# Linear Regression Model for Banking Loans Estimation During the COVID-19 pandemic

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#### Abstract

Starting from the natural and sometimes contradictory fears about whether 2021 and 2022 will be years of return to the crisis, even stronger than before, we believe that the use of a more precise scientific tool in our work is more than welcome. The authors of the current paper aim to create a scientific model based on mathematical regressions, based on several series of macroeconomic data gathered from a thorough study of the Romanian banking economy and financial market. Furthermore, starting from the mathematical formulas and equations on which these regressions are based, the authors will estimate, with a reasonable error rate, the evolutions of some indicators that are of major interest for the financial-banking market. Given the large number of macroeconomic variables that are strongly correlated with bank and capital market financing, this is not an easy task and a change must be made between the relatively short time frame of the available data series and the number of variables explanatory notes taken into account. The elaboration of this paper started in 2020, when the Romanian authorities, but also the other EU countries launched important projects and aid schemes that were designed to help economic agents survive the crisis following the SARS-CoV-2 pandemic. Aid schemes aimed at SMEs, but also other government financial support measures such as those for the purchase of hybrid and electric vehicles or housing can significantly change the evolution of loans on the Romanian banking market. These legal initiatives have created great contradictory discussions and opinions which, overlapping with some pessimistic estimates stated since the beginning of the COVID-19 pandemic and until now psychologically fuel the future decisions of companies and individuals in need of funding. Estimates can influence consumer behavior and unfortunately create great uncertainty for companies and individuals who would like to obtain loans from banks. On the other hand, banks are not sure about the evolution of loans on the main customer segments and do not know how to issue their strategies. In this uncertain landscape, the authors of this paper believe that a scientific model based on mathematical regressions is needed to provide a ray of certainty based on macroeconomic calculations.

#### Keywords

Loans; SARS-CoV-2 pandemic; regression model; forecast.



## Introduction

The historical experience of the past shows that there is a close connection between a crisis and the way the banking system reports to this crisis. Whether it is an economic, financial, or pandemic crisis, the banking system has always had the vision and strategies to respond effectively to these crises. The efficient response of the banks to the crisis conditions depends in principle on their power to adapt to the new market conditions and the new economic-financial context.

Without exception, the economic and financial crisis generated by the COVID-19 virus has forced the banking system to adapt to the new context conditions and to take appropriate measures in the market. Overall, the banking sector has coped better with the present crises, compared to the previous one (Marcu, & Zbuchea, 2021). All attempts, more or less successful by the authorities to reduce the negative effects of the COVID-19 pandemic will strongly affect the Romanian banking market that also stumbled during the crisis years 2008-2010, an aspect that was also reflected in the banking system, where the lending activity stagnated for a long time. Will the negative effects on the profitability of NPL (non-performing loans) fed banks that reached worrying thresholds at that time make the bankers more cautious in the future?

Through this paper, we will try to answer this question. Although currently, the macroeconomic situation improved, the lending activity had a low sensitivity, remaining negative also between January 2020 and June 2021. As either 2022 is not announced to be devoid of emotions year judging from the perspective of the macroeconomic and microeconomic evolution, the motivation of elaborating a mathematic regression model to estimate the evolution of lending on the main client segments appears to us as very attractive.

## Literature review

The economic analysis of the effects of pandemics on economies, especially the weak ones, led to too many sacrifices that everyone, from every person, household, small or large companies, to the entire social and economic life had to lose. Public health and economic growth have been affected, but extremely seriously, human rights have been called into question, with some feeling that lockdown, travel restrictions, or vaccination have affected the freedoms guaranteed by the Constitution. Although the outbreak of COVID-19 was neither defeated nor better known (Sansonetti, 2020), however, the policymakers were blind-sided by the disease's combination of SARS-like severe lower-respiratory impacts with the transmissibility of common-cold coronaviruses (Kormann, 2020). The pandemic has hard hit the global economy, particularly the countries that are mainly based on the tourism industry (Cvelbar, 2020). The major challenges for countries amid Covid-19 include the recovery of businesses against the backdrop of financial constraints (Ruane, 2020), fiscal pressure due to unemployment (Buhalis, 2020), and the sustainability of communities (Macbeth, 2020). To this end, it is vital to quantitatively measure the effects of the current disaster with respect to its intensity and duration. The economic performance of the countries affected by a pandemic is prone to restrictions and lockdown of social

and business activities that ultimately has twofold repercussions. Firstly, a great contraction of final demand takes place, but also the possible reduction of labor supply due to the interruption of several working tasks. Secondly, a contraction in the supply of goods and services results from the firm's shutdown. In addition, the negative economic effects could be non-negligible also for countries only marginally affected by the pandemic. With no sufficient vaccine and/or limited medical capacity, the ultimate strategy to contain novel coronavirus is nonpharmaceutical interventions which include lockdown, social distancing, closure of educational institutes and several industries, and restrictions on gatherings (Gossling, Scott, & Hall, 2020), Given the global character of the current pandemic, the global economy will most probably suffer a new technical recession, along with the high psychological, sociological repercussions (Ahmed et al., 2020; Baker et al., 2020). The fight against the virus diffusion through the reduction of contagions, outside a pharmacological strategy, demands the total block of individual transfers. This compromises the availability of the workforce for all those processes in which a substitution of work in presence with more flexible forms of labor cannot be realized.

The non-agile production activities undergo an inevitable and sudden output break due to scares labor mobility, either voluntary or forced, of individuals. In other words, all activities, deferrable or non-agile, will oblige to an immediate closure with undesired and relevant extra costs. One of the most important features of the economic crisis induced by COVID-19 is the uncertainty about the continuation of the business, or the vision and direction of their development. An extensive study conducted in 2020 by the National Institute of Statistics of Romania (after analyzing the opinions of managers in over 8,000 Romanian companies in the first month of the COVID-19 pandemic) shows that the level of uncertainty on the predictability of their business has increased from "24.5% in March 2020 to 40.1% in April 2020" (Report COVID-19, 2020, p. 2). Obviously, the increase of uncertainty on the predictability of the economic and financial evolution of their own companies directly affects the level of investments, as well as the future development projects. The lack of predictability regarding the evolution of one's own business can have important consequences, not only within the current activities of a company but also on the export-import balance of the companies that trade their goods on the foreign market.

In a similar study undertaken in the same period (March-May 2020) also by the National Institute of Statistics of Romania on several 1551 Romanian companies that traded together over 50% of the export volume of goods from Romania, it results that "over 15% of companies could not estimate how their business would evolve in the future, while 2.4% could not answer this question." (Report Ex-Im, 2020, p. 2). Such managerial approaches that lead to a lack of predictability, inevitably generate consequences on the outputs of the business. In turn, the change in business outputs inevitably leads to the revaluation of lending conditions by banks. On the other hand, the output generated and its resulting value creates actual asynchronies in the cash flows, and firms do not always have the capability of facing considerable demand fluctuations through the use of conventional tools as loan financing.

The continuous lending decrease and the constant deposit increase made that currently, the clients' savings cover the loan portfolios. This aspect would not be bad

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itself if it didn't indicate that most of the banks' clients do not lend anymore, not because they did not need loans for developments but, because of the fear for what the future may bring. The big problem is that the money saved with efforts in Romania finances the non-performance of some banks that is not even well-capitalized or provisioned. The financial resources of Romanians have generally increased during periods of crisis, we have seen this in the financial crisis of 2008-2010 and now, during the COVID-19 pandemic. If the part of attracting resources is really good during crises, people collect savings, but there is an important part of the population that has been so badly affected that it can no longer pay its accumulated debts. Those who were overindebted to the banks made the mistake of using the facility offered by the banks to postpone the debts during the pandemic. Now, interest has been calculated by capitalization, will be added to the principal debt, and will become almost impossible to pay. Initiating the personal insolvency and thus forcing the banks to be satisfied (only) with house foreclosure - that was an object to the loan - and not foreclosing all the present and future belongings also annoys the banks and makes them even more cautious.

The increased cautiousness from the banks 'side is overlapping with clients' fear to lend money and all this apparently paradoxical context and that may lead to the installation of the moral hazard will also strike the economy. The construction companies do not want to get loans for building new houses anymore, the industrial companies do not want to get loans for developing new production capacities anymore while the individuals reduce the loan based consumption and choose to save money instead of feeding the consumption, in a period in which the government measures of lock-down or drastic restrictions on culture, sports, restaurants, entertainment were able to amputate the appetite of the population to spend money and led to lack of liquidity and even insolvency most micro-enterprises and Romanian SMEs.

But, in an environment with such a risk level, we wonder, what shareholders could be still attracted to (re)invest? To part of these questions, we can find the appropriate answers in a work presented within Strategica International Conference in 2015, in Bucharest. In this paper, the authors offer solutions about how to evaluate the chances to successfully enter a new banking market, without facing additional risks (Treapăt & Ivan, 2015, pp. 509-517). A lot of other questions related to the errors done by many banks, in their boom period, standstill.

The mathematic model issued in this paper used the available databases with a quarterly log, along a period of 5 quarters (Q1\_2020-Q1\_2021, including), for thus granting and verifying the strength of the created model and calculated the loans evolution on client's segments for 3 further quarters, after the used database. These variables (that form the database that was used in the mathematic model) equally reflect the status and the evolution of the Romanian banking system, but also of the economy, as a whole (Bernanke et al., 1995, p. 29). According to the performed analysis, we acknowledged that the market demand for loans, until October 2008, registered a consistent increase of the loans volume (particularly corporate), being known that, the mentioned period was one of economic catching-up (Codîrlaşu et al., 2004, p. 2) and boom for loans. Unfortunately, starting with Q4 2008, the crisis show-up. Some analysts (Bayne, 2009) consider that the crisis was provoked by the private

sector. Others, (Benkovskis et al., 2012, pp. 27-47) state that the countries of Central, Eastern, and Southeastern Europe have demonstrated tremendous gains in international competitiveness during their transition from the centrally planned to market economies, as there was Romania's case. After the appeasement of the financial crisis, between 2010 and 2014, the lack of the solvable request for loans became general according to Mishkin (2007), and spread into the entire Romanian banking system. In these circumstances, the possibility of defense against a crisis or any other economic instability is smaller and smaller, stated researchers of globalization (Zaharia, 2004). A major role should be played by the international organizations, as demonstrated by the international diplomacy specialists (Ilie, 2014). We are now facing the same great risk, everything seems to be repeated indigo with the period following the real estate bubble crisis in the United States, which also took over Europe immediately after September 2008.

Within such a complex but also complicated context, in which the consistency in the economic estimation is missing, the authors of the current paper are convinced that the regression mathematic model that is presented in this paper - a model that uses relevant variables for determining the correct trend of the evaluated phenomenon will be able to bring a plus of accuracy in estimations that the interested parties (the strategists in the banks, the individuals having the corresponding knowledge in mathematics or the students and the researchers in the economic field) will make, for this way, the future lending evolutions to find them prepared with better-adapted strategies to the situations that might misapply their empirical evaluated expectations.

## The methodology of analysis

Economic analysis of pandemics, in particular on the forecasted effects of policies aimed at its containment, find space in the literature, especially on the topics of the method of estimation proposed. The availability of contributions to evaluation tools has significantly enhanced in recent years. Models utilized rely on sophisticated techniques of parametrization and validation. Some of them incorporate elements that refer to the behavior of individuals or micro and small enterprises (MSE) as Treapăt and Drăgănescu (2020, pp. 29-37) shown in their book about the economy of the transition countries in the EEC. Recent developments in economic analysis in crises include a meta-analysis, agent-based CGE models, and network models (Ahmed et al., 2020; Carrasco et al., 2013; Gallegati & Richiardi, 2009; Okuyama, 2007).

In this section of the paper, we aim at constructing two regression models to forecast the evolution of retail and corporate lending in the Romanian economy. The used research methodology is the quantitative analysis and more specifically, we used the analysis of variance as an exploratory tool to explain observations and to support the forecast.

The general form of the linear regression model used in our research is:

$$y = a_1 x_1 + a_2 x_2 + \dots + a_n x_n + b + \varepsilon$$

where:

y is the dependent variable, i.e., the variable whose evolution we wish to forecast  $x_i$  is the regressors (independent/explanatory variables)

 $a_i$  are the coefficients of the regressors (to be determined) b is the intercept (to be determined)  $\varepsilon$  is the error term

Taking into account the standard general assumptions of the multifactor linear regression model, the coefficients ai and the intercept b shall be determined using the statistical method of ordinary least squares. To estimate two statistically and economically valid linear regression models, we have analyzed a large data panel of economic variables. The period for which retail and corporate lending system-wide figures are available for our research restrains the number of the regressors included in the model. The data series taken into consideration are the quarterly balances of total loans granted by the Romanian banking system to non-government beneficiaries in the period Q1\_2020-Q1\_2021.

During the Period of COVID-19 applied in this paper used the published databases with a quarterly log, along a historical period of 5 quarters (Q1\_2020-Q1\_2021, including), for thus verifying and confirming the strength of the created model. Because at the time of completion of this paper there were no forecasts available for Q2,3 and 4 in terms of loans, we tried to prove that the calculation model based on linear regression supports us to calculate the loans evolution on client segments for 3 further quarters, after the used database.

For corporate loans we have considered the following specification for the linear regression model:

$$LC_{T} = a_{1}GDP_{T-4} + a_{2}LT_{T-1} + a_{3}ITO_{T-4} + b + \varepsilon_{T},$$

where:

- *LC* = total lending to non-government legal entities (including SMEs that might be classified in retail asset classes according to banking practice)
- *LT* = total bank lending to non-government counterparties
- *GDP* = gross domestic product in current prices (the base year 2019)
- *ITO* = index of industrial turnover (2019 = 100)

Loan figures are considered in real terms, i.e., by discounting them to 2019 prices using the harmonized index of consumer prices computed by Eurostat. All the variables are taken directly from the Eurostat and IMF databases, except loan balances, which are sourced from the National Bank of Romania. The inclusion of the total bank lending (with a lag of one quarter) as a regressor in the above equation is meant to ensure that the evolution of lending from one period to the next is smooth, i.e., the lending appetite of banks does not change significantly from one period to another. GDP in current prices (million lei) was included as the overall performance of the economy is clearly a factor that influences bank lending with strong levels of economic activity generally being associated with sustained growth in lending.

## Analyzing the case study results

In our analysis of case study results, the index of industrial turnover (T/O industrial index) is relevant because of the relative importance of industry in the Romanian economy (accounting for approx. 23% of total gross value added as an average of the

analyzed period). Unfortunately, the industry lost 1.7 percent of its share of GDP, falling from 21.3% in Q1 / 2019 to 19.6% of GDP in Q1 / 2020, and this without being affected by the pandemic. In Q1 2020 the industrial T/O index was below 100 without the negative influence of Covid 19, which hit in March, but in Q2 other branches of the economy, such as the hotel industry, restaurants, tourism, and others went directly into lock-down, their share market collapsing in total T/O and thus make it appear a higher industrial T/O index in total GDP. The appropriate numbers of lags were selected based on the respective correlations with total corporate loans, i.e., the dependent variable (the correlation coefficients are approx. 94% for total bank loans, 60% for GDP, and 60% in the case of industrial turnover). This is intuitive because the overall performance of the economy does not immediately influence bank lending – some time is needed for the effects to be reflected in the companies' ability and willingness to take bank financing on their balance sheets. The estimation of the model yields the following results, as we can see in Table 1.

Tuble 1. Keyression output - tor por ute touns				
<b>Regression Statistics</b>				
Multiple R	0.9729			
R Square	0.9465			
Adjusted R Square	0.9405			
Standard Error	1928.92			
Observations	31			

Table 1. Regression output - corporate loo	ıns
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	Coefficient	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	68,684.29	10,985.58	6.25	1.09E-06	46,143.73	91,224.84
X_1	-0.52	0.11	-4.84	4.67E-05	-0.74	-0.30
X_2	0.45	0.03	15.34	7.49E-15	0.39	0.50
X_3	102.22	27.18	3.76	0.001	46.44	157.99

ANOVA					
	df	SS	MS	F	Significance F
Regression	3	1,776,125,630	592,041,877	159.12	2.85E-17
Residual	27	100,459,868	3,720,736		
Total	30	1,876,585,498			

The information presented in this Table was elaborated by the authors, based on the analyses made upon the information sources.

The regression output emphasizes the model's high predictive power, as the coefficient of determination is very high (adjusted R square greater than 0.94). This means that the explanatory variables (i.e., regressors) considered are eloquent for more than 94% of cases. The computed "t" stats and the associated "p"-values show that all the variables in the model are statistically relevant (even at the extreme level of confidence of 99%), while the ANOVA analysis indicates an excellent goodness-of-fit, as the specialists have shown in their books Freedman (2005) and Gelman (2008).

The methodology chosen by the authors focuses on the applications of linear models, including the smallest generalized squares and the smallest squares in two steps, with samples and logs for binary variables. Bootstrap is developed as a technique for

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estimating bias and calculating standard errors. Particular attention is paid to the principles of statistical inference. In this way, we have all the prerequisites to make an optimal estimate of our predictions.

Given all this, it is interesting that the real GDP coefficient in regression is negative (-0.52), more, because it may seem somewhat counterintuitive. However, our support is that this value is justified in the current context of corporate debt and the attempt of all commercial banks to keep their balance sheets as clean as possible because the National Bank of Romania is extremely interested in reducing non-performing loans in the banking system and maintaining them at a reasonable level. According to the European Central Bank's (ECB, 2020) financial stability report, asset quality has already begun to deteriorate in the second quarter of 2020, and banks' provisions for loan losses increased significantly at the beginning of last year. Based on the simulation prepared by the ECB, in the absence of state support, more than 9% of total loans to euro area companies could run into difficulty in 2021.

In the case of retail loans, the multifactor linear regression model to be estimated is:

 $LR_T = a_1LT_{T-1} + a_2RNBR_{T-4} + a_3GAW_{T-4} + b + \varepsilon_T,$ 

where:

• *LR* = total lending to retail customers (only loans granted to individuals are taken into account)

- *LT* = total bank lending to non-government counterparties
- *RNBR* = the National Bank of Romania reference interest rate
- *GAW* = gross average salary

The end of quarter rates has been adjusted to their real values, i.e., using Fischer's formula: Real Rate = (1 + Nominal Rate) / (1 + Inflation Rate) - 1. The interest rates are sourced from NBR. Yearly inflation rates are provided by Eurostat.

As in the case of corporate loans, the total loan stock is included as a regressor to smoothen the evolution of bank lending. The other two regressors have been chosen due to the sensitivity of household debt concerning the cost of financing and real disposable income. Again, the lag of four has been chosen because the incentive to take on debt adjusts gradually to a change in the cost of funding and the income of individuals. The coefficients of correlation between retail loans and the variables included in the model are approx. 0.7, 0.5, and 0.7, respectively.

Estimating the model, we get the following results, as we can see in Table 2.

Regression Statistics	
Multiple R	0.9689
R Square	0.9389
Adjusted R Square	0.9321
Standard Error	2,437.64
Observations	31

### Table 2. Regression output – retail loans

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	17,369.73	4,804.43	3.62	0.001213	7,511.85	27,227.61
X Variable 1	0.51	0.04	11.56	5.82E-12	0.42	0.60
X Variable 2	2,020.18	400.14	5.05	2.67E-05	1,199.17	2,841.20
X Variable 3	-16.85	6.27	-2.69	0.01217	-29.71	-3.99

ANOVA					
	df	SS	MS	F	Significance F
Regression	3	2,463,671,887.27	821,223,962.42	138.20	1.70613E-16
Residual	27	160,436,601.21	5,942,096.34		
Total	30	2,624,108,488.48			

The information presented in this Table is elaborated by the authors, based on the analyses made upon the information sources.

The interpretation is similar to the one provided in the case of corporate lending. The adjusted R square of approx. 0.93 means that only 7% of the regressand's variability is unaccounted for by the three variables included in the analysis. The "t" stats and the "p"-values suggest the statistical significance is achieved even at a confidence level of 99% and the ANOVA analysis indicates a very high goodness-of-fit. It is interesting and again counterintuitive that the coefficient of gross average salary is negative, while the coefficient of interest rates is positive. This suggests that banks are faced with risks of adverse selection and moral hazard in the retail business and provides a justification for the fact that retail financing is mostly concentrated in the low-income bucket of borrowers. Of course, this leads to an increased risk of default of borrowers and poses a clear threat to the profitability of the banking system and, more generally, to the financial stability of the Romanian economy as a whole.

For providing an as high as possible practical utility to the regression mathematic model that is subject to the research in the current paper, we will exemplify the way forecasts about the future evolution of the lending can be done, by two case studies. We have shown the reasons why it is essential that, within a period dominated by plenty of uncertainties upon the way of predicting the future, an accurate scientific instrument to exist, able to support the companies, banks, and even householders' process of planning and forecasting.

We will show in the following examples how we can estimate the corporate lending evolution for the following 3 quarters (3 log) starting from the data series we already know, by using the most suitable coefficients of regression, as we can see in Table 3 and 4. For the case of estimating the future trend of corporate lending, the most relevant variables to be used in creating the regression model are the evolution of the GDP, the turn-over industrial ratio, and the evolution of the total loans.

Regression						
Intercept	68,684.29					
X_1	-0.52	GDP (L-4)				
X_2	0.45	Loans (L-1)				

### Table 3. Coefficients of regression for corporate loans

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X_3	102.22	T/0 Ind (L-4)

Equation :

Corp. Loan = -0.52 * GDP_R_(t-4) + 0.45 * Total Loans_(t-1) + 102.22 * T/O. Ind_(t-4)						
	+ 68684.2	9				
Ratio -0.52	0.45	102.22	68,684.29			

#### Table 4. The estimation upon the corporate lending evolution

Date	GDP (in current prices, million lei)	Total Loans (million lei)	T/O Industrial index (%)	Corporate Loans (million lei)
2020Q1	214,758.0	263,539.0	98.3*	118,302.2
2020Q2	225,436.6	261,842.3	124.0	116,344.8
2020Q3	284,382.7	266,074.7	123.6	120,577.2
2020Q4	329,304.1	273,849.9	121.4	123,962.4
2021Q1	286,198,7	279,830.3	119,3	128, 324.2
2021Q2	289,059.3	284,436.1(est.)	120,7	131,123.5
2021Q3	292,949.3(est.)	309,856.9 (est.)	115,2(est.)	135,523.1
2021Q4	345,769.2(est.)	338,055.8 (est.)	124,7(est.)	140,777.8

The decrease in Q1 2020 of the share of industry in GDP has not yet been influenced by the pandemic, but starting with Q2 and following, the apparent recovery of the T/O Industrial index is because other branches of the economy, such as trade, hotel industry, restaurants, tourism, but also many others have entered directly into lock-down, their market share collapsing in total T/O in GDP.

The evolution of the quarterly gross domestic product in the period 2019 - 2021, calculated as gross series and series seasonally adjusted, is shown in Table 5 below.

- in% compared to the corresponding period of the previous year.           Gross series         2019         105,0         104,4         103,0         104,3         104,1           2020         102,4         90,0         94,4         98,6         96,1           2021         99,8         -         -         -         -           Seasonally         2019         105,2         104,2         103,4         103,7         -           2020         102,8         90,0         94,5         98,0         -         -			Q. I	Q. II	Q. III	Q. IV	Y		
Gross series         2019         105,0         104,4         103,0         104,3         104,1           2020         102,4         90,0         94,4         98,6         96,1           2021         99,8         -         -         -         -           Seasonally         2019         105,2         104,2         103,4         103,7         -           adjusted series         2020         102,8         90,0         94,5         98,0         -	- in% compared to the corresponding period of the previous year -								
2020         102,4         90,0         94,4         98,6         96,1           2021         99,8         -         -         -         -           Seasonally adjusted series         2019         105,2         104,2         103,4         103,7         -           2020         102,8         90,0         94,5         98,0         -           2021         100,0         -         -         -         -	Gross series	2019	105,0	104,4	103,0	104,3	104,1		
2021       99,8       -       -       -       -         Seasonally       2019       105,2       104,2       103,4       103,7       -         adjusted series       2020       102,8       90,0       94,5       98,0       -         2021       100,0       -       -       -       -       -		2020	102,4	90,0	94,4	98,6	96,1		
Seasonally adjusted series         2019         105,2         104,2         103,4         103,7         -           2020         102,8         90,0         94,5         98,0         -           2021         100,0         -         -         -         -		2021	99,8	-	-	-	-		
adjusted series         2020         102,8         90,0         94,5         98,0         -           2021         100,0         -         -         -         -         -	Seasonally	2019	105,2	104,2	103,4	103,7	-		
2021 100.0	adjusted series	2020	102,8	90,0	94,5	98,0	-		
/ -		2021	100,0	-	-	-	-		
- in% compared to the previous quarter -									
Seasonally 2019 101,7 100,7 100,4 100,9 -	Seasonally	2019	101,7	100,7	100,4	100,9	-		
adjusted series 2020 100,7 88,2 105,5 104,6 -	adjusted series	2020	100,7	88,2	105,5	104,6	-		
2021 102,8		2021	102,8	-	-	-	-		

# Table 5: Quarterly Gross Domestic Product Evolution

Retrieved from https://insse.ro/cms/sites/default/files/com presa/com pdf/pib tr4r2020.pdf

By applying the mathematic model and also by making the calculations based on the equation in Table 6, it will lead us to estimation about the evolution of the retail

lending, along 3 future periods, 3 quarters for our case, represented by the blue colored area in Table 7. Starting from the working hypothesis used for estimating the total loans, that would have increased by aprox.1% annually, the conclusion that we can depict after applying the mathematic model is that the deleveraging will continue to extend in the Romanian economy until the banks will resume their appetite to finance the economy.

Further on, we will calculate the coefficients of regression by using relevant variables for determining the future evolution of the lending for private individuals. We used for variables the National Bank of Romania reference interest rate, the gross average wage, and the evolution of the total lending in the economy. The coefficients and the regression equation is to be calculated as presented below.

#### Table 6. Coefficients of regression for retail loans

Coefficients of	Regression					
Intercept	17,369.73	1				
X_1	0.51	Loans (L-1)				
X_2	2,020.18 NBR Int. Ref. Rate (L-4)					
X_3	- 16.85	Average Gross Wage (L-4)				
Equation : Loans_RET_t = 0.51 * Loans_TOTAL_(t-1) + 2020.18 * IR_NBR_(t-4) - 16.85 * Wage_Gr_(t-4) + 17369.73						
1	2,020.18	17,369.73				

https://www.bnr.ro/Credite-acordate-gospodariilor-populatiei-5771.aspx

Date	Total Loans (million lei)	NBR Interest. Ref. Rate (L-4)	Retail Loans (million lei)
2020Q1	263,539.0	2.00	145,236.8
2020Q2	261,842.3	1.75	145,497.5
2020Q3	266,074.7	1.50	148,580.6
2020Q4	273,849.9	1.50	149,887.5
2021Q1	279,830.3	1.25	151,506.1
2021Q2	284,436.1(est.)	1.25	156,901.8
2021Q3	309,856.9(est.)	1.25 (est.)	174,333.8
2021Q4	338,055.8(est.)	1.50 (est.)	187,278.0

#### Table 7. The estimation upon the retail lending evolution

# **Conclusions and reccomendation**

Analyzing all the presented in the case study previously highlighted, we can formulate some relevant conclusions. The first conclusion we can draw is that, even for individual loans, financing will be resumed slowly, at rates around 1% quarterly, amid borrowers' aversion to additional loans and the population's appetite for savings. As for the loans that will be requested by corporations from banks, they will also evolve quite slowly, at

rates even slower than 3% quarterly, depending on maintaining the uncertainty induced by the pandemic and the weaknesses of government policies.

The second conclusion we can draw is about the health crisis is affecting both consumers, traders, and the entire economic environment. In 2020 and 2021, years of the Covid 19 pandemic, more than 708,000 consumers have asked banks to postpone the payment of installments. It is almost impossible that unforeseen events do not occur during a contractual relationship. And the handiest example is the pandemic we are still facing, which has disrupted social relations, contractual relations, turned business upside down, changed the importance of some industries.

The third conclusion we can draw is about banks that are close to consumers in difficulty during the contract will reap the benefits of their trust in the coming years if they prove empathetic to their customers. Banks have every interest in having satisfied customers, but also customers who can assume their obligations to the end and who, in turn, keep their promise. If the pandemic is to have another wave, the banking system must quickly rethink its entire structure. Because just postponing the installments does not solve the problem itself. The most important thing is for the banks to continue the financing, the lending activity, to make sure that people will have jobs, will be able to consume or invest, and thus Romania will evolve, as it deserves.

The fourth conclusion we can draw is about our calculation model which indicates extremely prudent increases in non-government lending, which is in perfect agreement with the most select predictions of international financial institutions. The International Monetary Fund has published the 2021 edition of the Global Macroeconomic Report (Managing Divergent Recoveries), which includes the macroeconomic scenario for the countries of the world, updated by incorporating the latest developments in macro-financial indicators (including economic policy signals) from the pandemic and international commodity markets.

The fifth conclusion we can draw according to updated forecasts, which are proving in the same direction with the trends calculated by our linear regression model, Romania's economy could grow by at least 6% year/year in 2021 (revision up from 4.6% year/year), after adjusting by 3.9% year/year from 2020, determined by the incidence of the pandemic and the consequences of this unprecedented global health shock in the last century. For 2022 and 2023 the forecasts indicate the increase of the GDP with annual rates of 4.8%, respectively 3.8%. This can only be achieved by increasing investment, with a driving impact on the other components of GDP. Thus, the investment/GDP ratio could increase from 22.9% in 2020 to 23.6% in 2021, 24% in 2022, and 24.8% in 2023 (the highest level in 2015). Regarding the average annual dynamics of consumer prices, the forecasts indicate an acceleration from 2.6% in 2020 to 2.8% in 2021, followed by deceleration to 2.1% in 2022. At the level of public finances, the adjustment of the budget deficit / GDP ratio is expected from 9.7% in 2020 to 7.1% in 2021, 6.3% in 2022. The share of the public debt ratio in GDP could increase from 50.1% in 2020 to 52.6% in 2021, which is in the same logical line with the slow increase of the credit balance on both customer segments that we validated in this paper.

Regarding the usefulness and practical applicability of our forecasting model, it is obvious that it has a great value of social utility because it is addressed to the individuals who want to know how their loans will evolve in the future. It is also addressed to the companies that want to resort to loans and on whose success the jobs of thousands of citizens depend, consequently, its applicability and utility cover a national social scale.

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