0.412326	0.6828
RATA_SOMAJ	-0.752500	0.211933	-3.550653	0.0012
SAL_NETS(-1)	0.037267	0.014950	2.492775	0.0169
RAND_EURRON(-1)	-0.411588	0.200521	-2.052593	0.0467
C	0.062555	0.013750	4.549384	0.0001
R-squared	0.470139	Mean dependent var		0.009799
Adjusted R-squared	0.389857	S.D. dependent var		0.018057
S.E. of regression	0.014104	Akaike info criterion		-5.544017
Sum squared resid	0.006565	Schwarz criterion		-5.288085
Log likelihood	114.1083	Hannan-Quinn criter.		-5.452191
F-statistic	5.856089	Durbin-Watson stat		1.721353
Prob(F-statistic)	0.000560			

The results of the estimation presented by the previous output show that 5 of the six estimated coefficients are significantly different from zero and for them an economic interpretation can be offered (the probability for the Student test is less than a significance threshold of 5%). Only the coefficient for the inflation rate proved to be statistically insignificant, and this shows that the inflation rate does not significantly influence the change in the balance of loans to individuals.

It was observed that there is a similar relationship between the economic growth of the previous quarter and the evolution of the balance of loans for individuals in the current quarter. Therefore, at a change in the pace of economic growth by 1 percentage point, there can be, according to the model, an acceleration of the growth rate of the balance of loans to individuals by 0.54 percentage points.

On the other hand, there was a negative relationship between the unemployment rate in the previous quarter, the return on the EUR / RON exchange rate in the previous quarter and the evolution of the balance of loans to individuals. Thus, an increase in the EUR / RON exchange rate or the unemployment rate in the previous quarter leads to a decrease in the growth rate of the balance of loans granted to individuals. This result is in line with expectations and is in line with economic theory. An increase in the unemployment rate means a decrease in the number of bankable customers, and, implicitly, a lower demand for loans. In the case of the EUR / RON exchange rate, we can talk about an increase in the burden for those credited in

euro, and this leads to a decrease in disposable income, consumption and credit demand.

The last variable analyzed is the one related to the quarterly change of the net salary (stationary variable), and the estimated coefficient for this was approximately 0.037, which highlights a similar relationship between the change in the average net salary in the previous quarter and the change in the balance of loans in the quarter current. Thus, an increase in net wages leads to an increase in the consumption capacity and indebtedness of individuals. On the other hand, we can also talk about an increase in the level of confidence among the population as the level of income increases, as they have more confidence to use bank loans to finance certain needs or objectives.

In concluding these conclusions regarding the multifactorial model for explaining the variation of the balance of loans granted to individuals, the degree of determination of the mode of 47% should also be highlighted (R-Squared = 0.47). This degree of determination shows to what extent the variation of the dependent variable is explained by the whole constructed model.

In order to have more information about the model and how it can be used for predictions, it is also necessary to test the model's hypotheses. The first hypothesis I will test is the lack of autocorrelation of errors, and the test applied is Breusch-Godfrey, the result being the following:

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.837724	Prob. F(2,31)	0.0324
Obs*R-squared	7.739858	Prob. Chi-Square(2)	0.0209

The probability of this test is less than 5%, and this shows that the model errors are self-correlated.

The next hypothesis to be tested is homoschedasticity, and the result is as follows, and the test applied is White:

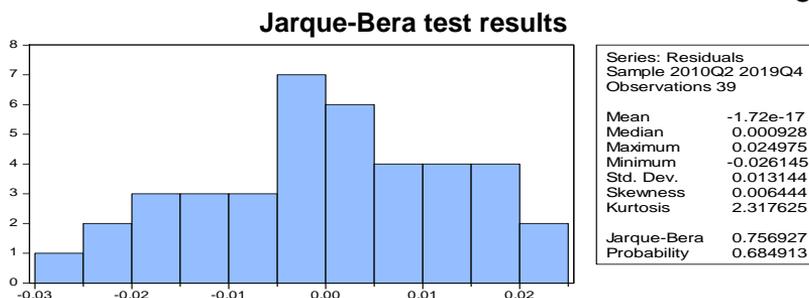
Heteroskedasticity Test: White

F-statistic	0.960032	Prob. F(20,18)	0.5381
Obs*R-squared	20.12936	Prob. Chi-Square(20)	0.4499
Scaled explained SS	9.494903	Prob. Chi-Square(20)	0.9764

The probability of the test is higher than 5%, which suggests that the homoschedasticity hypothesis is met.

The last hypothesis that will be tested is the one related to the normality of the model errors, and in this sense the Jarque-Bera test will be used:

Chart no. 5



Source: Own processing in Eviews

Again, it is observed that the probability related to the test is higher than 5%, suggesting that the basic hypothesis of the regression model is observed according to which the model errors follow a normal distribution.

The same approach will be applied for **loans granted to legal entities**, trying to explain the variation of the credit stock in the period 2009 Q4 - 2019 Q4, having the following general form of the **model**:

$$soldcred_{pj} = \alpha_0 + \alpha_1 \times creștereec + \alpha_2 \times \frac{EUR}{RON} + \alpha_3 \times salmediu + \alpha_4 \times ratasomaj + \alpha_5 \times ratainfl + \varepsilon_t$$

It should be noted that for this model several iterations were made, using several lags for all variables and the best model was chosen, ie the model that explains as much as possible the variation of the dependent variable.

The results of the estimation are presented below:

Dependent Variable: PJ_CREDITS

Method: Least Squares

Date: 04/05/20 Time: 21:32

Sample (adjusted): 2010Q2 2019Q4

Included observations: 39 after adjustments

Variables	Coefficient	Std. Error	t-Statistic	Prob.
CRESTERE_EC(-1)	0.706749	0.249245	2.835561	0.0078
RATA_INFLATIEI(-1)	0.698285	0.315227	2.215181	0.0338
RATA_SOMAJ	-0.674464	0.275044	-2.452206	0.0197
SAL_NETS	-0.077823	0.058543	-1.329329	0.1929
RAND_EURRON(-2)	-0.333724	0.246348	-1.354687	0.1847
C	0.049772	0.018278	2.723121	0.0103
R-squared	0.394733	Mean dependent var		0.005023
Adjusted R-squared	0.303026	S.D. dependent var		0.021586
S.E. of regression	0.018021	Akaike info criterion		-5.053905
Sum squared resid	0.010717	Schwarz criterion		-4.797972
Log likelihood	104.5511	Hannan-Quinn criter.		-4.962078
F-statistic	4.304284	Durbin-Watson stat		1.431136
Prob(F-statistic)	0.004002			

For the case of this model which tried to explain the change in the balance of loans to legal entities, it was observed that we have 4 of the 6 statistically significant coefficients, ie there are coefficients for which the probability of the Student test is greater than 5%. Thus, the coefficients for the variables SAL_NETS and RAND_EURRON (-2) are statistically insignificant, and an economic interpretation for them would not be valid.

We note that a positive value was obtained for this model as well for the coefficient related to the economic growth last quarter. This shows that the dynamics of the credit balance, for both individuals and legal entities, is significantly influenced by the smooth running of the economy, and the impact will be seen in the next quarter, as economic developments take effect.

On the other hand, a statistically valid relationship was observed between the inflation rate in the previous quarter and the dynamics of the balance of loans to legal entities. An increase in the inflation rate would stimulate corporate lending, as this model shows. The result may have a relevant economic interpretation in the sense that

an increase in the inflation rate means an increase in prices, and this usually occurs when there is sufficient market demand.

Sufficient demand means a good feeling among entrepreneurs, and this could translate into an increase in their appetite for lending, speaking here in particular of investment lending in order to increase production capacity, supply, to meet market demand and to capture the good economic moment.

The last variable analyzed is the one related to the unemployment rate, ie an expression of the state of the labor market and labor demand. An inverse relationship has been observed, ie an increase in the unemployment rate negatively influences the demand for loans for legal entities, often being associated with a difficult economic situation, which could induce a negative feeling among entrepreneurs and inhibit their desire to make sustained investments. of credits.

Last but not least, I will emphasize again that this model also obtained a good degree of determination, of approximately 39%, ie the variation of the balance of loans granted to legal entities is explained in a proportion of 39% by the multifactorial regression model built and in which lag variables were taken into account.

And this time the hypotheses of the regression model will be tested and we will start with homoschedasticity, using the White test:

Heteroskedasticity Test: White

F-statistic	1.785605	Prob. F(20,18)
Obs*R-squared	25.93032	Prob. Chi-Square(20)
Scaled explained SS	10.30042	Prob. Chi-Square(20)

The results indicate that this model hypothesis is met, with the probability of the test being greater than 5%.

The error autocorrelation will also be tested for this model, and the result of the Breusch-Godfrey test is presented below:

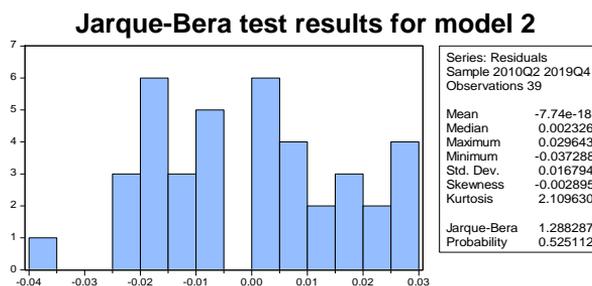
Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.744018	Prob. F(2,31)	0.1915
Obs*R-squared	3.944365	Prob. Chi-Square(2)	0.1392

The result indicates that the lack of error autocorrelation for this second model is observed. The probability of the test is higher than the 5% threshold chosen for interpretation.

The last hypothesis that has been tested is the one to verify the normality of the errors, ie the Jarque Bera test will be applied:

Chart no. 6



Source: Own processing in Eviews

Again, it is observed that the probability related to the test is higher than 5%, suggesting that the basic hypothesis of the regression model is observed according to which the model errors follow a normal distribution.

3. Conclusions

Optimizing the structure of banking assets and liabilities is a topical and important for the economy of our country considering that it is a developing economy, an economy that must recover the gap with developed countries in Western Europe, this being one of the objectives that and assumed them following accession to the European Union (achieving real convergence). Therefore, I wanted to show the evolution of lending in Romania, which were the determining factors for the dynamics of loans, ie for the most important component of banking assets. We have tried to achieve all this, taking into account that economic development requires a solid financial system, a financial system that ensures access to finance for businesses that have the potential to generate profit and bring added value to the country. At the same time, I specify that the most important objective was to identify the determinants of lending for the case of Romania and what is the meaning of the relationships between the variables used and the change in the credit stock, both for individuals and legal entities, thus covering two important directions of credit in Romania, which represent over 90% of the balance of loans granted so far. All this was important in the context in which the management of banking assets is a hotly debated topic and always in the attention of monetary policy makers and commercial bank decision makers.

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