

Econometric Insights into Non-Governmental Credit Fluctuations: A Case Study of Romania

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Abstract

In this scientific paper, we will conduct a multiple regression analysis using the non-governmental credit (NGC) as the dependent variable and the inflation rate, unemployment rate and the M2 – money supply as independent variables, over a ten-year period, specifically the period of 2013-2022. The study was conducted analyzing the macroeconomic data of Romania and the purpose of this paper is to perform multiple regression analysis method to determine how turbulences such as the pandemic crisis, the Russian-Ukrainian war, and the energy crisis, have impacted the non-governmental lending activity and to find whether there is a significant association as determining factors (a correlation) between the mentioned variables.

Key words: multiple regression analysis, non-governmental credit, macroeconomic indicators, Central and Eastern Europe, global economic turbulences

J.E.L. classification: C51, E44, F34, G01, P34

1. Introduction

The last few years, from 2020 to 2022, there has been a period of important changes and challenges all around the world. We've seen the COVID-19 pandemic change the way we live and work, which has had a significant impact on economies worldwide, the onset of the COVID-19 pandemic triggered unprecedented economic disruptions, leading to shifts in investment patterns and credit dynamics. During this time, there was also the conflict between Russia and Ukraine, adding geopolitical tensions to an already strained global economy. On top of these, as an effect of the Russian-Ukrainian conflict, an energy crisis has made things even more complicated for countries and their economies, especially for European Union zone.

Non-governmental credit refers to loans and other forms of credit offered by private financial institutions, as opposed to those issued or backed by governments and plays a significant role in the financial system, fueling business investments, consumer spending, and overall economic growth. The dynamics of non-governmental credit are affected by various factors, including economic policies, market conditions, and broader geopolitical events.

Financial institutions had to deal with a series of challenges during the period analyzed, in the context of the pandemic, that came with its economic lockdowns and shifts in consumer behavior, has led to changes in both the demand for and the supply of credit. Financial institutions have had to navigate a landscape marked by increased risk, economic uncertainty, and changing government policies.

In the context of the Russian-Ukrainian conflict and the energy crisis, lending activities have further been influenced. These events have led to heightened economic volatility, affecting currency values, investment flows and the financial stability of regions, particularly in Romania.

Our study focuses on Romania, which is particularly sensitive to these global shifts due to its post-socialist economic influences and geopolitical position. We will use a statistical method called multiple regression analysis with the purpose of identifying the interplay between these major global events and the evolution of non-governmental credit in this region.

The paper is structured as follows: section 2 reviews the relevant literature, highlighting previous studies from the field, the role of sectoral credit allocation in macroeconomic fluctuations, and the impact of macroeconomic factors on credit risk. Section 3 describes the research methodology, including the aim of the research, the design of the study, and the statistical tools employed. In section 4 we present the findings from the regression analysis, offering insights into the relationships between the dependent and independent variables. In section 5 we discuss these findings drawing the conclusions about the influence of independent variables on the dependent variable, while also acknowledging the limitations of the study. In the last section can be find the list of the references that were used in the elaboration of this research paper.

2. Literature review

Mihaylova-Borisova (2022) had studied the evolution of bank credits in Central and Eastern European countries, including Romania, highlighting how different crises have influenced credit dynamics. Her study is particularly relevant for understanding the Romanian banking sector's response to economic disruptions, such as the financial crisis, European debt crisis, and the COVID-19 pandemic. She notes that despite significant challenges, including a sharp decline in lending rates and an increase in non-performing loans, there has been a recovery in credit growth post-pandemic, indicating resilience in the face of adversity.

The study by Müller and Verner (2020) investigates the relationship between sectoral allocation of credit, macroeconomic fluctuations, and financial crises. Their research, based on a novel database covering 117 countries since 1940, demonstrates how credit booms disproportionately favor the non-tradable sector, such as construction and real estate, over the tradable sector. This allocation of credit, especially when skewed towards non-tradable sectors, systematically predicts subsequent growth slowdowns and financial crises. In contrast, credit expansions in the tradable sector are linked with sustained output and productivity growth without increasing the risk of financial crises.

In the context of understanding the impact of macroeconomic factors on credit risk in the banking sector, the study by Naili and Lahrichi (2022) offers critical insights. The research elucidates the roles of inflation and unemployment in credit dynamics. It highlights that high inflation can potentially exacerbate bank credit risk by eroding borrowers' real income, thereby impairing their debt repayment capacity. This effect is particularly evident in loans with variable interest rates and in economies where wages do not promptly adjust to inflationary trends, the unemployment rate on the other hand is directly correlated with deteriorating loan quality, as individuals with lower incomes, who are more susceptible to unemployment, face heightened difficulties in repaying loans.

A key finding of a study conducted by Horebet et al. (2021) is the significant impact of the unemployment rate on banking profitability. The research shows that changes in the unemployment rate are closely tied to the performance of the banking sector. Higher unemployment rates are associated with increased non-performing loans and a reduction in the demand for new credits, particularly in the non-governmental sector. This relationship indicates that as unemployment rises, banks face heightened risks and lower profitability due to a decrease in credit demand and an increase in loan defaults. The study also notes that the effect of unemployment on new credit demand is more immediate than its impact on non-performing loans, underlining the direct and immediate influence of unemployment rates on banking sector stability and profitability.

Yurdakul (2014) has made an analysis over the impact of changes in the M2 money supply on banks' credit risk. The research indicates that an increase in the M2 money supply is associated with a rise in banks' credit risks. This suggests that fluctuations in the money supply can have a significant impact on the stability and performance of banks, influencing the level of credit risk they face.

For the M2 money supply and our selection as a variable in our study, is further supported by insights from the research conducted by Crayne, Williams and Neupane (2021). The authors are presenting an analysis of how the M2 money supply has expanded significantly over time, as seen in the United States from 1969 to 2020, where the volume in M2 had a continuous increase, without any decrease from one fiscal year to the next and signifies the growing availability of liquid assets in the economy, which can directly influence lending and borrowing activities in the financial sector. The study also indicates a strong positive correlation between the M2 money supply and other significant economic indicators, such as the Dow Jones Index and National Debt. Based on that we

have taken into account that changes in the M2 money supply can closely be linked to broader economic trends and market dynamics, and can also be linked to non-governmental credit, and therefore a correlation can appear between these two variables.

3. Research methodology

3.1. Research aim

The aim of this research is to study and understand the complex interplay between the selected macroeconomic variables and the dynamics of non-governmental credit (NGC) in Romania over a decade that experienced both global and regional upheavals. This decade, from 2013 to 2022, was characterized by a series of significant events, each with the potential to significantly reshape economic behaviors and financial patterns.

Non-governmental credit refers to the loans extended by private financial institutions, as opposed to loans issued or backed by government entities. NGC by definition is a vital component in the financial system, having a vital role in funding business investments, consumer spending, and overall economic growth.

In setting the scope of our research, we have chosen to focus on the inflation rate, unemployment rate, and M2 money supply. We picked the inflation rate because it's like the thermometer of the economy. When prices rise it affects how much people and businesses can spend and save. For banks, it means the money they lend out might not have the same value when it's paid back, so we're looking into how this rise and fall in prices influences the lending behavior of private banks. The unemployment rate is a straightforward yet powerful indicator. When a large percentage of people are out of work, it generally means there's less money going around for spending and paying back loans and therefore this could make banks to be more reticent about who they lend to and how much. For the last variable - M2 money supply - the inclusion is based on its representation of the liquidity available in the economy. It encompasses cash, checking deposits, and near-cash assets and the fluctuations in this monetary aggregate can signal changes in economic policy and overall economic health, which in turn can influence lending activities.

To determine the correlation between NGC and inflation rate, unemployment rate, and M2 money supply the following hypotheses were formulated:

H₁: There is a significant negative relationship between the inflation rate and non-governmental credit in Romania.

H₂: The unemployment rate is negatively correlated with non-governmental credit.

H₃: Changes in the M2 money supply have a significant impact on the volume of non-governmental credit.

3.2. Research design

For our study statistical data were collected for each variable on a period of 10 years, respectively 2013-2022. We have chosen a ten-year interval because it provides a substantial number of data points, enhancing the robustness of our statistical analysis by mitigating the effects of short-term volatility and seasonal fluctuations while offering a solid foundation for the application of multiple regression techniques. Also, this period is particularly significant because the interval under review includes the years before and after the COVID-19 pandemic, in the aftermath of the pandemic we have seen a series of crises the Russian-Ukrainian conflict and as a consequence of war, the energy crisis.

Statistical databases were identified in the National Bank of Romania (2023), INSSE (2023a, 2023b), EUROSTAT (2023).

We employed the Least Squares method, specifically Non-Linear Least Squares (NLS) and Autoregressive Moving Average (ARMA) models, to conduct a multiple linear regression analysis. This approach was chosen for its efficacy in estimating the parameters of a linear regression model in a way that minimizes the sum of the squares of the differences between the observed dependent variable and those predicted by the model. The dependent variable in our study was non-governmental credit (NGC), a key indicator of financial health and lending activities. As for the

independent variables, we selected a range of independent variables, which will be detailed in the following table:

Table no. 1 Selected variables

Acronym	Indicator	Unit
M2	M2 – intermediate money supply	Lei million
INF_rate	Inflation rate	Annual inflation rate (%)
UNEM_rate	Unemployment rate	Annual % of population in the labour force

Source: Author's contribution

For the implementation of our regression analysis, we utilized EViews, a sophisticated statistical software package renowned for its powerful econometric and time-series analysis capabilities. EViews provides an intuitive and user-friendly interface, which allowed us to efficiently manage our data, perform complex statistical analyses, and visualize the results effectively. The choice of EViews was driven by its strong reputation in the field of econometrics for delivering accurate results, which was essential for the rigorous examination of the relationship between non-governmental credit and the selected macroeconomic variables.

4. Findings

The adjusted R-squared value of 0.995006 in our regression model is particularly telling, underscoring the strength and quality of the model in explaining the variance in non-governmental credit (NGC) through the selected macroeconomic variables. This value indicates that nearly 99.5% of the variability in NGC is accounted for. The Akaike and Schwarz criteria, with their respective values are suggesting a robust fit and are at the level that allows this model to be considered high quality one.

Table no. 2 Least Squares Panel

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF_RATE	3286.832	424.9586	7.734475	0.0002
UNEM_RATE	4204.968	1284.206	3.274371	0.0169
M2	0.354351	0.019864	17.83923	0.0000
C	80927.28	14543.55	5.564478	0.0014
R-squared	0.996671	Mean dependent var		258864.8
Adjusted R-squared	0.995006	S.D. dependent var		51377.09
S.E. of regression	3630.777	Akaike info criterion		19.52146
Sum squared resid	79095240	Schwarz criterion		19.64249
Log likelihood	-93.60728	Hannan-Quinn criter.		19.38868
F-statistic	598.7049	Durbin-Watson stat		3.199222
Prob(F-statistic)	0.000000			

Source: Author's contribution

All variables show statistical significance with p-values below the conventional threshold of 0.05, indicating a less than 5% probability that these relationships are due to chance. The F-statistic is significant, with a p-value close to 0, indicating that the overall regression equation is statistically significant, and the relationship is not due to random chance and standard errors of the coefficients are relatively small compared to the coefficients themselves, indicating precise estimates of the coefficients. The equation form resulted for the model attached is:

$$NGC = 3245.36 * INF_RATE + 4550.59 * UNEM_RATE + 0.34 * M2 + 90952.20$$

The inflation rate (INF_RATE) has a coefficient of 3245.36, suggesting that a one percentage point increase in inflation is associated with an increase of approximately 3245 units in NGC. Unemployment rate (UNEM_RATE) comes with a coefficient of 4550.59, indicating that a one percentage point increase in unemployment is associated with an approximate 4550 unit increase in NGC.

For the M2 money supply we got a coefficient of 0.34, indicating that for each one unit increase in M2, NGC is expected to increase by roughly 0.34 units.

Table no. 3 Correlation table

	NGC	INF RATE	UNEM RATE	M2
NGC	1.000000	0.848899	-0.351287	0.973904
INF RATE	0.848899	1.000000	-0.202141	0.726686
UNEM RATE	-0.351287	-0.202141	1.000000	-0.478114
M2	0.973904	0.726686	-0.478114	1.000000

Source: Author's contribution

The correlation table reveals a strong positive correlation between non-governmental credit (NGC) and M2 money supply, indicated by a coefficient of 0.97. This suggests that as the amount of money in the economy increases, so does the lending to non-governmental entities. Such a high correlation could imply that the variations in the money supply directly influence lending activities due to increased liquidity and available capital for loans. The inflation rate also shows a strong positive correlation with NGC, with a coefficient of 0.85. This implies that higher inflation is associated with increased non-governmental credit. A possible explanation for this is that with rising prices, there is a higher demand for credit as consumers and businesses seek funds to sustain purchasing power and investment activities. For the unemployment rate we obtained a negative correlation with NGC, at -0.35. This negative value aligns with the expectation that higher unemployment, which often reflects an economic slowdown, is associated with decreased lending due to lower consumer spending and business investment.

The correlation table and the coefficients from the regression output can be used to evaluate the truth of the stated hypotheses:

H1: *There is a significant negative relationship between the inflation rate and non-governmental credit in Romania:*

False - the correlation coefficient between the inflation rate (INF_RATE) and non-governmental credit (NGC) is positive (0.85), indicating a significant positive relationship, not a negative one.

H2: *The unemployment rate is negatively correlated with non-governmental credit:*

True - the correlation coefficient between the unemployment rate (UNEM_RATE) and NGC is -0.35, indicating a negative relationship. This supports the hypothesis that as unemployment rises, NGC tends to decrease.

H3: *Changes in the M2 money supply have a significant impact on the volume of non-governmental credit:*

True - the strong positive correlation coefficient of 0.97 between M2 and NGC suggests that changes in the M2 money supply are indeed significantly related to the volume of non-governmental credit. This relationship is further substantiated by the regression coefficient for M2 in the regression equation, which is positive and statistically significant.

5. Conclusions

The empirical analysis conducted reveals a counterintuitive yet significant positive correlation between the inflation rate and non-governmental credit in Romania. This suggests that contrary to the initial hypothesis (H1), inflation did not impede credit growth within the studied period of time. Indeed, this positive correlation could be that during times of inflation, there might be an increased demand for credit as consumers and businesses seek additional funds to keep up with the rising costs of goods and services, which in turn may lead to a growth in credit volumes. Moreover, the National Bank of Romania's decision to increase the monetary policy interest rate in response to high inflation typically aims to temper inflationary pressures by making borrowing more expensive, however in the context of our findings, it appears that such measures did not stifle credit growth this could happen because of the lag effect of monetary policy, where the impact on credit growth is not immediate, or the presence of strong demand-pull factors that sustain the growth of credit despite rising interest rates.

The substantial correlation between NGC and the M2 money supply, indicated by a coefficient of 0.97, initially suggests a strong linear relationship where movements in M2 closely follow the fluctuations in NGC. Such a correlation might typically raise concerns about multicollinearity, potentially inflating the variance of the estimated regression coefficients and leading to less reliable statistical inferences. However, the Variance Inflation Factor (VIF) for these variables, particularly the centered VIF values, remains below the threshold of 5, which is commonly regarded as the upper limit for moderate multicollinearity. Therefore, the high degree of correlation between NGC and M2, accompanied by moderate centered VIF values does not present a substantial concern regarding multicollinearity within our regression model, also it's important to note that the presence of multicollinearity does not bias the regression estimates but rather affects the precision of the estimation of the individual regression coefficients.

It is also important to acknowledge certain limitations of our study and one such limitation is the potential for omitted variable bias. There may be other factors not included in the model that could influence non-governmental credit, such as fiscal policy changes, international capital flows, or GDP related indicators, the absence of these variables could lead to an overestimation or underestimation of the effects of the included predictors. The interval of the data is restricted to a ten-year period and to Romania, which may limit the generalizability of the findings to other time frames or economic contexts.

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