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Article

The Economic Model of Banking Lending's Impact on Long-Term Growth Rates: The Russian Economy as a Case Study

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Abstract: This study investigates the role of commercial bank lending in Russia's economic growth, with a particular focus on the causal relationship between commercial credit expansion and macroeconomic performance. Employing econometric modeling and statistical analysis (Gretl), the research examines the dynamic interplay between banking sector credit volume and Russia's GDP growth rate, utilizing key financial indicators: aggregate loan issuance to households and firms, real lending rates, GDP growth dynamics, and money supply (M2). Annual data from 2012 to 2019 were analyzed to assess the directional impact of bank credit on economic growth. Empirical results confirm a statistically significant positive relationship, demonstrating that private sector loan growth directly elevates real household income. Furthermore, the analysis reveals that banking credit exerts a disproportionately stronger effect on both GDP and monetary aggregates (M2) during fiscal consolidation phases—when government program funding contracts—compared to periods of unaccommodative monetary policy. These findings underscore the critical intermediation role of banks in growth stimulation, particularly in emerging markets undergoing structural fiscal transitions.

Keywords: economic mathematical model, banking lending, economic growth, measure, analysis, error correction

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1. Introduction

The optimal calibration of banking credit expansion to sustain long-term economic growth remains a pivotal challenge for policymakers. This study addresses the research problem of how strategic credit allocation across economic sectors can accelerate growth in the Russian Federation, employing quantitative analysis of lending patterns and their macroeconomic impacts [1], [2]. Building upon established theoretical foundations while resolving persistent empirical contradictions, this investigation tests the hypothesis that commercial bank lending exhibits Granger-causal precedence over GDP growth in Russia's transitional economy [3]. Seminal work established financial intermediation as the critical mechanism for capital accumulation, a finding extended by dual-function model of savings mobilization and investment conversion. The credit view positions banks as monetary policy transmission channels, yet causality paradox - whether finance follows or leads growth - remains empirically unresolved, particularly for emerging markets [4],[5]. Recent Russian scholarship demonstrates this tension: monetary

transmission analysis contrasts with vector autoregression models, while regulatory effectiveness studies reveal context-specific banking impacts.

2. Materials and Methods

Methodologically, this study advances the literature through:

1. Sectoral decomposition of credit allocation patterns
2. VAR modeling with Granger causality tests
3. Cointegration analysis of long-term equilibrium relationships
4. Regulatory policy interaction terms

The primary objective is to establish the directional relationship between commercial bank lending and economic growth in Russia during 2012-2022, controlling for monetary policy shocks and structural breaks [6], [7]. This contributes to financial development theory by resolving the supply-leading/demand-following dichotomy in transitional economies, with practical implications for Bank of Russia's credit policy formulation [8].

3. Results

1. Banking Lending and Economic Growth

1. Theoretical Framework of Banking Lending

To mitigate credit and lending risks—which could lead to financial losses, loss of customer confidence, mass deposit withdrawals, and potential insolvency, while ensuring sustainable profitability, operational coherence, and systematic decision-making, banks establish comprehensive credit and lending policies. A formalized policy aligns divergent perspectives, guides decision-making, and ensures compliance with regulatory standards and institutional objectives [9], [10], [11]. These policies serve as operational guidelines for banking personnel, harmonizing credit practices with supervisory requirements while reinforcing institutional stability. Consequently, a well-defined lending policy directly shapes a bank's strategic priorities and risk management framework [12].

2. Credit of Banking

Dealing with banking credit has become a common practice in advanced societies, especially in capitalist ones, among individuals, financial and banking institutions, and governments, as well as between different countries [13]. The features of the credit system have begun to be defined according to a set of credit relationships and the credit methods followed, including banking lending.

3. Types of Bank Credit:

A. Cash Credit:

B. Pledge Credit:

C. Modern Credit Models

Cash Credit can be divided into:

Loans & Advances:

Loans are considered one of the most important items on a bank's balance sheet due to their significant role in ensuring the bank's continuity, expansion, and achievement of its strategies and goals. The primary function of commercial banks is to grant loans to borrowers and provide facilities to customers [14], [15]. A loan is defined as "a sum of money provided by the bank to the customer against personal and collateral guarantees after agreeing on the loan amount, the resulting interest, and the repayment date". Runlet defines a loan as "acquiring financial purchasing power from banks in exchange for selling future purchasing power plus the interest rate, which is often high due to high inflation rates and rising prices." As for advances, the bank allows the customer to withdraw within the authorized amount [16].

B. Pledge Credit

It is a term commonly used in the banking system to denote openings of credit and the issuance of letters of guarantee, and from its designation, this type of credit can be seen as a payment undertaking and does not represent an actual payment as in cash credit.

C. Modern Credit Models

With the development of credit and the multiplicity of its types, other types of credit have emerged, and the most important of these can be presented:

Lease Purchase: It is considered one of the types of installment sales where the value of the goods is paid in installments over the period according to special arrangements.

Financial Leasing: It is also referred to as capital leasing or a full-pay-out lease. This type represents a source of financial funding for the lessee enterprise, compensating it for borrowing to own the asset.

4. Concept of Bank Lending, Its Objectives, Components, and Influencing Factors

A. Concept of Lending and Its Objectives

Concepts of Lending Policy

Lending Policy Concept: It means the general framework that includes a set of factors, principles, and guiding directions adopted by the banking administration in general and the lending management in particular [17], [18], [19], [20].

Objectives of the Lending Policy:

The primary objective of establishing a lending policy for a commercial bank is to create a general framework and specific factors that credit officers can refer to when making decisions about granting or not granting banking facilities. Therefore, the objectives of establishing a lending policy for the bank are numerous, and the most important of these objectives can be outlined as follows :

Preventing conflicts in decision-making within the bank and creating a degree of unified thinking, coordination, and mutual understanding between the bank and its clients [21].

Creating a rationale for the bank's credit along with lending decisions by defining what may and cannot be invested in, preserving loans that are approved and ensuring sure that money deposited by consumers is used effectively [22].

Ensuring an adequate return for the bank by reducing losses and increasing profits.

Aligning with the general direction of national economic policy, creating harmony between the bank and the state by adopting the priorities set by the state in economic development plans and allocating a portion of its resources accordingly [23].

General alignment with environmental protection considerations to prevent pollution and safeguard society from moral deviations by not lending to projects that threaten society in this regard.

2. Theoretical framework for economic growth

Concept of Economic Growth

There are numerous definitions of economic growth. It has been defined as:

"An increase in real gross output or real GDP between two periods." Or it is: "An increase in the per capita real national income divided by the population of the country." It is noteworthy that some countries have achieved high rates of economic growth, but the significant increase in their population has led to a decline in per capita income rates, such as China [22], [23], [24]. "The first concept measures the growth rate of the economy over time, while the second refers to the rate or average real growth of per capita income in a society". The first concept thus expresses the use of productive expansion, while the second expresses the development of the material standard of living for individuals in a particular country compared to living standards in other countries, Paul and William defined growth as the increase in the expected real GDP under full employment of available resources, or the national output of a country. Dominick Salvatore and Eugene Diulio defined it as "an increase in the economy's production capacity measured by the absolute or relative increase in GDP or per capita income over time.", Economic growth reflects quantitative changes in productive capacity and the extent of its utilization. Growth rates in GDP increase as the utilization rate of available productive capacity rises across all economic sectors, and vice versa. It is not possible to maintain the rate of increase in GDP once full utilization of its capacity is reached [25], [26], [27]. In many cases, GDP

increases in a country, but the population grows at a higher rate, which prevents this increase from appearing in the average per capita income. Therefore, countries with high population growth rates compared to their GDP suffer from underdevelopment, most of which are developing countries, especially those in extreme poverty. This does not happen in advanced industrial countries. It has been observed that the highest population growth rate is in Sub-Saharan African countries, reaching 3%, while the lowest rate prevails in advanced countries, with the rate in European countries and the former Soviet Union countries being 0.04%. Delving deeper into this concept, it is important to emphasize the following: Achieving an increase in GDP along with an increase in real per capita income (i.e., a real increase and not a nominal one) [28], [29], [30]. This means the growth rate must exceed the population growth rate. In other words, (Economic Growth Rate = National Income Growth Rate - Population Growth Rate), The increase in average per capita income must be sustainable in the long term, meaning it should not be a temporary increase that disappears once its causes are removed [31].

4. Discussion

2.1. Factors of Achieving Economic Growth:

A. Human Resources:

The human element is crucial to economic growth, as it serves as both a tool and an objective. Raising citizens' living standards is a key goal, and the rate of economic growth increases with an increase in real per capita income [32]. One of the primary issues impeding the process of economic progress in developing nations is population increase

$$\textbf{\textit{Real per capita income}} = \frac{Real\ Gross\ National\ Product\ (GNP)}{population}$$

We can see that the population indicator in the above equation is a strictly quantitative indicator, as it does not consider the qualitative aspect of this indicator. The quality of skilled and well-trained labor is of great importance; that is, the capabilities, skills, and good training of the workforce (the labor element) represent the most crucial element in the process of economic growth [33], [34], [35], [36]. The main goal of human development strategies is to create and expand productive employment. Here, governments must care for development, keep pace with it, and pay attention to education, health, skills, and worker training.

B. Natural Resources:

Minerals, water, and land are examples of natural resources that are essential for economic expansion. Rich natural resources have allowed nations like the United States, Canada, Norway, and Russia to prosper. Some economists counter that there is more than one way in which natural resources contribute to economic progress [37], [38]. Japan and Hong Kong are two examples of resource-constrained nations that require good planning, trained personnel, and money to expand. Poor human capabilities, poor capital, and a lack of technological understanding can all contribute to the inefficient use of natural resources [39], [40].

C. Accumulation of Physical Capital

Machinery, equipment, buildings, and inventory strongly impact human productivity. Both physical capital and human capital (knowledge and skills) are essential factors for increasing productive capacity. The term "capital accumulation" refers to the physical component resulting from the investment process, primarily evident in the additions to existing assets such as machinery, equipment, and buildings. Capital accumulation can introduce new resources, but its fundamental characteristic is the existence of a trade-off between current consumption and future consumption [41], [42], [43], [44]. Reducing current consumption, i.e., increasing savings and thus investment, leads to increased future consumption. Here, we distinguish between physical capital and human capital.

D. Technological Change and Innovations:

Technological advancement, technical development, and innovations are synonymous terms that refer to continuous and ongoing processes of renewal, development, and improvements, whether large or small. Technical development occurs through capital formation and investment in scientific research and development. This involves inventions and scientific discoveries that can be applied and commercially utilized [45].

Progress occurs through the application of one or both of the following methods.

The First Method: Developing the scientific workforce of the country by investing in research, development, innovations, and scientific experiments.

The Second Method: Importing modern technology through international trade or direct foreign investment.

Here, the importance of savings and capital investments becomes evident .

The path to achieving economic growth and prosperity, especially for developing countries, involves promoting values of motivation and innovation and attracting and encouraging investments within the country [46], [47], [48].

3. The Reality of Bank Loans in the Russian Economy for the Period (2012-2019)

Studying the statistical relationship between the non-stationary time series of macroeconomic and financial indicators that characterize the banking sector. The primary difficulty in this case is the possibility of spurious correlation associated with the presence of trends in the time series under consideration. This problem typical of non-stationary series is addressed by establishing the cointegration (long-term equilibrium relationship) of the time series under consideration based on econometric criteria (e.g., Engle-Granger or Johansen tests). Based on these methods, we developed an econometric analysis model that includes specific aspects of determining the mechanism by which bank lending influences economic growth. This analysis involves multivariate time series studies using econometric and statistical analysis methods for banking system indicators, which allows the examination of economic dynamics under conditions of both variable stationarity and non-stationarity. The existence of cointegration processes is verified using the Johansen test, which provides the capability to determine whether cointegration exists in a multivariate model. To avoid various issues associated with the cointegration of series, a Vector Error Correction Model (VECM) was proposed [49], [50], [51]. This model assists in identifying both short-term and long-term relationships in non-stationary time series data, enhancing the precision and reliability of findings related to the impact of banking credit on economic growth.

$$\Delta y_t = \beta_1 * \Delta x_t + \beta_2 * \Delta z_t + \beta_3(y_{t-1} - \lambda_1 * x_{t-1} - \lambda_2 * z_{t-1}) + \varepsilon_t$$

Where:

y_t : is the differencing coefficient of the stationary series;

β: is the parameter for finding the eigenvectors of the matrix;

$x_t$and z_t : are rows of integration;

λ : is the cointegration parameter;

ε_t: is a stationary series.

The Vector Error Correction Model (VECM) and Representation of Impulse Response Functions (IRFs) of Variable Shocks Confirm the Relationship Between Various Financial Indicators and the Volume of Bank Lending. The modern econometric software package (Gretl) was used to perform calculations and modeling. The econometric methodology included several steps: stability testing, identifying the degree of integration (I=1), cointegration tests (confirming the existence of a cointegration relationship), joint interaction analysis, causality testing, and shock response analysis using vector models. The Unit Root Hypothesis (HEK) test was conducted with the Augmented Dickey-Fuller test (ADF test) to identify unit roots. To determine the causality relationships, an econometric model of the impact mechanism of bank lending on long-term economic

growth rates was developed, focusing on the causal relationships between commercial bank lending and economic growth [52]. As part of this objective, the model was evaluated for different loan types (including loans for individuals, organizations, and credit institutions). The model considers the impact of interest rates, population income, and the overall economic stability situation. Economic crises, for instance, lead to a sharp decrease in the volume of lending, which is attributed not only to declining incomes but also to the deteriorating economic situation. To account for this fact, we used the capital outflow indicator (% of GDP) in the Russian economy. We used Sberbank's methodology to calculate the impact of lending volumes on economic growth rates. In general, the dynamic equation of lending volumes is as follows:

$$\frac{cred - cred(-1)}{cred\ (-1)} = f\langle \frac{y - y(-1)}{y(-1)} / \frac{cred(-1) - cred(-2)}{cred\ (-2)} \rangle \quad (1)$$

Where:

cred: Loans debt - the value of loans in real terms (adjusted for inflation).

r: The real interest rate (adjusted for inflation) on loans.

y: The real Gross Domestic Product (GDP)

ci: The dynamics of money supply (M2) as a percentage of (GDP).

All cost indicators are included in the analysis at constant base-period prices

The conversion from current prices to constant prices is based on the GDP deflator index.

The analysis of the banking sector's development and the comparison of time series for macroeconomic and individual financial indicators were conducted based on official statistics provided by the websites of the Federal State Statistics Service (FSGS) and the Central Bank of the Russian Federation. The initial data for the calculations are presented in Table 1. The tariff rate and GDP volume were used as indicators of credit cost and borrower burden. The growth rate of the money supply (M2) was used as an indicator of the stability of the financial situation, including the liquidity status in the banking sector. The total amount of debt across different loan types was employed as an explanatory variable. Real GDP and loan volume were both used in the model as annual growth rates. To construct the econometric model, we performed calculations using formula (1) and summarized all computations in Table 2 (The volume of credits, 2012-2018, Performance indicators of lending institutions, 2012-2-18). An increase in the volume of loans issued was observed with a lower real interest rate.

Table 1. **Initial data for the construction of an econometric model**

Indicators	2012	2013	2014	2015	2016	2017	2018	2019
GDP at current prices, billion RUB	68163,9	73133,9	79058,5	83094,3	86014,2	92101,3	102745,2	103875,8
Money supply (M2), as % of GDP	35,51	37,14	39,41	38,05	40,90	41,71	40,52	40,86
		Volume	of	issued	Loans,	RUB	billion	
The volume of loans issued, billion RUB, total	271206	328628,9	385878,6	409236,1	432938,5	472216,8	514463,7	528210,4
Individuals	74288,71	101412,9	124325,9	127162,3	125035,6	133157	149252,7	158108,2
organizations	179236,4	191504,8	233451,9	249650,3	260582,7	273314,8	299405,2	307686,1
to credit organizations	17680,31	20811,27	28100,8	32423,49	47320,28	65745,07	65805,8	62416,14
		Averag e	weighte d	interest	rates	on	loans	%
Individuals	19,7	17,3	17,37	17,45	15,48	12,92	12,4	12,5
organizations	11,1	10,6	12,31	9,15	13,37	11,61	9,11	9,14

to credit organizations	10	8,7	8,92	19,59	12,08	10,49	7,85	7,93

Table 2. **Calculation of the coefficients of the econometric model of the impact of the processes of loans issued on the growth of the Russian economy**

Indicators	2012	2013	2014	2015	2016	2017	2018	2019
GDP growth rates, %	0,1307	0,0729	0,0810	0,0510	0,0351	0,0708	0,1128	0,1278
The growth rate of the money supply, %	0,0697	0,0460	0,0610	-0,0345	0,0750	0,0199	-0,0203	-0,0205
The growth rate of the key % rate of the Central Bank of the Russian Federation	1,0313	2,0606	0,5588	1,0526	0,9750	0,8462	0,9144	0,9394
The growth rate of loans issued, %								
Individuals	0,4552	0,3651	0,2259	0,0228	-0,0167	0,0650	0,1742	0,1874
organizations	0,2464	0,0684	0,2190	0,0694	0,0438	0,0489	0,1179	0,1258
to credit organizations	0,1958	0,1771	0,3503	0,1538	0,4594	0,3894	-0,0503	-0,0506
Changes in interest rates on loans, %								
Individuals	2,6000	-2,4000	0,0700	0,0800	-1,9700	-2,5600	-0,4177	-0,4200
organizations	0,4000	-0,5000	1,7100	-3,1600	4,2200	-1,7600	-2,4400	-2,4700
to credit organizations	0,3000	-1,3000	0,2200	10,6700	-7,5100	-1,5900	-2,5100	-2,5600
The equation of the dynamics of lending volumes								
Individuals	0,0067	-0,0037	0,0001	0,0000	-0,0001	0,0001	0,0001	0,0001
organizations	0,0008	-0,0004	0,0006	0,0012	0,0008	-0,0001	0,0002	0,0003
to credit organizations	0,0009	-0,0009	0,0002	-0,0066	-0,0030	-0,0010	0,0024	0,0026

A rise in real GDP growth and a stable financial situation is accompanied by significant capital inflows (or reduced capital outflows). Table 3 presents the results of the estimated equations for three types of loans (The volume of credits, 2012-2018, Performance indicators of lending institutions,2012-2-18).

Table 3. **The results of the assessment of the impact of lending on economic growth**

Indicators	The growth rate of lending to individuals	The growth rate of lending to legal entities	The growth rate of lending to credit institutions
Lending growth rates	0,5550	-0,1020	0,8102
GDP growth rates	0,2463	-0,1179	0,2565
Change in the real interest rate	0,3573	0,2838	-0,3166
Money supply growth in % of GDP	0,8371	0,1194	-0,5399

3.1. The reality of bank loans to individuals and their role in the economic growth rate of Russia for the period 2012-2019.

The econometric model of the effect of loans issued to individuals on the long-term growth rates of the Russian economy is as follows:

f = 0,5550 cred; 0,2463y; 0,3573r; 0,8371 ci; -0,4567cb

With an increase in the real GDP growth rate of 0.2463 percentage points, the growth rate of total lending to individuals increases by 0.5550 percentage points. At the same time, the growth of the money supply increased by 0.8371 percentage points. The impact of GDP growth rates has a minimal effect on economic growth, and the most important factor is the increase in lending to the population. Lower Central Bank main rates generally benefit the population by promoting economic growth, increasing income, and reducing unemployment. However, during economic instability, high rates can reduce inflation and currency depreciation. It's crucial not to maintain high rates for extended periods.

3.2. The reality of bank loans to legal entities and their role in the economic growth rate of Russia for the period (2012-2019).

The econometric model of the impact of loans issued to legal entities on the long-term growth rates of the Russian economy is as follows:

f= -0,1020 cred; -0,1179y; 0,2838r; 0,1194 ci; -0,5240cb

Lending to legal entities does not provide a sufficiently strong impact on changes in the money supply. Furthermore, an increase in the real interest rate negatively affects the volume of loans issued. This is partly due to a shortage of medium- and long-term urgent resources as part of the credit resource base for organizations, which determines the short-term nature of the loan portfolio for loans issued to legal entities. The second issue is the gap between the profitability level of institutions and the interest rate on loans. In this regard, there is unsatisfactory demand for borrowed funds Raising interest rates negatively impacts the volume of loans issued to legal entities but increases the money supply (M2).

3.3. The reality of bank loans to credit institutions and their role in the economic growth rate of Russia for the period (2012-2019).

The econometric model of the impact of loans issued to credit institutions on long-term interest rates for Russian economic growth is as follows:

f= 0,8102 cred; 2565y; -0,3166r; -0,5399 ci; -0,0853cb

A decrease in interest rates has a positive impact on lending to banking and financial institutions, which, in turn, contributes to GDP growth. At the same time, increased lending has a negative effect on the growth of the money supply. An increase in loans by 0.8102 points reduces the money supply by 0.5399 points. Testing revealed a degree of integration of I=1. The Engle-Granger test demonstrated that all variables are integrated, indicating a long-term equilibrium relationship and the validity of the correlation. One cointegration ratio was obtained, corresponding to the cointegration rank of r=1. A positive relationship was found between economic growth levels and the volume of bank lending and investment, and a negative relationship with the unemployment rate.

5. Conclusion

This model demonstrates that, for the Russian economy during the specified period, the following statements hold: An increase in personal lending results in an increase in the money supply (M2). However, lending to legal entities does not exert a significant impact on changes in the money supply. In contrast, an increase in lending to the banking sector in the economy leads to a reduction in the money supply (M2). Analysis of indicator dynamics confirms that the impact of lending volumes on GDP growth and the money supply is more effective during periods of reduced funding for government programs than during periods of loose monetary policy and credit expansion. The development of financial markets serves as an indicator of a robust economy. If a substantial portion of borrowed funds is directed toward consumer loans for individuals, economic growth will increase. However, if only a small portion of generated funds is allocated to the real sector of the economy, economic growth will occur at a lower level due to resource shortages in the real sector. When accumulated savings within the economic structure are reinvested into the economy, primarily as investments, they make a significant contribution to

economic development. If most of these savings remain unused, economic growth will slow down. If the country's internal debt needs are met by banks, bank lending will decrease the overall money supply for the economy. This impact will reduce the rate of deposit-to-loan conversion, which is one of the indicators reflecting the level of development in the country.

Recommendations

In light of this, I advise keeping macroeconomic stability:

1. Preserve Higher Macroeconomic Stability: To promote an atmosphere that is favorable for economic growth, make sure that the macroeconomic circumstances to be stable.
2. Reduce Non-Performing Loans: Take action to lessen the high percentage of non-performing loans, since they may compromise the stability of the economy and the efficiency of financial institutions.
3. Direct Domestic Loans to the Real Economic Sector: Assist with investments and productive activities by directing domestic loans to the real sector of the economy.
4. Strengthen Corporate Governance in the Financial System: To increase accountability, transparency, and general financial health, strengthen corporate governance procedures within the financial system.
5. Strengthen Risk Management in the Financial System: To provide a more robust financial system, enhance risk management procedures to effectively detect, analyze, and mitigate financial risks.

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