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Monetary Policy Transmission Mechanism in Romania - a Bayesian VAR Approach

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Abstract. The transmission of monetary policy to the economy is a subject of major importance for central banks and without a good knowledge of it, central banks cannot achieve the goal of high and sustainable economic growth in the long run. For this reason, an analysis of the monetary policy transmission mechanism in Romania is undergone, by using Bayesian VAR approach with multiple types of priors, over the period 1998Q1-2012Q3. Based on the priors used, both analytical and Gibbs sampler results are obtained. The shape of the impulse responses functions vary depending on the type of prior being used and even though the response to shocks is not high, they do not exhibit puzzles and reflect the high volatility given by the current economic crisis.

Key words: Bayesian VAR approach, Gibbs Sampler, monetary policy, Monte Carlo integration, Romania
JEL classification*:* E52, C11, C82

1 Introduction

The purpose of this research is to analyze the importance of the credit channel for the monetary policy transmission mechanism in Romania. Results are aimed to show the impact that a shock in monetary policy and interbank rates have on the evolution of loan and deposit interest rates. Also a distinction is made between the evolution of households and corporate loans and deposits.

For this analysis a Bayesian Vector Autoregressive model is used with three types of priors: diffuse prior, normal-wishart prior and independent normal-wishart prior. The purpose of using different priors is to observe whether different shapes of the impulse-response functions are plotted. It can be seen though, that results are not sensitive to the type of prior that is being used.

The section *Literature review* offers some insight on several studies that cover the monetary policy transmission mechanism from the interest rate pass-through point of view. The next section *Characteristics of the banking system* offers general information about the banking system in Romania which are relevant considering the transmission of interest rates. Details about data transformation, information regarding Bayesian Vector Autoregressive models, types of priors and impulse-response results are described in *Empirical evidence* section. Conclusions and ideas for further research are presented in the final section of the paper.

2 Literature review

The analysis of the transmission mechanism of the interbank interest rates towards the interest rates that are used by banks for their clients has been conducted in a large number of studies. Alexander Tieman (2004) investigates the interest rate pass-through from policy interest rates to market rates and inflation starting with the hypothesis that it plays a lesser role in Romania than in other Central European transition economies. The conclusion of the paper is that the pass-through in Romania is in line with that in comparable emerging countries included in the study: the Czech Republic,

Hungary, Poland, the Slovak Republic and Slovenia.

Razvan Radu (2010) analyzes the transmission of the interbank interest rates towards households and companies loans and deposits interest rates and concludes that the transmission is slow and is lagging behind due to the characteristics of loans and deposit contracts too. One explanation for this evolution is the utilization of fixed rates and also indexing interest rates according to an internal benchmark.

Matteo Ciccarelli, Angela Maddaloni and José-Luis Peydró (2010) are using the answers from two confidential surveys: Euro Area Bank Lending Survey and United States Senior Loan Officer Survey in order to distinguish between loan supply and demand and between bank lending channel and balance-sheet channel and conclude that the transmission of monetary policy using credit channel is functional through balance sheet of both banks and non-financial borrowers. Also bank lending channel is stronger than balance sheet channel for firms and the situation is exactly opposite for households. Another conclusion of the study is that a shock on loan supply has a bigger impact on gross domestic product growth and a shock on loan demand affects more inflation.

De Bondt (2002) is presenting an error correction model of the interest rate pass-through and also impulse response functions from a vector autoregressive model. The pass-through of changes in market interest rates to bank deposit and lending rates on short term is smaller than on long term. Cointegration tests are ran between retail bank and comparable market interest rates and the results show that these series are cointegrated.

3 Characteristics of the banking system

There are theoretical aspects underpinning the slowness in interest rate pass-through, but it should be also mentioned that this evolution is largely dependent on the structural characteristics of the banking system that is analyzed.

1.1 Theoretical aspects

It has been proven empirically that interest rates are adjusting with lags. But there are also theoretical arguments for this slow transmission. One of these arguments would be the costs that banks have due to *information asymmetry*: when interest rates corresponding to loans increase, banks may attract borrowers with a higher risk profile; borrowers are also more likely to get involved in riskier projects. Therefore, if the probability of default of the borrowers increases, the expected revenues of the banks may decrease along with an increase of their financing costs. Due to this reason, banks may decide not to increase loan interest rates as much as the shock in monetary interest rate.

Another argument is clients *switching costs*. These costs appear when a client decides to switch the bank he is working with and have an important impact on markets where long term relations are dominant.

Banks have also *adjustments costs* when interest rates are changing. A bank will modify loan interest rate only if the costs of adjusting the rate are less than the cost of keeping the rate at the same level. The reason for this behavior is that the objective of the bank is maximizing the profit.

Another argument for the slow adjustments of interest rates is related to *risk sharing*. Borrowers may have a higher risk aversion than banks have and might prefer a lower volatility of the rates they are paying therefore banks may accept this lower volatility of loans rates with the cost of a risk premium.

The results of the empirical studies also prove the heterogeneity of the interest rate pass-through process. Several explanations for this heterogeneity are: the intensity of the competition, banking market concentration, the health of credit institutions, foreign equity participation and also monetary policy regime.

3.2 Banking system in Romania

The ability of the monetary policy to influence the decisions of the economic agents evolved over time: it increased between 2004 and 2009 -

considering the rapid growth of loan share in gross domestic product - and kept its level between 2009 and 2013 - when considering the evolution of the same indicator around a constant trend. Even under these circumstances, its level is slow compared to the average of this indicator in euro area or European Union.

The structure of loans by currency has a negative impact on financial intermediation in domestic currency and on the monetary policy transmission mechanism too. The percentage representing the share of national currency loans in total loans decreased between 2007 and mid 2012 with a slow increase afterwards.

Regarding the share of deposits in gross domestic product, it had a different evolution than the one described for loans. The level of this indicator increased over the period under investigation. The percentage representing the share of national currency deposits in total deposits decreased between 2007 and mid-2010, followed by an increase until mid-2012 and a decrease until mid-2013.

The elasticity of demand for loans and supply of deposits is directly influenced by the possibility to substitute these two products with other forms of financing or investments. Capital markets play a small role in providing resources for financing, corporate bond market being underdeveloped. On the other hand, the degree of substitutability for bank deposits is also reduced.

All aspects described so far led to a decrease in the elasticity of demand for loans and supply of deposits and, in the end, to a slower or incomplete transmission of the changes in interbank interest rates.

4 Empirical evidence

For a better understanding of the impact that monetary policy interest rate has on interbank and loans/deposits rate, a Bayesian Vector Autoregressive model is estimated. Three types of priors are used: diffuse, normal-wishart and independent normal-wishart in order to check whether the results are robust to estimation methodology.

Four models are being estimated. *First model* includes the following variables in the analysis: monetary policy interest rate, interbank interest rate, interest rate for new corporate loans and the corresponding level of loans. *Second model* is using: monetary policy interest rate, interbank interest rate, interest rate for new loans to households and the corresponding level of loans. For the *third model,* the following time series are used: monetary policy interest rate, interbank interest rate, interest rate for new deposits made by firms and the corresponding level of deposits. And fourth model is using: monetary policy interest rate, interbank interest rate, interest rate for new deposits made by households and the corresponding level of deposits.

For each one of these models three impulse-response functions are computed, one function for each type of prior.

4.1 Bayesian VAR methodology

Many of the models used in modern empirical macroeconomics involve several variables. Therefore, they imply the usage of multivariate time series methods and Vector Autoregressive models have been among the most popular. The challenge facing macroeconomists is to build models that are flexible enough to be empirically relevant, but not too flexible as to be over-parameterized. Shrinkage can be of great benefit and can take the form of imposing restrictions on parameters or shrinking them towards zero by prior information.

The priors used in VARs differ from several viewpoints. First, they can lead to analytical results for the posterior and predictive densities or Markov Chain Monte Carlo methods could be required to carry out Bayesian inference. Second, they are used to shrink forecasts and prior information offers different ways of doing this shrinkage. Third, they differ in how easy they can handle departures from the unrestricted VAR, such as allowing for different equations to have different explanatory variables or allowing for VAR coefficients to change over time.

Natural conjugate priors are characterized by the fact that the prior, the likelihood and posteriors come from the same family of distributions. They do not allow extensions like different equations to have different explanatory variables or VAR coefficients to change over time, but they have the large advantage that analytical results are available for posterior inference and prediction.
Non-informative or diffuse priors are a particular case of natural conjugate priors. This setting leads to posterior results which are based on OLS quantities.
The independent normal-wishart priors can be used to calculate posterior properties of any function of the parameters, therefore they allow for the coefficients of the model to vary over time and for the possibility of a restricted VAR. They also require posterior simulation algorithms such as the Gibbs Sampler.

4.2 Data analysis

The Bayesian VAR is estimated using monthly data over the period 2007M1-2013M6. All series are considered to be endogenous variables and no exogenous variable is used. When estimating the impulse response functions, structural shocks are recursively identified, by using the standard *Choleski-decomposition*. These assumptions asses that shocks on interbank interest rate have a lagged impact on loan and deposit interest rates.
Several transformations were done: the level of corporate and households loans and deposits are used in logarithm. All series were seasonally adjusted, if needed and they were also verified for the existence of unit roots using Augmented Dickey Fuller (ADF) test and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test.
Seasonally adjustment of the series was done in Demetra+ by using TRAMO/SEATS method with RSA4 specification, which means that series are kept in level or in logarithm and the adjustment is done for working days, Easter and outliers by using an automatic model identification (Demetra+ automatically identifies and estimates the best Arima model).

Regarding ADF test, it assesses the null hypothesis of a *unit root* in univariate time series. Therefore, if the probability computed by the test is larger than the significance level of five percent, the null hypothesis is accepted, series are integrated and they need to be differentiated in order to become stationary. Same results are returned when using KPSS test. The difference is that KPSS test assesses the null hypothesis that a univariate time series is trend stationary against the alternative that it is a nonstationary unit-root process. Both tests are used in the analysis to ensure better evidence regarding the existence of unit roots.

4.3 Results of the empirical evidence

The response of the level of corporate loans, corporate loans interest rates and interbank interest rate to shocks in corporate loans interest rates, interbank interest rate and monetary policy interest rate, using diffuse prior is plotted in Figure 1.

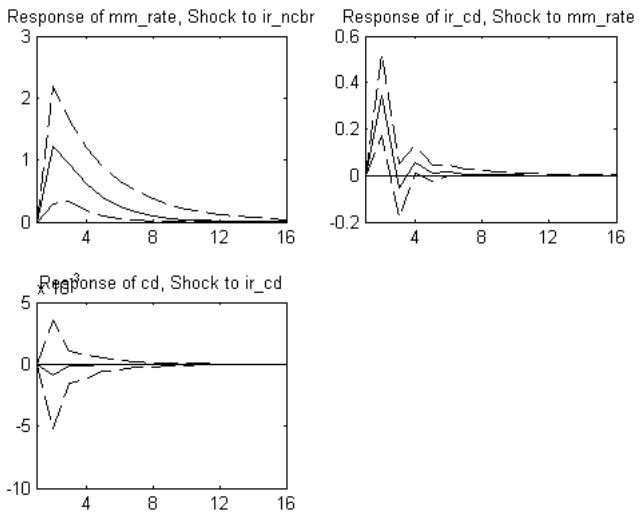

Figure 1. Impulse-response functions for VAR model with corporate loans and diffuse prior

It can be seen that an increase in monetary policy interest rate leads to an increase in the level of interbank interest rate, which is then followed by an increase in the level of interest rates on corporate loans. Also a shock in the last mentioned variable determines a decrease of the level of corporate loans, because loans become less attractive for clients due to increased costs.

Estimations of the same model is presented in Figure 2 and Figure 3. The difference is that two new types of priors are used for the estimation: normal-wishart and independent normal-wishart. It can be seen that the shape of the impulse-response functions is similar, with the small difference that these functions are having a smoother evolution for the last two priors. Therefore it can be concluded that results are not sensitive to the methodology used for estimation.

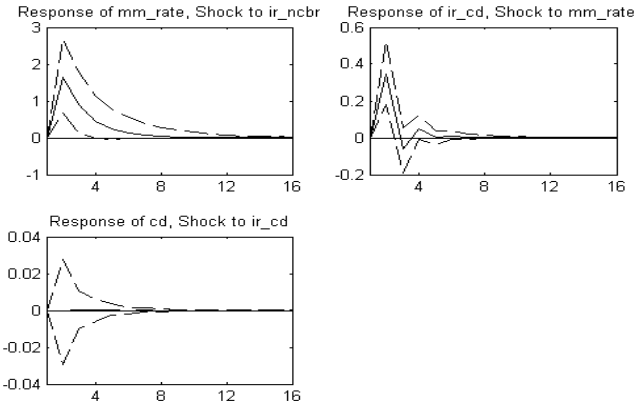

Figure 2: Impulse-response functions for VAR model with corporate loans and normal-wishart prior

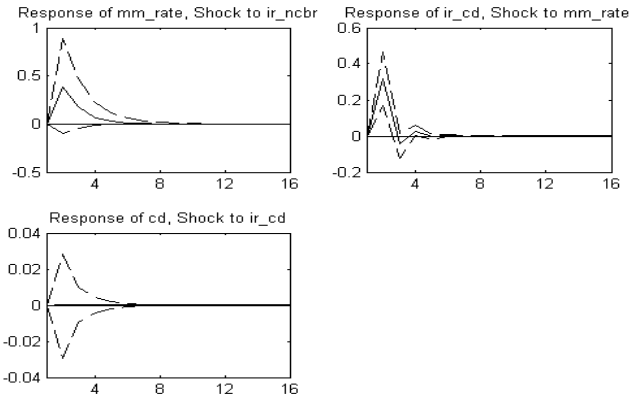

Figure 3: Impulse-response functions for VAR model with corporate loans and independent normal-wishart prior

All three models are estimated using Gibbs sampler methodology.

Same results were obtained for the other three models which consider household loans, corporate deposits and household deposits. The results for the second mentioned model, estimated with diffuse prior, is plotted in Figure 4.

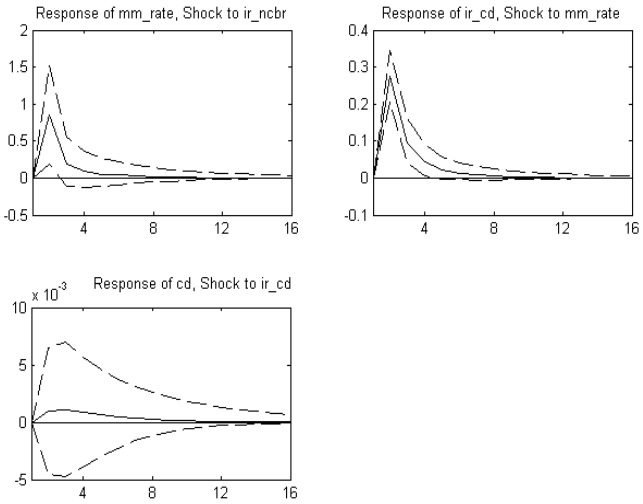

Figure 4: Impulse-response functions for VAR model with household loans and diffuse prior

Regarding short term transmission, a stronger reaction for interest rates on corporate loans than for households can be noticed. The reason for this behavior is represented by the different characteristics of loan agreements between the two sectors. Therefore, the interest rate for the majority of new loans offered to non-financial companies is variable or fixed for a period less than one year. Moreover, this practice of indexing an interest rate considering ROBOR benchmark indices is used more frequently in relation to non-financial companies. The difference regarding the speed of transmission is also explained by the level of competition which is more significant in the field of non-financial companies. This difference is due to the greater ability that companies have to negotiate the terms of contracts, considering the easier access that they have to other financing or investment products.

In the same time, the results of the estimations show that the speed of adjustment to the equilibrium level is higher for non-financial companies. The higher volatility of interbank interest rates is not transmitted so much to interest rates for household loans due to several reasons: grater share for fixed interest rate loans in this sector and also the lack of explicit indexation by money market interest rate for loans at floating interest rate. Another reason would be the more pronounced variation of risk premium in this segment as a result of a more

pronounced information asymmetry when comparing to corporate sector.
Same adjustment reaction that was observed when analyzing the evolution of corporate and household loans can be seen for corporate and household deposits from Figure 5 and Figure 6. Besides the reasons mentioned above for this evolution, the population preference for new deposits with fixed rate should be mentioned.

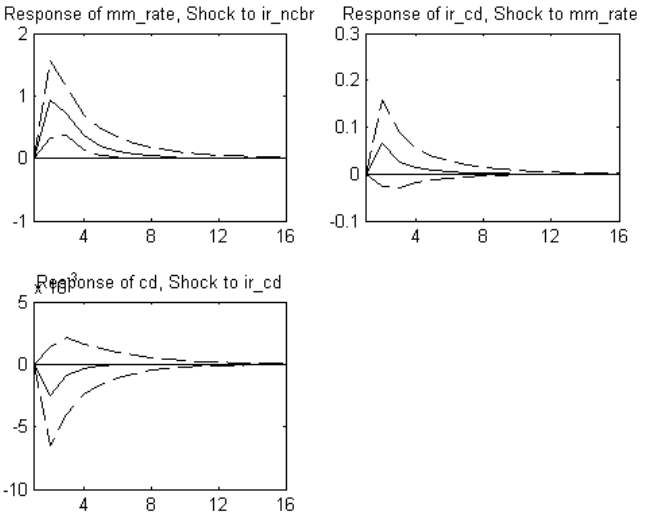

Figure 5: Impulse-response functions for VAR model with corporate deposits and diffuse prior

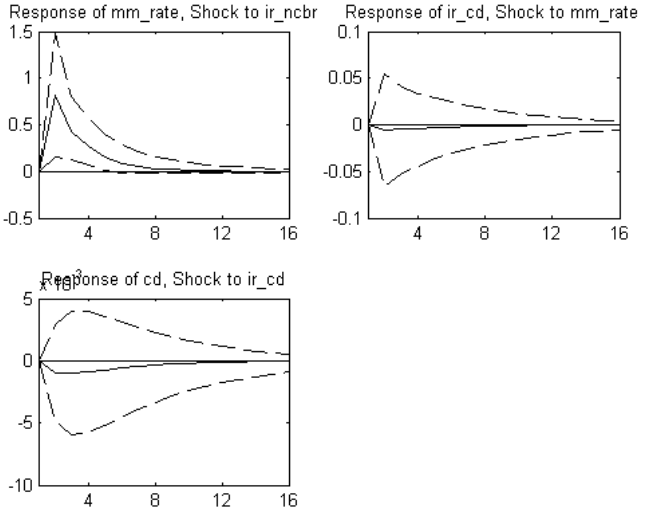

Figure 6: Impulse-response functions for VAR model with household deposits and diffuse prior

When comparing loans and deposits evolution, it can be noticed that the adjustment of loans rates is faster than the one for deposits. These results could show the concern of credit institutions for attracting and retaining financial resources, considering that, during most of the analyzed period, interbank interest rates were declining.

5 Conclusions

The analysis is confirming the fact that the adjustment process of loans and deposits interest rates is a slow one and this characteristic of the monetary policy transmission mechanism is in line with most of the results of the studies that were done for different economies. This behavior is also a consequence of the characteristics of loans and deposits contracts.
Also, it can be noticed that results are not sensitive to the methodology used for estimation. The shape of the impulse-response functions is similar, with the small difference that these functions are having a smoother evolution for normal-wishart and independent normal-wishart priors than for diffuse prior.
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In the same time, the results of the estimations show that the speed of adjustment to the equilibrium level is higher for non-financial companies. The higher volatility of interbank interest rates is not transmitted so much to interest rates for household loans.
Regarding the comparison between loans and deposits evolution, the adjustment of loans rates is faster than the one for deposits. The reason behind this evolution is the concern to attract liquidity.
Further research might include the analysis of the evolution of the monetary policy strategy. This would imply time-varying parameters VARs as a methodology for estimation. Different other channels could be investigated, such as expectations channel. Moreover, both monetary policy and fiscal policy could be considered as they both have an impact on grоass domestic product and inflation evolution.

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