5. THE IMPACT OF MONETARY POLICY ON THE ROMANIAN ECONOMY

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Abstract

Most of the research papers revealing the monetary policy transmission mechanism in Romania focused on VAR, Structural VAR or Dynamic Stochastic General Equilibrium (DSGE) models. Our paper brings new empirical evidence regarding the impact of NBR's monetary policy shocks on the real economy, as we use a factor-augmented vector autoregression (FAVAR). Previous research papers generally showed the impact of a monetary policy shock on the GDP, inflation, the money supply and the exchange rate. Our paper also indicates the effect of a monetary policy shock on other macroeconomic variables regarding different sectors of the economy, labor market and the foreign trade sector.

Keywords: monetary policy, Bayesian estimation, FAVAR.

JEL Classification: C11, C3, E50.

I. Introduction

The collapse of the Lehman Brothers investment bank generated a global liquidity crisis that has severely affected the emerging economies in Central and Eastern Europe (CEE) due to the increase in the foreign investors' risk aversion. The macroeconomic conditions in Romania deteriorated during the global crisis after a period of significant economic boom. The local currency depreciated significantly, output slumped, while the unemployment rate increased. In the last quarter of 2008, the National Bank of Romania (NBR) kept the monetary policy rate at 10.25% due to the heightened inflationary pressures that were generated by the depreciation of the leu, as well as the pro-cyclical fiscal policies. After February 2009, the NBR has gradually eased the monetary policy, as the inflationary pressures diminished due to the slump of domestic demand and stabilization of the exchange rate. The VAT

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increase operated in the second part of 2010, as well as the heightened risks due to the public debt crisis in the Euro Zone determined the NBR to adopt a prudent approach and to keep the monetary policy rate at 6.25%. In September 2011, the headline inflation dropped to a historical low of 3.45% from 4.25% in the previous month, due to the reduction in volatile food prices, the fading out of the effects of the VAT hike, as well as the weak domestic demand. At the beginning of November 2011, the NBR Board held its last monetary policy meeting for the mentioned year and decided to lower the monetary policy rate by 25 basis points at 6.0%, being the first time since May 2010 when the central bank changed its main interest rate.

In this paper, we determine the impact of the NBR's monetary policy decisions using a factor-augmented vector autoregression (FAVAR) estimated by a Bayesian technique. Our paper brings new empirical evidence, as the literature on the monetary policy transmission mechanism in Romania using FAVAR methodology is very poor. Although we are generally interested in revealing the impact of monetary policy measures on the economy after the collapse of the Lehman Brothers, the database also covers the pre-crisis period as a shorter timeframe faces the degrees of freedom problem.

II. The VAR Approach

VAR models were widely used in macroeconomic analysis in 1980s and 1990s due to their simplicity and reliable results. The main purpose of VAR analysis is to assess the effects of various shocks on the variables in the system. The use of VARs to estimate the impact of monetary policy measures on the economy was pioneered by Sims (1972, 1980). The development of the approach moved from bivariate (Sims, 1972) to trivariate (Sims, 1980) and to larger and larger systems (Walsh, 2003). Today, VAR models are still used to measure the effects of monetary policy shocks on the economy (Weber, Gerke and Worms, 2009). Despite their popularity, VARs often received many critics. VARs are a-theoretical models, because they use less prior information as the main task of the economist is to choose the appropriate variables, and then follow standard steps (Gujarati, 2004; Enders, 2004).

Walsh (2003) considers that VARs are not able to capture sufficient information about the economy because they use only a limited number of variables. VAR modeling often provides bizarre results, which are not compatible with the economic theory, the price puzzle being the most eloquent example. Price puzzle in VAR models shows that a contractionary policy shock generates a hike in inflation. Price puzzle is eliminated by introducing oil prices or commodities prices in the VAR model as commodities prices respond quicker to the monetary policy changes. Choosing the appropriate variables for the VARs is a very important task. Belviso and Milani (2005) notice that some variables like the output or output gap, the federal funds rate and a measure of inflation are often used in the VAR models. Rudebush (1996) criticizes VAR users as they only use certain types of variables and not a wider variety of variables. VAR is an overparameterized model that could be estimated using the Choleski decomposition that is not always compatible with the economic theory (Enders, 2004).

VAR models have also been used successfully to study the monetary policy transmission mechanism in the emerging markets. Oros and Romocea-Turcu (2009) implemented Structural VAR models in order to study the monetary policy transmission channels in Hungary, Poland, the Czech Republic, Romania, Slovakia and Slovenia. The interest rate channel is the most important monetary policy transmission channel in the Czech Republic, Slovakia, Slovenia and Romania, while in Hungary and Poland the exchange rate channel has the highest influence on the real economy, according to their calculations. Popescu (2012) implemented a VAR model for the Romanian economy in order to quantitfy the effects of a monetary policy shock on the GDP, the extended monetary policy aggregate (M3), the nominal exchange rate and prices. According to Popescu (2012), tightening the NBR's monetary policy determines a reduction in GDP, M3 and the nominal exchange rate, while the effect on prices is negative. Birman (2012) provided empirical evidence using the VAR methodology in order to reveal that the adoption of inflation targeting (IT) in Romania improved significantly the monetary policy transmission mechanism. Pelinescu (2012) used the Structural VAR methodology in order to study the correlation between the interest rate channel and demand, as well as the complex role of the exchange rate channel in Romania. Spulbăr and Nițoi (2013) implemented a Bayesian VAR (BVAR) model to study the interest rate channel in Romania. Their results are in line with the economic theory.

III. The Dynamic Factor Model Approach

VAR limits determined economists to develop complex models that better quantify monetary policy effects on the modern economies. Dynamic Factor Models (DFMs) represent an important discovery in econometrics, as they can quantify the influence of dozens of macroeconomic variables using only several factors. Breitung and Eickmeier (2005) consider that DFMs resolve the degrees of freedom problem, eliminate idiosyncratic movements, which possibly include measurement errors and local shocks and do not rely on tight assumptions regarding the economy. DFMs are very useful where the number of variables used exceeds the number of observations (Stock and Watson, 2010). This could be an important advantage when studying emerging economies like Romania, where the time series used are very short.

Bernanke, Boivin and Eliasz (2005) use an econometric model derived from a DFM to trace out the effects of Fed's monetary policy measures on the U.S. economy. They called this new model a factor-augmented vector autoregressive (FAVAR). Bernanke, Boivin and Eliasz (BBE) obtain the impulse response functions (IRFs) using two different approaches. The first method is the principal components approach, used by Stock and Watson (2002) for forecasting. The second method is a Bayesian approach. The two methods provided similar results according to BBE.

The main advantage of FAVAR is the use of a huge number of macroeconomic variables in the analysis, making it compatible with the "looking at everything approach" adopted by central banks (Bernanke and Boivin, 2003). Bernanke, Boivin and Eliasz (2005) notice that their FAVAR eliminates the price puzzle often found in VARs, as their model takes into consideration the changes of many asset prices as compared to the simple VAR. Ahmadi and Ritschl (2009) use a FAVAR model to study the role of the monetary policy during the Great Depression. Banerjee and Marcelino (2008) propose a factor-augmented error correction model (FECM), which represents a combination between a FAVAR and a VEC model. Belviso and Milani (2005) criticize FAVAR invoking that the factors have no economic interpretation. Belviso and Milani (2005) suggest that a structural FAVAR (SFAVAR) provides better results in measuring the effects of monetary policy. Belviso and Milani (2005) introduced a real activity factor, an inflation factor, a long-term interest rate factor, a financial market factor and credit factor in their analysis. Dave, Dressler and Zhang (2009) use the FAVAR proposed by BBE to study the credit channel in the U.S. Blaes (2009) studies the impact of the ECB's policy on the monetary aggregates. The important benefits presented by FAVAR transformed it into a widely used model today.

The implementation of the FAVAR methodology for emerging markets could be more complicated as compared to applying the model to the developed economies. We consider that the difficulty is given by the database, as the FAVAR methodology requires the introduction of dozens of macroeconomic variables. The authorities in certain emerging markets do not publish statistics regarding the evolution of a large number of variables over an adequate timeframe that could allow the use of a complex econometric model like FAVAR. The second problem would be the higher frequency of structural breaks in the emerging economies as compared to the developed countries. Structural breaks determine significant changes in the database on the short term, which could affect the results provided by the econometric models. The difficulties in applying the FAVAR methodology to the Romanian economy determined researchers to focus more on using VAR, Structural VAR or Dynamic Stochastic General Equilibrium Models (DSGE) in order to study the impact of the NBR's monetary policy on the economy. Therefore, our paper brings new empirical evidence as the literature studying this issue applied for Romania is very poor. We consider that the implementation of a FAVAR model for studying the NBR's monetary policy impact was possible only recently, after the National Institute of Statistics (NIS) as well as the Eurostat published indicators for longer periods, allowing for the implementation of the multivariate model.

IV. The model

A FAVAR model can be written in a standard form as follows:

$$\begin{pmatrix} F_t \\ Y_t \end{pmatrix} = \Phi(L) \begin{pmatrix} F_{t-1} \\ Y_{t-1} \end{pmatrix} + v_t \tag{1}$$

where: Y_t is a $M \times 1$ vector of important macroeconomic variables, F_t is a $K \times 1$ vector of unobserved factors, $\Phi(L)$ is a lag polynomial of finite order d while v_t is the vector of residuals with mean zero and covariance matrix Q. K is very small.

We consider X_t a $N \times 1$ vector of dozens of macroeconomic variables.

$$N > M + K$$

We can write the correlation between X_t, F_t and Y_t as follows:

$$X_t' = \Lambda^f F_t' + \Lambda^y Y_t' + e_t' \tag{2}$$

Λ^f - $N \times K$ matrix of factor loadings

Λ^y - $N \times M$ matrix

e_t - $N \times 1$ vector of residuals

In the FAVAR model, the influence of the macroeconomic variables considered is quantified by several dynamic factors. The most difficult task is to estimate the unobserved factors. BBE proposes two methods of estimation for FAVAR as follows: 1) the principal components approach 2) the likelihood-based Gibbs Sampling, which is a Bayesian approach.

V. Estimation by Gibbs Sampling

In this paper, we estimate FAVAR using Gibbs Sampling as in BBE. The model in a state-space form can be written as follows:

$$\begin{bmatrix} X_t \\ Y_t \end{bmatrix} = \begin{bmatrix} \Lambda^f & \Lambda^y \\ 0 & I \end{bmatrix} \begin{bmatrix} F_t \\ Y_t \end{bmatrix} + \begin{bmatrix} e_t \\ 0 \end{bmatrix} \tag{3}$$

$$L = \begin{bmatrix} \Lambda^f & \Lambda^y \\ 0 & I \end{bmatrix} \tag{4}$$

e_t and v_t are error vectors that are independent and normally distributed as follows: $e_t \sim N(0, R)$ and $v_t \sim N(0, Q)$. The restriction in order to identify uniquely the factors is the following:

$$\Lambda^{f\,'} \Lambda^f / N = I \tag{5}$$

We consider the following vector:

$$\theta = (\Lambda^f, \Lambda^y, R, vec(\Phi), Q)$$

where: $vec(\Phi)$ is a column vector of the elements of the stacked matrix Φ of the parameters of the lag operator $\Phi(L)$, Q is the covariance matrix and R diagonal.

In Gibbs Sampling, θ is considered a vector of random variables.

$$\tilde{X}_T = (X_1, X_2, ..., X_T)$$

$$\tilde{F}_T = (F_1, F_2, ..., F_T)$$

The marginal posterior densities of $\tilde{F}_T$ and θ are the following:

$$p(\tilde{F}_T) = \int p(\tilde{F}_T, \theta) d\theta \tag{6}$$

$$p(\theta) = \int p(\widetilde{F}_T, \theta) d\widetilde{F}_T \tag{7}$$

where: $p(\widetilde{F}_T, \theta)$ is the joint posterior density.

$\widetilde{F}_T$ and θ estimates can be obtained as means of densities.

Gibbs Sampling methodology consists of three important steps. First, we choose the starting values of the parameters of θ. Second, considering the starting values θ^0 and the data X_t, we draw a set of values for $\widetilde{F}_T$ from the conditional density $p(\widetilde{F}_T | \widetilde{X}_T, \theta^0)$. We consider the values obtained $\widetilde{F}_T^1$. In the final step, we draw a set o values of the θ parameters from $p(\theta | \widetilde{X}_T, \widetilde{F}_T^1)$. The final two steps are repeated until the empirical distributions of $\widetilde{F}_T^S$ and θ^s converge. A detailed description of the Gibbs Sampling is provided by Bernanke, Boivin and Eliasz (2005) and Casella and George (1992).

We propose the following parameters in our FAVAR analysis:

$Y_t = [hicp\ emp\ robor3m]$

hicp - Harmonized index of consumer prices: all items (2005=100)

emp - Number of employees in industry (2005=100, SA)

robor3m – 3-month short-term interbank interest rate in Romania (monthly average)

X_t contains 45 macroeconomic variables presented in Annex 1.

We standardized the data of the X_t vector and we extracted the principal components from X_t and used them as the starting values for θ, as in BBE and Koop and Korobilis (2010). We assume that the elements of Λ^f and Λ^y follow normal distributions with zero mean and variance one. We also consider that the diagonal elements of the covariance matrix R follow Gamma distributions with both parameters 0.01. As for $\Phi(L)$, we have chosen the Diffuse prior. We started the calculations after chosing the initial parameters and the distributions. We used 20,000 iterations in the Gibbs Sampling in order to estimate the parameters. The Matlab code for FAVAR analysis was taken from Gary Koop's website, while a detailed description of Bayesian multivariate time series methods is provided by Koop and Korobilis (2010).

Determining the optimal number of unobserved factors is a difficult task. The number of factors in DFMs represents the number of fundamental shocks driving the macroeconomic dynamics according to Onatski (2009). In the last decades, economists have tried to implement different methods for determining the optimal number of factors in DFMs. The methods vary from simple visual inspection to complex econometric models. Catell (1966) used the visual inspection of the scree plot to observe the number of factors. Determining the number of factors in DFMs is still an ongoing debate in macroeconomics. Recent researches try to offer better tests for determining the optimal number of factors. Onatski (2009) considers that the simple visual inspection of the scree plot and the separation of the eigenvalues into “large” and “small” could provide misleading results. He used instead a statistical test for measuring the curvature of the frequency-domain screeplot. Onatski (2005) considers that his test outperforms the Connor-Korajczyk test. We tested the model with different number of factors (2, 3, 4, 5 and 6). The Impulse Response Functions (IRFs) provided by the FAVAR model with 2 factors proved to be the most reliable, as they were compatible with the economic theory and other previous research. The visual inspection of the scree plot also indicated 2 factors. We also tested the model with different lags (2, 3, 4, 5 and 6) and we decided to use 6 lags, as the results provided by this model were reliable. We also chose a higher lag in our model, as the macroeconomic theory indicates that the effects of a monetary policy decision are visible in the real economy after a certain period. Therefore, chosing a shorter lag could not allow IRFs to capture adequately the effects of the NBR’s decisions.

VI. The Database

Although in VAR analysis the specialists generally transform the variables in order to obtain stationarity, we decided to use the series as given (after seasonally adjusting them and applying the logarithm function). We compared two FAVAR models that used the same variables, timeframe, number of lags and number of factors. The first model used stationary time series, while the second model used the data as given. We noticed that the FAVAR model with series as given provided better results. Bernanke, Boivin and Eliasz (2005) use stationary variables in their FAVAR analysis. Sims (1980) and Sims, Stock and Watson (1990) do not recommend differentiating the data, even if the variables contain a unit root. They consider that the goal of the VAR analysis is to determine the interrelationships between variables and not the parameter estimates. Important information could be lost by differentiating the data. Caraiani (2010) and Carriero, Clark and Marcellino (2011) used non-stationary variables in their Bayesian VAR analysis. Mishkin (2011) considers that the global crisis in 2007-2009 affected negatively the results provided by the macroeconomic models, as most of them assumed that the economies were affected by shocks that followed a time-invariant Gaussian distribution. In reality, the shocks affecting the economy are complex and are very difficult to be specified during periods of significant turmoil. A detailed description of the database used in FAVAR model is presented in Annex 1.

VII. Results

We obtained the Impulse Response Functions (IRFs) in order to reveal the impact of a monetary policy shock on the Romanian economy. We consider that the 3-month interbank interest rate (ROBOR3M) represents a proxy of the monetary policy and, therefore, a monetary policy shock represents a shock on ROBOR3M in our model. The unit of measure of the charts is the standard deviation and we ignore the correlations in the VAR residuals. The horizontal axis represents the number of months, while the dotted lines are the 95 % confidence intervals. The results are presented in the figures bellow. Figure 1 shows the impact of a monetary policy shock on the variables included in the standard VAR form of FAVAR. Figure 2 reveals the effects of the NBR's monetary policy on different chosen macroeconomic variables. The model assumes a significant correlation between the monetary policy rate and the market interest rate, ROBOR3M. However, there were periods, especially during the crisis between September 2008 and end-2010, when the evolution of the interbank interest rates in Romania decoupled from the monetary policy interest rate, due to increased risk aversion and regional turmoil. Therefore, a possible solution would be the selection of the NBR's monetary policy rate instead of ROBOR3M. However, adopting this approach is troublesome. The monetary policy rate has been constant over certain periods and, therefore, it could not be used in econometric models. The second assumption in the model is that the monetary policy rate indicates a tightening or easing of the monetary policy. NBR also has other instruments which could be very important in certain periods (minimum reserve requirements and regulation and supervision). Birman (2012), Pelinescu (2012), Popescu (2012) and Spulbăr and Nițoi (2013) use the 3-months interbank interest rate as a proxy of the monetary policy in Romania.

A positive shock on the interest rate determines a decrease in the inflation rate, the effect still persisting after 21 months, according to Figure 1. The result is similar to the one obtained by Spulbăr and Nițoi (2013) in their BVAR analysis. Birman (2012) considers that the monetary policy interest rate has a weak effect on inflation before the implementation of the inflation targeting (IT), while the interest rate shock has a persistent effect on inflation after the adoption of IT. Popescu (2012) found that less than 2% of the evolution of the consumer price index (CPI) is explained by the evolutions of the short-term interest rate and the exchange rate.

A tightening of the NBR's monetary policy generates a decrease in the number of employees that work in industry in the first 12 months, a stabilization of the shock effect in the next 3 months and, then, a gradual recovery in the remaining period. The number of employees working in industry does not return to its initial value after 21 months, denoting the persistence of the monetary policy shock. We have not found in other research papers IRFs showing the effects of a monetary policy shock on the number of the total employees in the economy or activating in a certain sector of the economy. We consider that including this indicator in the VAR models is important, as policymakers are more interested in the current evolution of the labor market. The economic crisis generated increase in the unemployment rate, as well as reduction in the number of employees in the economy in many countries. Consequently, policymakers are striving to increase the employment rate and reduce poverty, as the the number of employees working in the economy has not yet reached its pre-crisis level. We think that the we should study the labor market indicators with caution, because their evolution also depends on other factors, such as: i) the aging of the population in Central and Eastern Europe (CEE) ii) structural changes in the economy iii) migration towards developed countries. We also have to take into consideration the fact that targeting the unemployment rate is not the NBR's objective.

Figure 2 shows the impact of an interest rate increase on different variables of the economy. A tightening of the NBR's monetary policy determines a reduction in the industrial output in the first three months, a slight increase in the next three months and, then, a reduction during the remaining period. The result is similar to the one obtained by Birman (2012). Oros and Romocea-Turcu (2009) obtained a different result in their VAR model. They consider that an interest rate shock has no significant effect on the industrial production in most CEE countries, including Romania.

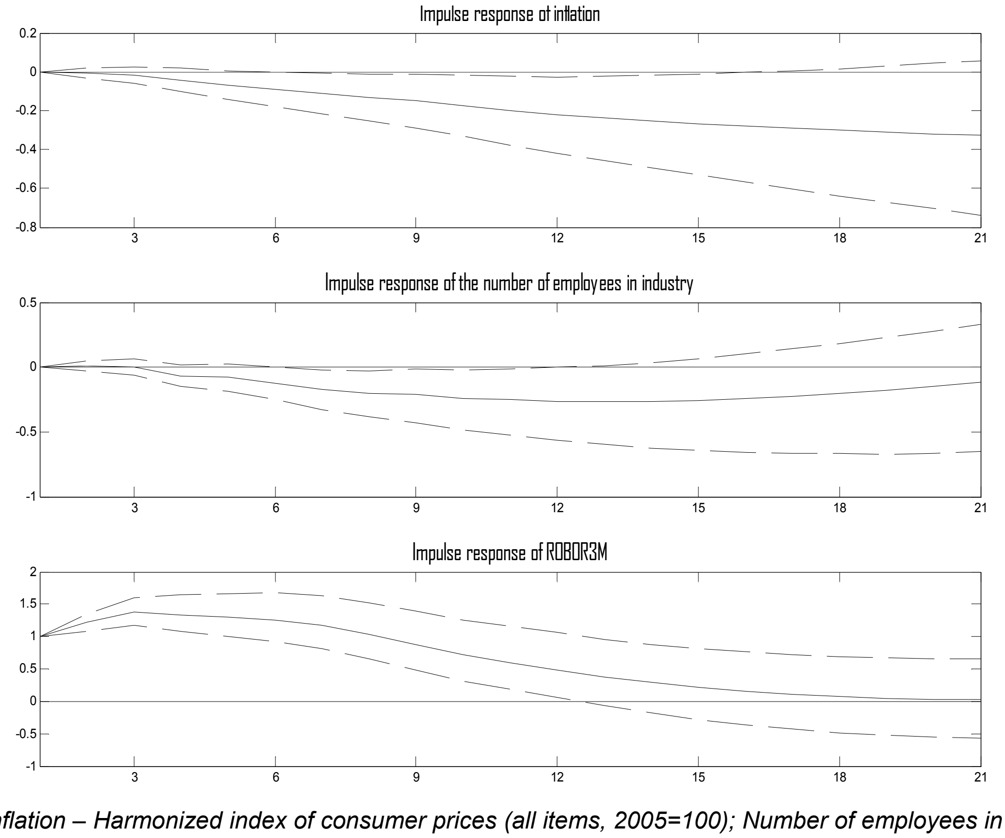
The increase in the interest rate generates a drop in industrial output in the manufacturing industry in the first three months, a relative stabilization in the following three months and a slight decrease during the remaining 15 months. A monetary policy shock has no impact on the CORE inflation (all items of the harmonized index of consumer prices, excluding energy and seasonal food) in the first six months according to Figure 2. The CORE inflation shows a downward trend after the mentioned period. An interest rate increase determines a contraction of the economic activity in the construction and retail trade sectors. The activity in the two mentioned sectors does not return to its intial level, showing that the monetary policy shock is persistent. A tightening of the NBR's monetary policy also determines a decrease in the food and beverages sales. A monetary policy shock determines a reduction in imports in the first 12 months, their value stabilizing in the next 6 months and, then, revealing a slight increase during the remaining period. A positive shock on the interest rate generates a reduction in exports in the first three months, then stabilizing in the remaining 19 months. A monetary policy shock determines an increase in the 12-month short-term interest rate (ROBOR12M) in the first three months, the indicator revealing a gradual reduction afterwards. A tightening of the NBR's monetary policy determines a slight increase in the EUR/RON exchange rate in the first nine months, and then the indicator shows a gradual downward trend over the remaining period.

In conclusion, our model indicates that a tightening of the NBR's monetary policy affects significantly inflation and the economic activity in industry, manufacturing, constructions and retail trade sectors. An interest rate increase determines a reduction in the number of employees in the economy. The NBR's monetary policy shocks are less persistent regarding the evolution of exports as compared to the evolution of imports according to our FAVAR model. Macroeconomic theory indicates that the tightening of the monetary policy determines an appreciation of the local currency and the reduction in the total exports. Our model indicates that an interest rate hike determines a reduction in total imports, while total exports decrease only in the first three months, stabilizing in the following period. Despite the contraction of GDP during the economic crisis, total exports increased significantly, as the depreciation of the local currency made the Romanian products more competitive on foreign markets.

A tightening of the NBR's monetary policy determines an appreciation of the local currency after a lag of nine months, as RON tends to depreciate against euro initially. The monetary theory indicates that the exchange rate is a fast-moving variable, which means that it responds quickly to the shocks on the financial markets. Despite the fact that our FAVAR model indicates an opposite trend regarding the the pass through of the interest rate shock to the nominal exchange rate, the result should be regarded with great caution. We consider that during the economic crisis, the evolution of EUR/RON exchange rate decoupled from the macroeconomic fundamentals, as it was influenced more by the perception of foreign investors' view on the region. According to the VAR model implemented by Birman (2012), an interest rate shock has no effect on the nominal exchange rate. Oros and Romocea-Turcu (2009) consider that in Romania, Hungary, Poland, Slovakia and the Czech Republic the monetary policy shocks do not influence significantly the nominal exchange rate. Slovenia is the only country studied where an interest rate shock has a persistent effect on the nominal exchange rate. Popescu (2012) found that an interest rate increase determines an appreciation of the RON against EUR.

Figure 1

Impulse response functions generated by FAVAR with 2 factors, 6 lags and estimated by Gibbs Sampling. Responses of the variables to a shock applied to the 3-month short-term interbank interest rate (ROBOR3M). The unit of measure of the chart is the standard deviation

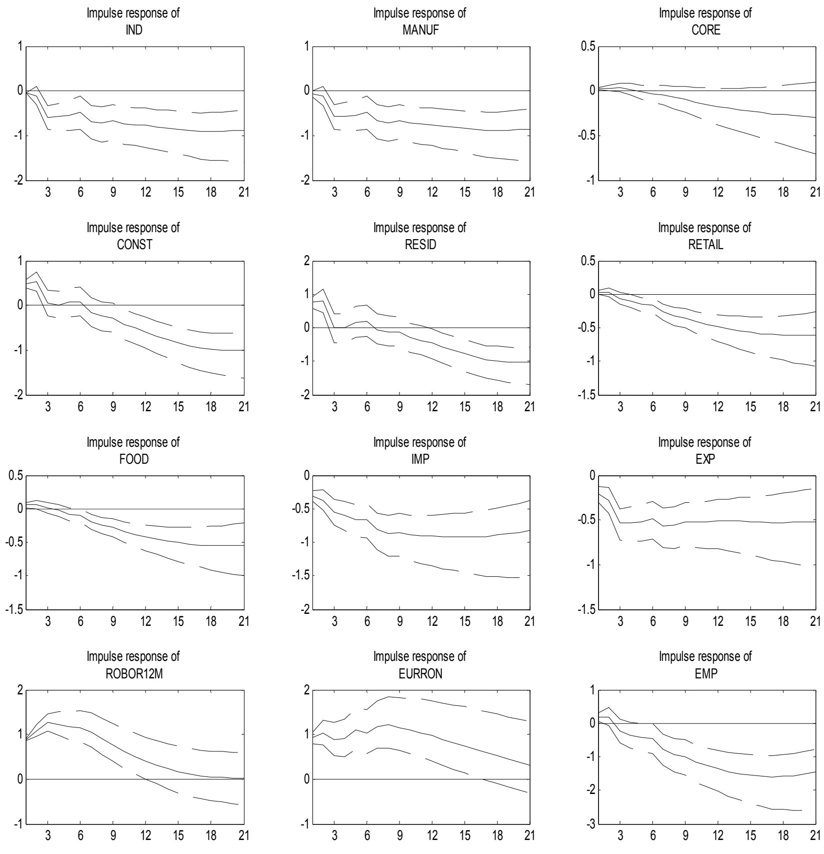


Inflation – Harmonized index of consumer prices (all items, 2005=100); Number of employees in industry (2005=100, SA); ROBOR3M – 3-month short-term interbank interest rate (monthly average).

Source: Authors' calculations using Matlab.

Figure 2

Impulse response functions generated by FAVAR with 2 factors, 6 lags and estimated by Gibbs Sampling. Responses of the variables to a shock applied to the 3-month short-term interbank interest rate (ROBOR3M). The unit of measure of the chart is the standard deviation



IND – industrial production, total (2005=100, SA); MANUF – industrial production, manufacturing (2005=100, SA); CORE – harmonized index of consumer prices, all items excluding energy and seasonal food (2005=100); CONST – construction production index (2005=100, SA); RESID – construction production index in the residential buildings sector (2005=100, SA); RETAIL – retail trade, excepting motor vehicles and motorcycles (2005=100, SA); FOOD – retail trade, food beverages and tobacco (2005=100, SA); IMP – imports (EUR mn); EXP – exports (EUR mn); EMP – number of employees in constructions (2005=100, SA); EURRON – nominal EUR/RON exchange rate (monthly average).

Source: Authors' calculations using Matlab.

VIII. Conclusions

Most of the research papers revealing the monetary policy transmission mechanism in Romania focused on VAR, Structural VAR or Dynamic Stochastic General Equilibrium (DSGE) models. Our paper brings new empirical evidence regarding the impact of the NBR's monetary policy shocks on the real economy, as we use a factor-augmented vector autoregression (FAVAR) estimated by a Bayesian technique in order to obtain the Impulse Response Functions (IRFs). Previous research papers generally showed the impact of a monetary policy shock on the GDP, inflation, the money supply and the exchange rate. Our paper also shows the effect of a monetary policy shock on other macroeconomic variables, such as the number of employees in the economy, the number of employees working in industry, the volume of construction works, the volume of construction works in the residential building sector, exports, imports, retail trade, retail trade in the food goods and beverages sector and a longer-term interest rate.

Our calculations indicate that an interest rate increase operated by NBR determines a reduction in the economic activity in all the studied sectors (industry, manufacturing, constructions and the retail trade). The monetary policy shock has also a persistent effect on inflation. Therefore, we consider that the adoption of IT improved significantly the monetary policy transmission mechanism in Romania. An interest rate increase influences total exports only on short term (in the first three months). A tightening of the NBR's monetary policy generates a slight depreciation of the local currency against the EUR in the first nine months, then the local currency appreciates in the remaining period.

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Annex 1

Database Used in the FAVAR Model

We use 45 monthly variables that show the evolution of the Romanian economy. The data span from May 2001 to November 2010. The variables were taken from the Eurostat and the NBR. Certain variables were seasonally adjusted using the Tramo-Seats program developed by the Bank of Spain. We use the series as given in the analysis. SA = seasonally adjusted series.

Industry

1. Industrial production, total (2005=100, SA)
2. Industrial production: total excluding constructions (2005=100, SA)
3. Industrial production: mining and quarrying (2005=100, SA)
4. Industrial production: manufacturing (2005=100, SA)
5. Industrial production: electric and thermal energy (2005=100, SA)
6. Industrial production: intermediate goods (2005=100, SA)
7. Industrial production: capital goods (2005=100, SA)
8. Industrial production: durable goods (2005=100, SA)
9. Industrial production: current use goods (2005=100, SA)
10. Industrial confidence indicator (balance, SA)

Constructions

11. Construction production index (2005=100, SA)
12. Construction production index: residential buildings (2005=100, SA)
13. Construction production index: civil engineering works (2005=100, SA)
14. Construction confidence indicator (balance, SA)

Retail trade

15. Retail trade, except for motor vehicles and motorcycles (2005=100, SA)
16. Retail trade: food, beverages and tobacco (2005=100, SA)
17. Retail trade: non-food goods including fuel (2005=100, SA)
18. Retail confidence indicator (balance, SA)

Foreign trade

19. Total imports (EUR mn)
20. Total exports (EUR mn)
21. Total imports from EU27 countries (EUR mn)
22. Total exports to EU27 countries (EUR mn)

Harmonized index of consumer prices

23. Harmonized index of consumer prices: all items (2005=100)
24. Harmonized index of consumer prices: food and non-alcoholic beverages (2005=100)
25. Harmonized index of consumer prices: alcoholic beverages (2005=100)
26. Harmonized index of consumer prices: clothing (2005=100)
27. Harmonized index of consumer prices: housing, water, electricity, gas and other fuels (2005=100)

28. Harmonized index of consumer prices: furnishings, household equipment and routine maintenance of the house (2005=100)
29. Harmonized index of consumer prices: health (2005=100)
30. Harmonized index of consumer prices: transport (2005=100)
31. Harmonized index of consumer prices: communication (2005=100)
32. Harmonized index of consumer prices: culture (2005=100)
33. Harmonized index of consumer prices: education (2005=100)
34. Harmonized index of consumer prices: hotels and restaurants (2005=100)
35. Harmonized index of consumer prices: all items, excluding energy (2005=100)
36. Harmonized index of consumer prices: all items, excluding energy and seasonal food (2005=100)
37. Economic sentiment indicator (balance, SA)

Interest rates

38. ROBOR 3M (monthly average)
39. ROBOR 6M (monthly average)
40. ROBOR 12M (monthly average)

Employment

41. Number of employees in constructions (2005=100, SA)
42. Number of employees in retail trade (2005=100, SA)
43. Number of employees in industry (2005=100, SA)

Exchange rates

44. EUR/RON (monthly average)

USD/RON (monthly average)