BAYESIAN VAR EVIDENCE ON ROMANIA'S FINANCIAL MARKET MATURITY AND MACROECONOMIC DYNAMICS

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Abstract
This paper investigates the dynamic relationships between financial intermediation, monetary policy and Romania's macroeconomic performance in the context of convergence towards the standards of the Organisation for Economic Co-operation and Development. The study estimates a Bayesian Vector Autoregressive model on quarterly data covering the period 2007Q4–2025Q4, using real GDP growth, inflation, the monetary policy rate and the credit-to-GDP ratio as core macro-financial variables. The methodological contribution of the paper consists in applying a compact Bayesian dynamic framework to the Romanian case, combining stationarity testing, lag-structure diagnostics, recursive shock identification, impulse response functions, forecast error variance decomposition and robustness checks. The results indicate that monetary policy shocks generate a modest negative response of real GDP growth and a more visible negative response of inflation, although the credible intervals suggest that the magnitude of these effects should be interpreted cautiously. Credit-related shocks have a weak and short-lived effect on output growth, while forecast error variance decomposition shows that real GDP growth is explained predominantly by its own innovations. Robustness checks based on alternative lag structures and an alternative Cholesky ordering confirm that the main qualitative conclusions remain broadly unchanged. Overall, the findings suggest that Romania's macro-financial transmission mechanism is present but uneven, with the monetary policy channel appearing more identifiable than the credit-intermediation channel.

Keywords
Bayesian vector autoregression; financial intermediation; monetary policy transmission; impulse response functions; forecast error variance decomposition; emerging markets.

JEL Classification
C11, C32, E44, E52, O16

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Introduction

The relationship between financial development, financial intermediation and macroeconomic performance has remained one of the most debated issues in applied macroeconomics, particularly in the case of emerging European economies. Over the last two decades, Romania has experienced substantial structural change, marked by European integration, shifts in monetary policy regimes, inflationary episodes, financial adjustment, and evolving credit dynamics. These developments make Romania a relevant case for examining how monetary and financial conditions interact with real economic activity over time.

From a macroeconomic perspective, understanding these interactions is important for at least two reasons.

First, the effectiveness of monetary policy depends not only on the policy instrument itself, but also on the way financial conditions transmit policy signals to the broader economy. Second, the structure and depth of financial intermediation influence how shocks are absorbed, amplified, or redistributed across sectors, even though financial maturity remains a broader concept that also includes access, efficiency, market depth and stability. In this sense, macroeconomic performance cannot be fully understood by looking at output, inflation, or interest rates in isolation. A dynamic framework is required in order to capture the interdependence between real activity, price dynamics, monetary policy, and financial intermediation.

Romania provides an especially interesting empirical setting for such an analysis. As an emerging economy within the European Union, it combines characteristics of convergence and structural transformation with the presence of persistent domestic vulnerabilities. Its macroeconomic evolution has included periods of strong growth, severe contraction, disinflation, renewed inflationary pressures, monetary easing, and subsequent tightening. At the same time, the development of financial intermediation has not been linear, and the role of credit deepening in supporting macroeconomic adjustment remains an open empirical question. This is particularly relevant because credit-based indicators capture only one dimension of financial development and should therefore be interpreted as proxies for intermediation rather than as complete measures of financial market maturity. These features justify a country-specific dynamic analysis rather than a simple extrapolation from broader euro area or advanced-economy evidence.

The present article investigates the dynamic relationship between real Gross Domestic Product growth, inflation, the monetary policy rate and credit-intermediation conditions in Romania by using a Bayesian Vector Autoregressive framework estimated on quarterly data. The study does not aim to predict crises or to build a forecasting tool in a narrow sense. Instead, it focuses on identifying short- and medium-term transmission mechanisms among macroeconomic, monetary and financial-intermediation variables. More specifically, it seeks to answer the following research question: how do monetary policy and credit-intermediation shocks propagate through the Romanian economy, and to what extent do they influence output dynamics?

The contribution of the article is threefold. First, it provides an integrated Romania-specific analysis of macro-financial transmission using a compact multivariate

framework that jointly includes output growth, inflation, the monetary policy rate and a credit-to-Gross Domestic Product indicator interpreted as a proxy for financial intermediation and credit deepening. Second, it applies a Bayesian Vector Autoregressive model to a recent quarterly dataset extending to 2025, which is particularly suitable for a setting with persistent macroeconomic variables and a moderate sample size. Third, it goes beyond static relationships by interpreting the estimated dynamics through orthogonalized impulse response functions, forecast error variance decomposition and robustness checks based on alternative lag structures and an alternative recursive ordering of the monetary and credit variables. In this way, the paper contributes to the literature by offering a cautious, Romania-specific assessment of how monetary and credit-intermediation shocks are transmitted to output and inflation. The empirical strategy combines descriptive analysis, stationarity testing, lag-order selection, classical Vector Autoregressive diagnostics, Bayesian estimation and post-estimation analysis based on recursive shock identification. The final specification retains real Gross Domestic Product growth in levels and introduces inflation, the monetary policy rate and the credit-to-Gross Domestic Product ratio in first differences, following the results of the preliminary time-series tests. The estimated Bayesian Vector Autoregressive model is then used to evaluate the effects of monetary policy and credit-intermediation shocks over a twelve-quarter horizon, while the robustness of the main qualitative findings is assessed through alternative lag specifications and an alternative Cholesky ordering. The results indicate that the monetary policy channel is more clearly visible than the credit-intermediation channel within the estimated system, although the magnitude of the responses should be interpreted cautiously given the width of the Bayesian credible intervals. A positive monetary policy shock is associated with a modest negative response of output growth and a more visible negative response of inflation, while shocks to the dynamics of the credit-to-Gross Domestic Product ratio generate a weak and short-lived response in real economic activity. At the same time, forecast error variance decomposition suggests that Romanian output dynamics are explained predominantly by their own innovations, with monetary, inflationary and credit-related shocks playing a secondary role. These findings point to a macro-financial structure in which transmission mechanisms are present but uneven in strength and not fully captured by aggregate credit-based indicators alone.

The remainder of the article is organized as follows. Section 1 reviews the recent literature on financial development, monetary policy transmission, and Bayesian multivariate macro-financial modelling. Section 2 presents the data, variables, and methodological framework. Section 3 discusses the empirical results derived from the Bayesian Vector Autoregressive model. The final section concludes and outlines possible directions for future research.

1. Review of the scientific literature

The relationship between financial development and macroeconomic performance has remained a central topic in empirical economics, but recent research has moved away from the earlier assumption that financial expansion automatically generates stronger

economic growth. Instead, the contemporary literature shows that the macroeconomic role of finance is conditional on institutional quality, fiscal conditions, structural resilience, and the broader policy environment. In a study focused on European Union countries, Asteriou, Spanos, and Trachanas (2024) show that financial development continues to matter for economic performance, but its effects are shaped by fiscal conditions and become more sensitive during periods of stress. In a similar direction, Struthmann (2025) finds that financial development may reduce growth volatility, while also emphasizing that the relationship is not necessarily linear and may weaken when financial expansion becomes excessive.

This shift in the literature is highly relevant for emerging economies, where the financial sector often evolves unevenly and where credit deepening does not always translate into a strong and stable growth impulse. In such contexts, the key issue is not only whether finance matters, but how it interacts with inflation, monetary policy, and output over time. This perspective is particularly important for Romania, where macroeconomic adjustment has been shaped by both structural convergence and persistent domestic vulnerabilities.

A second important strand of recent literature focuses on the transmission of monetary policy. Here, the evidence increasingly suggests that monetary policy cannot be fully understood without taking financial conditions into account. Checo, Grigoli, and Sandri (2024) show that, once monetary policy shocks are identified more carefully in emerging markets, the transmission mechanism looks more similar to that found in advanced economies than earlier evidence had suggested: tighter monetary policy raises financing costs, weakens real activity, and lowers inflation with a lag. Likewise, Ha, Kim, Kose, and Prasad (2025) argue that some of the classic empirical anomalies in emerging-market monetary transmission can be substantially reduced when forward-looking information is incorporated into the econometric framework. These contributions are important because they reinforce the idea that dynamic macroeconomic adjustment must be studied through a system-wide perspective rather than through isolated correlations.

More recent studies also show that the effectiveness of monetary policy depends on the level and quality of financial development. Oyadeyi (2025) finds that financial development and financial inclusion strengthen the transmission of monetary policy in African economies, especially through the interest-rate and inflation-expectations channels. Although the regional focus differs from Romania, the conceptual implication is directly relevant for the present study: the policy rate does not operate in a vacuum, and its macroeconomic impact depends in part on the structure of domestic financial intermediation. In this sense, financial intermediation should be treated not merely as a background condition, but as an active component of macroeconomic transmission.

A third major development in the literature concerns the increasing use of Bayesian multivariate models in macro-financial analysis. Bayesian Vector Autoregressive approaches have become especially valuable in settings characterised by moderate sample sizes, persistent variables, and potentially unstable relationships. Velasco (2024) shows that Bayesian Quantile Factor Augmented Vector Autoregressive models are useful for identifying asymmetries in the transmission of monetary policy shocks over

the business cycle. In a related framework, Trabelsi (2025) uses a Bayesian time-varying coefficient Vector Autoregressive model to analyze macro-financial responses under uncertainty shocks, while Baškot (2025) applies Bayesian Vector Autoregressive tools in a macro-financial supervisory context. Together, these studies confirm that Bayesian dynamic systems are particularly well suited for studying macro-financial linkages when the researcher is interested in probabilistic interpretation and transmission mechanisms rather than in purely mechanical forecasting.

The recent literature has also become more attentive to regime dependence and changing macroeconomic environments. Gargiulo, Matthes, and Petrova (2025) show that the effects of monetary policy differ across inflation regimes, which implies that the same interest-rate shock may generate different outcomes depending on the prevailing macroeconomic environment. Similarly, Alex (2025) demonstrates that the transmission mechanism in India changes across different policy and institutional phases, while Beutel et al. (2025) emphasize that macro-financial interactions are closely related to downside risks and the global financial cycle. These results are useful for the Romanian case because they suggest that output, inflation, and credit dynamics should be interpreted within a broader context of structural and regime-specific adjustment, rather than as fixed relationships.

The regional and country-specific literature also provides important insights. Obradović and Grubišić (2025), in a multivariate study on Southeast European economies, confirm the relevance of dynamic interactions among output, inflation, and interest rates in the region. For Romania specifically, Pleșa (2026) shows that monetary policy effects are state-dependent and time-varying, which means that the domestic transmission mechanism cannot be assumed to be constant across time. This conclusion supports the methodological orientation of the present article, which also approaches Romanian macroeconomic adjustment as a dynamic and evolving process rather than as a static system.

A relevant Romanian contribution is also provided by Antohi, Ionescu, Dinca, Zlati, and Fortea (2023), who examine Romania's economic vulnerability through the dynamics of the Social Security Index under crisis conditions. Although their article does not employ a Bayesian Vector Autoregressive framework, it is useful for the present study because it treats Romania's macroeconomic fragility as a systemic phenomenon shaped by interconnected economic and financial risks. This broader systemic perspective is consistent with the underlying logic of the current article, which likewise views Romanian macroeconomic performance as the result of interacting real, monetary, and financial forces rather than isolated indicators.

Taken together, the recent literature supports three broad conclusions. First, financial development remains relevant for macroeconomic performance, but its effects are conditional, nonlinear, and institutionally mediated. Second, the transmission of monetary policy is closely linked to the quality and depth of financial intermediation. Third, Bayesian Vector Autoregressive approaches are increasingly valuable for the analysis of macro-financial dynamics because they provide a flexible and robust framework for studying persistent interdependencies under limited sample conditions.

However, despite the growing body of recent work, there is still limited evidence for Romania that jointly examines output growth, inflation, the monetary policy rate, and credit dynamics in a compact Bayesian Vector Autoregressive framework over a long quarterly horizon extending to 2025. The present article addresses this gap by estimating such a model for Romania and by interpreting the results through impulse response functions and forecast error variance decomposition.

2. Research methodology

This study investigates the dynamic interaction between macroeconomic performance, monetary policy, and financial intermediation in Romania by relying on quarterly data covering the period 2007Q1–2025Q4. The empirical database was constructed from official statistical sources and initially contained 76 quarterly observations. The imported dataset includes real Gross Domestic Product growth, quarterly Harmonised Index of Consumer Prices inflation, the monetary policy rate, domestic credit expressed in both thousand lei and million lei, nominal Gross Domestic Product in million lei, and two alternative versions of the credit-to-Gross Domestic Product ratio.

The initial conceptual framework of the article was based on four core dimensions: the real economy, inflation dynamics, monetary policy, and financial intermediation. In this regard, the empirical design includes real Gross Domestic Product growth, the inflation rate, the monetary policy rate, and a credit-to-Gross Domestic Product indicator used as a proxy for credit intermediation and credit deepening. This distinction is important because financial market maturity is a broader concept that includes not only the volume of credit, but also financial access, market depth, efficiency, stability and institutional quality. Therefore, the credit-to-Gross Domestic Product ratio is not interpreted in this article as a complete measure of financial market maturity, but as an aggregate indicator of the scale of credit intermediation relative to economic activity. The broader purpose was not to generate forecasts or crisis warnings, but to identify dynamic transmission mechanisms between the financial and real sectors of the Romanian economy.

The final empirical implementation retained the same conceptual structure but refined the operational definition of the financial variable. Real economic activity is captured through quarterly real Gross Domestic Product growth. Inflation is measured using quarterly averages of the Harmonised Index of Consumer Prices, while monetary policy conditions are represented by the quarterly average of the monetary policy rate. Financial intermediation is proxied by a credit-to-Gross Domestic Product ratio computed using the stock of domestic credit and the sum of nominal Gross Domestic Product over the previous four quarters. This construction is more appropriate than a direct contemporaneous stock-to-flow comparison because it places the credit stock in relation to a cumulative annualized measure of economic output. Nevertheless, the indicator remains an aggregate credit-based proxy. It captures the relative scale of credit intermediation, but it does not distinguish between household credit, corporate credit, credit quality, sectoral allocation or broader dimensions of financial market development. This limitation is explicitly considered when interpreting the empirical results.

The time-series structure of the dataset was verified by transforming the quarter identifier into a proper quarterly time variable and setting the dataset as a time-series database. The resulting series covers the interval from 2007Q1 to 2025Q4 with no temporal gaps. However, because the four-quarter Gross Domestic Product denominator cannot be computed immediately at the beginning of the sample, the credit-to-Gross Domestic Product ratio is unavailable for the first three observations. After restricting the sample to complete observations for the four main variables, the effective estimation sample covers 2007Q4–2025Q4 and contains 73 quarterly observations.

Table no. 1. Variables, definitions, transformations, and data sources

Variable	Definition	Transformation in the final model	Frequency	Source
gdp_growth	Quarterly real Gross Domestic Product growth	Level	Quarterly	European Central Bank / Eurostat
inflation	Quarterly average Harmonised Index of Consumer Prices inflation	First difference	Quarterly	European Central Bank
policy_rate	Quarterly average monetary policy rate	First difference	Quarterly	National Bank of Romania
credit_to_gdp	Domestic credit stock relative to the sum of nominal Gross Domestic Product over the previous four quarters	First difference	Quarterly	National Bank of Romania and Eurostat

Source: Author`s own research

2.1. Preliminary econometric procedures

Before estimating the main dynamic model, a series of preliminary econometric procedures was conducted. First, descriptive statistics were computed for the main variables, both for the broader database and for the final complete-case sample used in the model. These statistics allow a preliminary assessment of central tendency, volatility, asymmetry, and tail behaviour. The complete-case sample consists of 73 observations and is therefore fully consistent with the final multivariate analysis.

Second, pairwise correlations were examined to obtain a first descriptive view of the association structure among the variables. The results suggest that simple contemporaneous correlations are relatively weak between real Gross Domestic Product

growth and the other variables, whereas inflation and the policy rate are positively associated, and the policy rate is also positively associated with the credit-to-Gross Domestic Product ratio. These patterns indicate that inflation and monetary conditions move more closely together than output and credit in a simple static framework, which further justifies the use of a dynamic multivariate model.

Third, stationarity was assessed through the Augmented Dickey-Fuller and Phillips-Perron unit-root tests. The purpose of these procedures was to determine whether the variables could be safely used in level form or whether they required transformation before entering the multivariate system. The results showed that real Gross Domestic Product growth is stationary in levels, while inflation, the monetary policy rate, and the credit-to-Gross Domestic Product ratio display non-stationary behaviour in level form. After first differencing, inflation and the monetary policy rate became stationary according to both tests. For the credit-to-Gross Domestic Product ratio, the Augmented Dickey-Fuller result was sensitive to the number of lagged differences included, but the Phillips-Perron test strongly supported stationarity after first differencing. This led to the final variable treatment adopted in the model: gdp_growth was retained in levels, while inflation, the policy rate, and the credit ratio entered the system as first differences.

Table no. 2. Summary of stationarity test results and final variable treatment

Variable	ADF result	Phillips-Perron result	Final treatment
gdp_growth	Stationary in levels, p = 0.0004	Stationary in levels, p = 0.0000	Included in levels
inflation	Non-stationary in levels, p = 0.6364; stationary in first difference, p = 0.0024	Non-stationary in levels, p = 0.3159; stationary in first difference, p = 0.0000	First difference
policy_rate	Non-stationary in levels, p = 0.2040; stationary in first difference, p = 0.0164	Non-stationary in levels, p = 0.5791; stationary in first difference, p = 0.0009	First difference
credit_to_gdp	Non-stationary in levels, p = 0.4003; first-difference result sensitive to lag length	Non-stationary in levels, p = 0.5726; stationary in first difference, p = 0.0000	First difference

Source: Author`s own research

2.2. Lag selection and model specification

The initial research design envisaged a Bayesian Vector Autoregressive specification with one lag and a Minnesota-type prior. The argument behind this choice was parsimony: each variable would depend on its own previous value and on the lagged values of the other endogenous variables, while the model would remain stable and relatively easy to interpret. However, given the quarterly frequency of the data and the

possibility that monetary and financial effects unfold with a delay longer than one quarter, the lag structure was re-examined before estimating the final Bayesian model.

Lag-order selection produced mixed results. The more parsimonious information criteria, namely HQIC and SBIC, favoured a one-lag specification, while AIC, FPE and the likelihood-ratio statistic pointed toward a richer four-lag structure. The likelihood-ratio test also indicated that adding the second lag improved the model relative to a one-lag specification. For this reason, alternative lag structures were examined through classical Vector Autoregressive diagnostics before retaining the final Bayesian specification.

The one-lag Vector Autoregressive model satisfied the eigenvalue stability condition and did not show residual autocorrelation at conventional significance levels. However, it imposed a very restrictive quarterly dynamic structure. The four-lag specification was also stable, but the Lagrange-multiplier test indicated residual autocorrelation at the first lag, while the number of estimated parameters increased substantially relative to the available sample. The two-lag specification satisfied the stability condition, did not display residual autocorrelation, and allowed monetary and financial-intermediation effects to unfold beyond a single quarter. Consequently, the final empirical specification adopted in this study is a two-lag Bayesian Vector Autoregressive model, selected as a compromise between parsimony, diagnostic adequacy and macroeconomic interpretability.

The final model includes four endogenous variables: real Gross Domestic Product growth, the first difference of inflation, the first difference of the monetary policy rate, and the first difference of the credit-to-Gross Domestic Product ratio.

The choice of a Bayesian Vector Autoregressive approach is justified by both theoretical and empirical considerations. First, the objective of the article is to identify dynamic transmission mechanisms, not simply to estimate isolated static relationships. Second, the sample is moderate in size relative to the number of variables and lags. Under such circumstances, Bayesian estimation offers an advantage by shrinking excessive parameter variability and reducing the risk of over-parameterisation. Third, the Bayesian framework is particularly suitable when the focus lies on impulse response functions and variance decomposition, because it provides a coherent probabilistic characterisation of parameter uncertainty.

The empirical implementation was carried out in Stata using a Bayesian Vector Autoregressive specification with two lags. In substantive terms, the prior structure follows a Minnesota-type logic in the sense that each variable is assumed to be influenced primarily by its own lagged values, while the effects of the other variables are allowed but regularised. This shrinkage structure is appropriate in a macro-financial setting where the number of coefficients grows quickly relative to the number of observations.

Table no. 3. Lag selection criteria and final model specification

Criteria / diagnostic	Result	Interpretation
Information criteria	HQIC and SBIC favoured 1 lag; AIC, FPE and LR favoured 4 lags	Lag-order evidence is mixed
VAR(1) diagnostics	Stable; no residual autocorrelation at 5%	Parsimonious, but dynamically restrictive
VAR(2) diagnostics	Stable; no residual autocorrelation at 5%	Balanced specification
VAR(4) diagnostics	Stable, but residual autocorrelation at lag 1	Richer model, but weaker residual diagnostics
Final specification	Bayesian Vector Autoregressive, 2 lags	Adopted as a compromise between parsimony, diagnostic adequacy and macroeconomic interpretability

Source: Author`s own research

2.3. Diagnostic validation and post-estimation tools

The final Bayesian Vector Autoregressive model was validated through both classical and Bayesian diagnostics. At the classical level, the preliminary two-lag Vector Autoregressive specification satisfied the eigenvalue stability condition and did not show residual autocorrelation according to the Lagrange-multiplier test. At the Bayesian level, the stability analysis indicated that the posterior probability of all eigenvalues lying inside the unit circle is 0.9951, confirming that the estimated system is dynamically stable in probabilistic terms. This provides a strong basis for interpreting the subsequent impulse response functions and forecast error variance decomposition.

The interpretation of the final results relies on two post-estimation tools. The first is the orthogonalized impulse response function, which traces the response of one variable to a one-time structural shock in another variable over a twelve-quarter horizon. The second is the forecast error variance decomposition, which measures the relative contribution of each type of shock to the variability of the endogenous variables. Together, these tools provide a dynamic picture of how monetary and financial-intermediation disturbances propagate through the Romanian economy.

Because orthogonalized impulse response functions require a formal identification strategy, the baseline specification uses a recursive identification scheme based on the Cholesky decomposition of the innovation covariance matrix. The baseline ordering is: real Gross Domestic Product growth, the first difference of inflation, the first difference of the monetary policy rate, and the first difference of the credit-to-Gross Domestic Product ratio. This ordering assumes that real activity and inflation are relatively slow-moving within the quarter, while the monetary policy rate may react contemporaneously to macroeconomic conditions, and the credit-intermediation variable is ordered last in the baseline specification. Given that recursive identification may influence the interpretation of structural shocks, a robustness check was also conducted by reversing

the ordering of the monetary policy variable and the credit-to-Gross Domestic Product variable. The alternative ordering was real Gross Domestic Product growth, the first difference of inflation, the first difference of the credit-to-Gross Domestic Product ratio, and the first difference of the monetary policy rate. The alternative Bayesian Vector Autoregressive specification remained dynamically stable, with a posterior stability probability of 0.9954. The main qualitative conclusions remained broadly unchanged, although the exact magnitude of the responses should still be interpreted with caution because it depends on the identification scheme and on the width of the Bayesian credible intervals.

3. Results and discussion

3.1. Descriptive analysis

The descriptive statistics reveal substantial heterogeneity across the four core variables included in the final model. Real Gross Domestic Product growth has a mean of approximately 0.60 in the complete-case sample, but it is also characterized by marked volatility, with a minimum of -9.7 and a maximum of 5.5. This result reflects the presence of major macroeconomic shocks and adjustment episodes over the analyzed period. The distribution is also asymmetric and leptokurtic, indicating that extreme observations play a non-negligible role in the behavior of output growth.

Inflation has a mean of approximately 4.58, a standard deviation of 3.52, and ranges from around -2.03 to 14.07, revealing substantial variation in price dynamics across the sample. The monetary policy rate has a mean close to 4.65 and ranges from 1.25 to 10.25, confirming the existence of distinct monetary policy phases, from tight monetary conditions in the earlier years to a prolonged low-rate environment and, later, a renewed tightening cycle. The credit-to-Gross Domestic Product ratio displays a mean of approximately 39.79 and is less volatile than the other variables, which is expected for a stock-based indicator, but it still shows meaningful medium-term movement.

Table no. 4. Descriptive statistics of the main variables

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
gdp_growth	73	0.60	2.53	-9.70	5.50
inflation	73	4.58	3.52	-2.03	14.07
policy_rate	73	4.65	2.64	1.25	10.25
credit_to_gdp	73	39.79	8.26	29.90	54.18

Source: Author`s own research

The time-series graphs reinforce this descriptive picture. The monetary policy rate exhibits a clear long-term decline from high pre-crisis values toward a lower-interest-rate regime, followed by a pronounced increase in the more recent period. Inflation also

displays substantial swings, with episodes of elevated inflation, disinflation, and renewed price acceleration. These descriptive figures are useful not only for presentation purposes but also for contextualizing the later impulse response results.

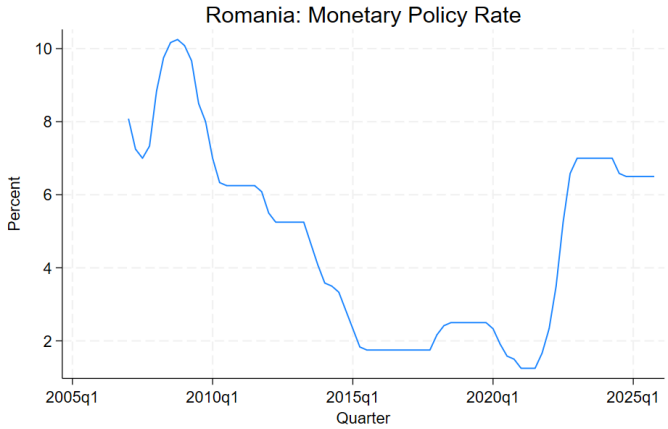

Figure no. 1. Romania: Monetary Policy Rate
Source: Author`s own research

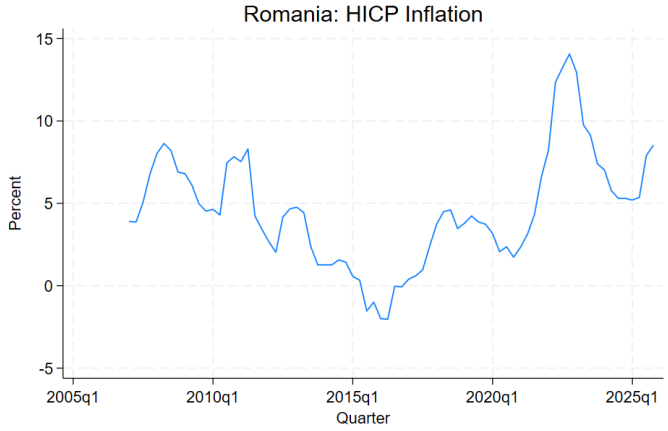

Figure no. 2. Romania: HICP Inflation
Source: Author`s own research

The correlation matrix suggests that the strongest contemporaneous association appears between inflation and the monetary policy rate, followed by the relationship between the monetary policy rate and the credit-to-Gross Domestic Product ratio. By contrast, the correlation of real Gross Domestic Product growth with the other variables is

relatively weak in static terms. This is an important descriptive result because it indicates that the main value added of the empirical framework lies not in simple contemporaneous correlations, but in uncovering dynamic propagation effects over time.

Table no. 5. Pairwise correlations among the main variables

Variable	gdp_growth	inflation	policy_rate	credit_to_gdp
gdp_growth	1.0000	-0.0521	-0.1388	-0.0508
inflation	-0.0521	1.0000	0.6205	0.0731
policy_rate	-0.1388	0.6205	1.0000	0.5969
credit_to_gdp	-0.0508	0.0731	0.5969	1.0000

Source: Author`s own research

3.2. Preliminary econometric results

The preliminary econometric testing confirmed that the variables could not all be treated in the same way. Real Gross Domestic Product growth was found to be stationary in levels, while inflation, the monetary policy rate, and the credit-to-Gross Domestic Product ratio required first differencing. This result is economically plausible, as output growth is typically closer to a stationary cyclical variable, whereas inflation, policy rates, and financial ratios tend to be more persistent. The lag-selection and diagnostic phase also proved important for refining the final specification. Although the original design was based on a one-lag specification, the information criteria did not provide a single unambiguous recommendation. HQIC and SBIC favoured a parsimonious one-lag model, while AIC, FPE and the likelihood-ratio statistic pointed toward a richer lag structure. For this reason, alternative lag lengths were examined through classical Vector Autoregressive diagnostics. The one-lag model was stable and did not show residual autocorrelation, but it imposed a restrictive quarterly dynamic structure. The four-lag model was also stable, but the LM test indicated residual autocorrelation at the first lag. The two-lag model satisfied the stability condition, did not display residual autocorrelation, and provided a balanced specification between parsimony, diagnostic adequacy and macroeconomic interpretability. These findings justify the final transition from the initial one-lag conceptual plan toward a two-lag Bayesian specification, not because the one-lag model was invalid, but because the two-lag model provides a more appropriate compromise between quarterly macroeconomic dynamics, residual diagnostics and sample-size constraints.

3.3. Bayesian Vector Autoregressive estimation

The final model was estimated as a two-lag Bayesian Vector Autoregressive system including real Gross Domestic Product growth in levels and the first differences of

inflation, the monetary policy rate, and the credit-to-Gross Domestic Product ratio. The model was estimated using 70 effective observations in the Bayesian estimation sample, after accounting for lag structure and transformations.

The Bayesian diagnostic results confirm that the estimated system is stable. In particular, the probability that all eigenvalues lie inside the unit circle is very high, indicating that the posterior dynamics are well-behaved. This provides a strong basis for interpreting the subsequent impulse response functions and forecast error variance decomposition.

More specifically, the posterior probability that the eigenvalues lie inside the unit circle is 0.9951, which indicates a high degree of dynamic stability. This result is important because impulse response functions and forecast error variance decomposition are meaningful only if the estimated system is dynamically well behaved.

Table no. 6. Bayesian Vector Autoregressive estimation and diagnostic summary

Diagnostic	Result
Model type	Bayesian Vector Autoregressive
Number of endogenous variables	4
Number of lags	2
Estimation sample	2008Q3–2025Q4
Number of observations	70
Burn-in	2,500
Markov Chain Monte Carlo sample size	10,000
Stability condition	Satisfied
Probability that eigenvalues lie inside the unit circle	0.9951

Source: Author`s own research

At the coefficient level, the posterior estimates suggest persistence in the system, especially in the equations for the monetary policy rate and the credit variable. Nevertheless, the article does not place primary emphasis on individual coefficients, as the core objective is to understand dynamic responses and the relative contribution of shocks rather than isolated lag effects. For this reason, the main interpretation focuses on the impulse response functions and on the variance decomposition results.

3.4. Impulse response analysis

The impulse response functions provide the most informative perspective on the transmission mechanisms embedded in the estimated system. The results are interpreted as orthogonalized impulse response functions obtained under the baseline recursive identification scheme. Therefore, the responses should be read as conditional on the Cholesky ordering adopted in the methodology section, rather than as identification-free

causal effects. The first key result concerns the response of real Gross Domestic Product growth to a positive shock in the first difference of the monetary policy rate. The posterior mean indicates a modest negative response of output growth over the first part of the horizon, after which the effect gradually fades toward zero. This pattern is economically plausible and is consistent with the standard transmission mechanism through which tighter monetary conditions may dampen short-run economic activity. However, the Bayesian credible intervals remain relatively wide, which means that the magnitude of the effect should be interpreted cautiously.

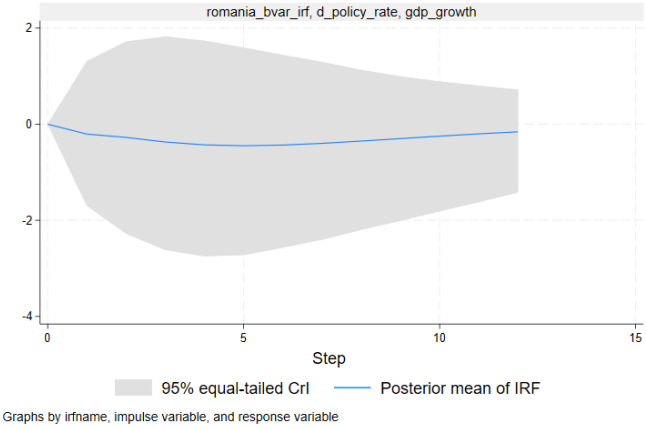

Figure no. 3. Impulse response of real Gross Domestic Product growth to a monetary policy shock
Source: Author`s own research

A second important result relates to the response of inflation to a monetary policy shock. The posterior mean shows that a positive shock to the first difference of the monetary policy rate is followed by a negative response of the first difference of inflation, especially over the first quarters of the response horizon. This result is theoretically coherent and suggests that monetary tightening is associated with a moderation of inflationary dynamics. Nevertheless, the credible intervals remain broad, so the result should be interpreted as indicative evidence of the monetary transmission mechanism rather than as a precisely estimated effect.

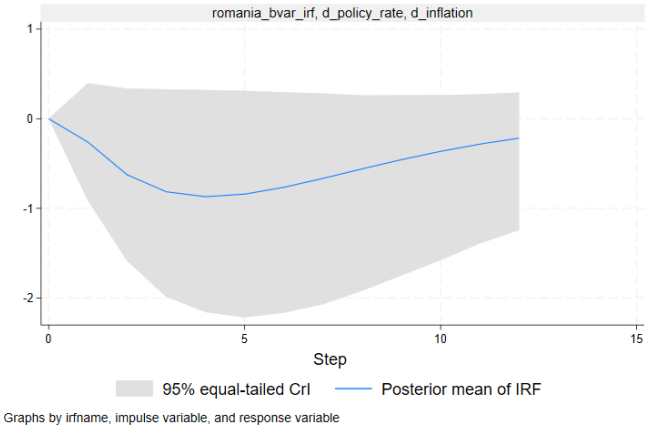

Figure no. 4. Impulse response of inflation to a monetary policy shock
Source: Author`s own research

The third impulse response of interest concerns the effect of a credit-intermediation shock on real Gross Domestic Product growth. In this case, the posterior mean indicates only a weak and short-lived response, remaining close to zero over most of the horizon. Compared with the monetary policy channel, the estimated credit-intermediation channel appears weaker in the short run. This does not imply that financial intermediation is irrelevant, but rather that the aggregate credit-to-Gross Domestic Product proxy does not generate a strong or sharply identified output response within the estimated Bayesian Vector Autoregressive framework.

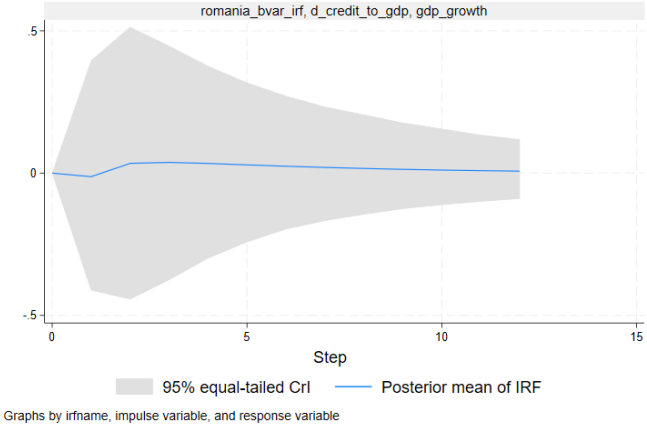

Figure no. 5. Impulse response of real Gross Domestic Product growth to a credit shock
Source: Author`s own research

Table no. 7. Summary of impulse response function results

Shock	Response variable	Direction of response	Persistence	Interpretation
d_policy_rate	gdp_growth	Modestly negative	Gradually fading	Monetary tightening is associated with weaker output growth, but the magnitude is uncertain
d_policy_rate	d_inflation	Negative	Visible over the first quarters	Monetary tightening is associated with lower inflation dynamics
d_credit_to_gdp	gdp_growth	Weak / close to zero	Short-lived	The aggregate credit-intermediation channel appears limited in the short run

Source: Author`s own research

Overall, the impulse response evidence suggests that the monetary policy channel is more visible than the aggregate credit-intermediation channel in the Romanian case. However, given the width of the credible intervals and the recursive nature of the identification scheme, these results should be interpreted cautiously and as conditional on the adopted model specification.

3.5. Forecast error variance decomposition

The forecast error variance decomposition confirms that real Gross Domestic Product growth is explained predominantly by its own innovations. This means that the largest share of uncertainty surrounding future output dynamics originates from shocks internal to output itself rather than from monetary, inflationary, or financial disturbances. The contribution of the other variables is present, but clearly secondary.

This result is important because it suggests that short-run Romanian output dynamics retain a substantial autonomous component, even in the presence of monetary and financial interactions. From the perspective of financial intermediation, the finding implies that credit-related shocks do not play a dominant role in explaining output variation over the forecast horizon considered here.

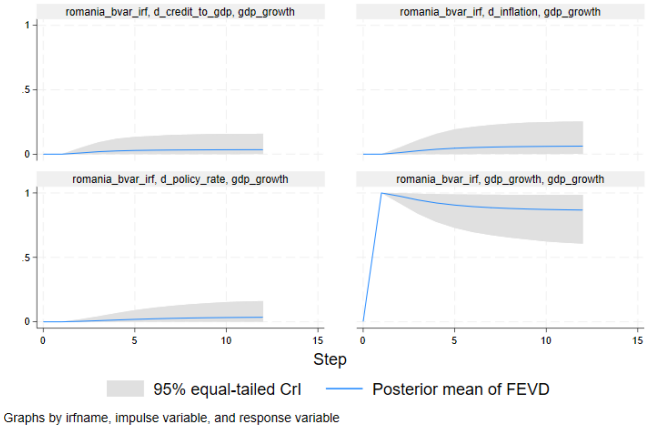

Figure no. 6. Forecast error variance decomposition for real Gross Domestic Product growth

Table no. 8. Forecast error variance decomposition of real Gross Domestic Product growth: interpretative summary

Component	Relative contribution
Own shocks to gdp_growth	Dominant
Inflation shocks	Secondary
Monetary policy shocks	Secondary
Credit shocks	Secondary and comparatively limited

Source: Author`s own research.

The decomposition results complement the impulse responses in a coherent way. While monetary shocks are associated with changes in output growth and inflation, and while credit-intermediation shocks are not entirely irrelevant, neither of these channels dominates the explanation of short-run output variance. This suggests that the Romanian economy remains strongly influenced by its own output-specific disturbances and that the macro-financial transmission mechanism is present but not overwhelming in the short run.

3.6. Discussion of findings

Taken together, the results outline a consistent but nuanced picture of Romania's macro-financial dynamics. The monetary policy channel appears more visible than the aggregate credit-intermediation channel. A tightening shock to the policy rate is associated with a modest decline in output growth and a negative response of inflation dynamics, which is compatible with standard macroeconomic theory. However, the magnitude of these responses is surrounded by non-negligible uncertainty, as reflected in the Bayesian credible intervals. For this reason, the results should be interpreted as evidence of directional macro-financial transmission rather than as precise estimates of

the size of monetary policy effects. By contrast, the relatively weak role of credit-intermediation shocks in driving output growth suggests that the short-run macroeconomic role of aggregate credit dynamics may be more limited than initially expected. This may reflect several factors: the use of an aggregate proxy for credit, the structure of Romanian financial intermediation, the dominance of other macroeconomic shocks, or the fact that financial deepening does not automatically translate into a strong short-run growth impulse.

The forecast error variance decomposition further supports this interpretation by showing that most of the variation in real Gross Domestic Product growth is explained by own shocks. Thus, while monetary and financial variables are clearly relevant for understanding the direction of adjustment, they do not fully dominate the short-run dynamics of the Romanian economy. This finding is important for the broader interpretation of financial intermediation: it suggests that Romanian macroeconomic dynamics are influenced by monetary and financial mechanisms, but that these mechanisms operate within a structure still strongly shaped by internal output-specific disturbances.

The robustness checks support this interpretation. Alternative lag specifications were examined before retaining the two-lag Bayesian Vector Autoregressive model. The one-lag specification was stable and parsimonious, while the four-lag specification, although suggested by some information criteria, displayed residual autocorrelation at the first lag. The two-lag model therefore provided the most balanced specification from the perspective of diagnostic adequacy and macroeconomic interpretability. In addition, the recursive ordering of the monetary policy variable and the credit-to-Gross Domestic Product variable was reversed as a robustness check. The alternative Bayesian specification remained dynamically stable, with a posterior stability probability of 0.9954, and the main qualitative conclusions were preserved. This indicates that the results are not driven exclusively by the baseline Cholesky ordering, although the exact magnitude of the responses remains conditional on the identification scheme.

Conclusions

This study examined the dynamic interaction between real economic activity, inflation, monetary policy and credit intermediation in Romania by using a Bayesian Vector Autoregressive framework estimated on quarterly data. The analysis was based on an initial dataset covering 2007Q1–2025Q4, while the effective complete-case sample used for the main variables covered 2007Q4–2025Q4. After accounting for first differencing and the two-lag structure of the final model, the Bayesian estimation sample covered 2008Q3–2025Q4 and included 70 effective observations. The final specification retained real Gross Domestic Product growth in levels and included inflation, the monetary policy rate and the credit-to-Gross Domestic Product ratio in first differences.

The contribution of the study lies in offering a recent and Romania-specific Bayesian assessment of macro-financial transmission by jointly examining output growth, inflation, the monetary policy rate and a credit-intermediation proxy over a quarterly horizon extending to 2025. Unlike purely descriptive approaches, the article combines

stationarity analysis, lag-structure diagnostics, Bayesian estimation, recursive shock identification, impulse response functions, forecast error variance decomposition and robustness checks. In this way, the paper contributes to the literature by showing not only whether monetary and credit-related variables are associated with macroeconomic performance, but also how shocks propagate dynamically through the Romanian economy. The contribution is also methodological, as the analysis explicitly acknowledges the limits of the credit-to-Gross Domestic Product ratio as a proxy for financial intermediation and tests the sensitivity of the main findings to alternative lag structures and an alternative Cholesky ordering.

The empirical results provide a nuanced picture of Romania's macro-financial transmission mechanism. The monetary policy channel appears more visible than the aggregate credit-intermediation channel. A positive shock to the monetary policy rate is associated with a modest negative response of real Gross Domestic Product growth and with a negative response of inflation dynamics. These results are consistent with the standard view that tighter monetary conditions may contribute to disinflation while also dampening short-run real activity. However, the Bayesian credible intervals remain relatively wide, which means that the estimated effects should be interpreted cautiously. The results support the presence of directional macroeconomic transmission rather than precise conclusions regarding the exact magnitude of monetary policy effects.

The role of credit-intermediation shocks appears more limited in the estimated system. Shocks to the credit-to-Gross Domestic Product ratio generate only a weak and short-lived response of output growth. This finding does not imply that financial intermediation is irrelevant for Romania's macroeconomic performance. Rather, it suggests that an aggregate credit-based proxy may not fully capture the channels through which the financial system influences real economic activity. Credit quality, the distinction between household and corporate credit, sectoral allocation, access to finance and the maturity of financial instruments may all matter for the transmission mechanism, but they are not directly captured by the aggregate credit-to-Gross Domestic Product ratio used in this article.

The forecast error variance decomposition reinforces this interpretation. Real Gross Domestic Product growth is explained predominantly by its own innovations over the forecast horizon, while monetary, inflationary and credit-related shocks play secondary roles. This result suggests that short- and medium-term output dynamics in Romania remain strongly influenced by output-specific disturbances and by broader macroeconomic conditions that are not fully captured by the four-variable system. In this sense, the findings point to a macro-financial structure in which transmission mechanisms exist, but their intensity is uneven and should not be overstated.

From a policy perspective, the results suggest that monetary policy remains relevant for macroeconomic stabilization, especially through its association with inflation dynamics. At the same time, the limited role of aggregate credit shocks indicates that strengthening financial intermediation cannot be reduced only to increasing the volume of credit relative to Gross Domestic Product. A more effective policy approach would require improvements in the quality, allocation and accessibility of credit, as well as stronger institutional and regulatory conditions supporting financial depth and resilience.

Therefore, the results should be interpreted as supporting cautious financial deepening rather than credit expansion as an objective in itself.

The study also has several important limitations. First, the credit-to-Gross Domestic Product ratio is used as a proxy for credit intermediation and credit deepening, not as a complete measure of financial market maturity. Financial market maturity is a broader concept that includes access, efficiency, depth, stability, institutional quality and the diversification of financial instruments. Second, the impulse response functions are based on a recursive identification strategy using Cholesky decomposition. Although an alternative ordering of the monetary policy and credit variables was tested and the main qualitative conclusions remained broadly unchanged, the exact magnitude of the responses remains conditional on the identification scheme. Third, the model does not explicitly include fiscal policy, exchange-rate dynamics, external demand, global financial shocks or other variables that may influence Romania's macroeconomic adjustment. Fourth, the period analyzed includes major structural episodes, including the global financial crisis, the COVID-19 pandemic and the post-pandemic inflationary episode. These events may have generated regime shifts that cannot be fully captured by a compact constant-parameter Bayesian Vector Autoregressive model.

Future research could extend the present analysis in several directions. One avenue would be to use more disaggregated financial variables, such as household credit, credit to non-financial corporations, non-performing loans, banking-sector indicators or broader composite measures of financial development. A second direction would be to estimate the model over subperiods in order to examine whether the transmission mechanism changed after the global financial crisis, during the low-interest-rate period, during the COVID-19 shock or in the post-pandemic inflationary environment. A third extension would be to compare Romania with other emerging European economies in order to determine whether the weaker short-run role of aggregate credit shocks is country-specific or regionally shared. Finally, future studies could complement the Bayesian Vector Autoregressive framework with alternative identification strategies, structural restrictions or time-varying parameter models.

Overall, the article shows that Romania's macro-financial transmission mechanism is present but uneven. Monetary policy shocks generate responses that are more visible and more consistent with theoretical expectations, while credit-intermediation shocks appear weaker in the short run. At the same time, output growth remains driven mainly by its own innovations, which suggests that domestic real-sector disturbances and broader macroeconomic factors continue to play a central role. These findings contribute to a more cautious and empirically grounded understanding of the relationship between monetary policy, credit intermediation and macroeconomic performance in Romania.

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