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Monetary policy analysis in Romania: A Bayesian VAR approach

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In this study we use the Bayesian VAR framework to provide an analysis of the transmission mechanism of the monetary policy. We develop a bayesian vector autoregression (BVAR) model for the Romanian economy in order to identify the major shock in Romania for the last 10 years and to provide information concerning the evolution of the economy response to these shocks. That's why, we have included in the analysis variables that emphasize the industrial production evolution, the exchange rate, the inflation, the real estate prices, the monetary aggregate M2 and the interest rate. The analysis shows important conclusions. The exchange rate remains an important mechanism that influences significantly the variables of the real economy, but the channel of the interest rate is being more and more consistent in the last years. The positive aspect that emerges from this study is related to the absence of output and price puzzle.

Key words: Monetary policy transmission mechanism, bayesian vector autoregression (BVAR) model, small open economy, Bayesian analysis, model comparison.

INTRODUCTION

Recent research carried out in the specialized literature, based on dynamic stochastic general equilibrium (DSGE) models or on bayesian vector autoregression (BVAR) models plays an important role in the process of creation and implementation of monetary policy. This role stems from the importance of the information provided to the central bank, and to the public, the anticipation channel being well known as an important part of the monetary policy. Information regarding the evolution and the persistence of the inflation, the testing of the hypotheses concerning the nominal rigidities existent in case of prices and wages, the factors determined in establishing prices, the evolution of the output gap, the estimation of Taylor's rule coefficient, but also the impact of an expansionist monetary shock upon a group of variables, are useful in providing an overall image of the economic evolution of a country, but they can also be used in comparison to other countries.

For the last decade, Romania has completed an economic cycle. Thus, the economic growth period, comprised between 2000 and 2008, and was followed by a descending period. The economic growth period itself can be split into two parts, the milestone being the year 2004. During the first part of the decade, exports have led to a moderate but a sustainable economic growth. This period of accumulations was followed by one period when the consumption created the premises of a positive output gap. The consumption was mostly covered by imports, domestic offer being insufficient to satisfy the demand.

Also, in this period, Romanian monetary policy confronted with different challenges. Major fluctuations of the national currency (Euro depreciated relative to the national currency starting from an exchange rate of 4.1 in September, 2004 reaching a value of 3.1 in July, 2007). Then the European currency appreciated reaching the value of 4.2 in January, 2009, when the exchange rate became stable. The national currency had, related to other regional currencies the longest and the strongest appreciation in 2007 and consequently the depreciation was considerable. The inflation had a visible descendent

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Abbrevaitions: BVAR, Bayesian vector autoregression; **DSGE,** dynamic stochastic general equilibrium.

trend, but the inflation rate in Romania remains one of highest of European Union. Capital account liberalized in 2005, when massive flows of foreign currency entered our economy.

Current account deficit reached a value of 13-14% of gross domestic product in 2008. In 2005-2006, the current account deficit was financed through direct foreign investments in proportion of 80%. In the following years, financing external deficits have become extremely difficult, and less than 30% of the current account deficit has been financed from direct foreign investments, the rest representing the leveraging especially of the private sector. Starting with the year 2005, the non-governmental credit had spectacular growth rates, its value growing 5 times in only 4 years. A considerable proportion of the non-governmental credit was represented by the consumption credit that led to the accentuation of the current account deficit because the majority of goods requested by consumers were imported. The basis of these credits had not been represented by domestic savings, but by an external one, Romanian banks became therefore dependent on external financing. Romanian macroeconomic structure dealt with influences of a new element that is "hyperinflation" of the real estate sector, the value of real estate's index tripled between T1.2005 and T2.2008. In our opinion, the evolution of the real estate prices index had not been founded on a superior quality of dwellings, but on a speculative impulse.

In order to provide information concerning the aspects aforementioned, but taking into consideration the last 10 years overall image of the monetary situation, we set as an objective of this work to extend the area of research in this field.

Thus, the first part of the work has as main objective the performance of an analysis of the transmission mechanism of the monetary policy by developing a model able to identify the major shock in Romania of the last 10 years, providing information concerning the evolution of the economy response to these shocks.

In the second part, we proposed ourselves to emphasize the correlations between production, inflation, exchange rate, monetary aggregate M2, and the prices of real estate assets. The model used is a Bayesian Autoregressive Vector (BVAR) with a Sims and Zha (1998) prior and then the same model is estimated using a KoKo Minnesota/Litterman (2010) prior. BVAR models have been introduced for the first time by Litterman as an alternative to the VAR technique (Litterman, 1980). They solve the problem of freedom degrees specific to the VAR technique, and they provide also possibilities of prediction concerning more efficient economic variables.

LITERATURE REVIEW

The contribution of this study to the specialized literature is important and original from different points of view. Firstly, as far as we know, BVAR modelling has not been frequently used for the purpose of a macro monetary analysis of the Romanian economy. Secondly, the number of variables introduced in the analysis is big enough, comprising monthly dates over a ten year period. Thirdly, an original step is represented by introducing into the analysis an index of real estate assets prices, being widely known that evolutions in the real estate market have a major economic effect upon the economic activity and especially for Romania during the expansion period starting from 2004 to the end of the third trimester of the year 2008.

The assets prices deviation from the economic foundations can lead to inadequate investments that diminish the economy efficiency. That's why we consider that it is necessary to introduce in the analysis, an index of real estate prices.

According to the empirical literature, there are numerous studies using BVAR techniques. Mallick and Sousa (2009) use Bayesian methodology in order to point out the evolution of the economic activity and the monetary policy within BRICS group. The authors show that a restrictive monetary policy has in these countries a negative effect upon the output gap, and also upon the capital market. Such a restrictive policy leads to an appreciation of the national currency and produces a reduced liquidity effect. Migliardo (2010) proposes a BVAR model in order to examine the short-term effects of the monetary policy shock upon Italian economy. The results confirm the micro evidence of the inflation persistence. Berger and Osterholm (2008) used the Bayesian techniques in order to check the relationship between the monetary aggregates and USA inflation. The two authors concluded that the introduction of a growth rate of M2 in a VAR model does not contribute in a significant way to the inflation prediction. Fratzscher and Straub (2009) analyse the effects of capital market shocks upon the current account deficits from the industrialized countries using a BVAR with sign restrictions. Jarocinski and Smets (2008) estimate a BVAR for the USA economy and try to determine whether evolutions of the real estate sector can be explained by the growth in the gross domestic product or by the interest rates, which are the effects of the monetary policy shocks upon the real estate sector.

This work is structured as follows. The second section describes the econometric methodology and the data used for this study. In the third section, the main results obtained are presented and the last section is dedicated to the presentation of the conclusions.

METHODS AND DATA

In the present study, we will estimate a Bayesian autoregressive vector. In order to strengthen the validity of the obtained data, we carried out a double check. Thus, we will firstly use prior

distribution suggested by Sims and Zha (1998), and then the validity of the obtained data will be also be verified by means of prior distribution of Koop and Korobilis (2010). Consider the following VAR (p) model:

$$y_t = a_0 + \sum_{l=1}^{p} A_l y_{t-1} + \varepsilon_t, \qquad \varepsilon_t \sim N(0,\Sigma) \qquad (1)$$

where y_t is an $m \times 1$ vector of $t = 1,..........,T$ observations on m time-series variables, a_0 is an $m \times 1$ vector of intercepts, and A_l is a $m \times m$ matrix of regression coefficients for the l th lag with the p maximum number of lags.

If we define Y to be a $T \times 1$ matrix which stacks the T observations on each dependent variable in columns next to one another. In particular, by denoting:

$$x_t = [1 \ y_{t-1} \ ...... \ y_{t-p}], \qquad X = \begin{bmatrix} x_1 \\ \vdots \\ x_T \end{bmatrix}, \qquad B = \begin{bmatrix} a_0 \\ A_1 \\ \vdots \\ A_p \end{bmatrix}, \qquad (2)$$

and $\beta = \text{vec}(B)$, the VAR model can be rewritten:

$$y_{mT \times 1} = X_{T \times (mp+1)} B_{(mp+1) \times m} + E_{T \times m}, \qquad E \sim N(0,\Sigma)$$
(3)

The choice of prior has always been a contentious issue in Bayesian analysis. If you choose the Sims-Zha prior, the model (1) is rewritten as:

$$y_t = c + \sum_{l=1}^{p} y_{t-1} B_l + u_t, \qquad u_t \sim N(0, I_M) \qquad (4)$$

Where, $\Sigma = A_0^{-1'} A_0^{-1}$ and A_0 is nonsingular. By denoting:

$$B = \begin{bmatrix} B_1 \\ \vdots \\ B_p \\ c \end{bmatrix}, \qquad c = a_0 A_0^{-1}, B_1 = A_+ A_0^{-1}, u_t = \varepsilon_t A_0^{-1}, \qquad (5)$$

One can relate this model to the reduced form in Equation 2. Following Sims-Zha notations, this model can be also written in compact form:

$$YA_0 - XA_+ = U \qquad (6)$$

$$ZA = U \qquad (7)$$

Where

$$Z = [Y - X] \text{ and,} \quad A = \begin{bmatrix} A_0 \\ A_+ \end{bmatrix} \qquad (8)$$

Unlike the independent hyperprior specification (that is, $\pi(A_0)\pi(A_j)$), Sims and Zha suggests the conditional prior (Sims-Zha prior):

$$\pi(A) = \pi(A_0)\pi(A_+|A_0) = \pi(A_0)\phi(B_0,\Psi_0) \qquad (9)$$

Where, $\pi(.)$ is a marginal distribution of A_0, and $\phi(.)$ is the standard normal density with mean B_0 and covariance Ψ_0. Each element of Ψ_0 is written as:

$$\Psi_{0l,ij} = \left(\frac{\lambda_0 \lambda_1}{\sigma_j l^{\lambda_3}} \right)^2 \qquad i,j = 1,..........,m, \qquad (10)$$

Where σ_j^2 is the j th element of Σ for the l th lag of variable i in equation j. Note that the hyperparameters such as λ_0, λ_1 and λ_3 reflect the general beliefs about the series being modeled. A complete description of the hyperparameters of Sims and Zha prior can be found in Brandt and Freedman (2006). For the estimation of the model with a Sims and Zha prior, we use a Normal-Wishart prior distribution.

In order to obtain more robust results, we will estimate the model using the Ko-Ko Minnesota/Litterman prior (2010). The Ko-Ko Minnesota prior assume that Σ is known (for example, equal to $\overset{\wedge}{\Sigma}$). The prior for β is:

$$\beta \sim N(\beta_0, \underline{V}) \qquad (11)$$

With mean $\beta_0 = 0$ and covariance $\underline{V} \neq 0$. Koop and Korobolis specified the prior covariance matrix $\underline{V}$ as a diagonal matrix with its elements $v_{ij,l}(1 = 1,........,p)$.

$$v_{ij,l} = \begin{cases} a_1/p^2 & \text{for coefficients on own lags} \\ (a_2\sigma_i)/(p^2\sigma_j) & \text{for coefficients on lags of variable } i \neq j \\ a_3\sigma_i & \text{for coefficients on exogenous variables} \end{cases}$$
(12)

Where σ_i^2 is the ith diagonal element of Σ.

Both models are estimated using Bayesian techniques. In order to provide a comparison between the two models we relate the hyperparameters in Sims-Zha model to those in Ko-Ko Minnesota

model (the values of the hyperparameters used for the estimation of the models are presented in the annexes) as follows:

$$a_1 = \lambda_1; a_2 = \lambda_1\lambda_2; a_3 = (\lambda_0\lambda_4)^2; 0 = \mu_5, 0 = \mu_6. \quad (13)$$

In the analysis are included monthly data regarding the evolution of the industrial production, the real exchange rate (expressed as an index, this index growth indicating a leu's real appreciation against the currencies of the commercial partners of Romania), the consumption prices index, the M2 monetary aggregate, the Leu-Euro exchange rate (the exchange rate is presented as: 1 euro for x units of currency of a country), the interest rate of the interbank market and the real estate prices index for a period between 2001 to 2010. These data come from the database of the International Monetary Fund (International Financial Statistics) and from the database of the European Central Bank (Statistical Data Warehouse). The real estate index is taken from the site http://indeximobiliar.blogspot.com. Comparing to the index calculated by the National Statistics Institute of Romania, starting with the year 2009, differences are very small, approximately up to 0.79%. All the data are seasonal adjusted, excepting the exchange and interest rate. All the data are expressed in logarithm (excepting the interest rate), and then the prime difference operator is applied. The completed results of the two models are presented in Annexes 1 and 2.

RESULTS AND DISCUSSION

The response of the variables was introduced in the analysis to a positive shock of the industrial production. A positive shock of the industrial production (Figure 1) will lead to an appreciation of the real rate exchange and to a reduction in the inflation. Normally, the inflation response to a positive shock of the demand should be positive, but the appreciation of the exchange rate absorbs rapidly this effect. Also, the positive variation of the production will trigger a negative variation of the Leu-Euro exchange rate.

The response of the variables introduced in the analysis to a positive shock of the real exchange rate. Conventionally, in the case of the real exchange rate shock, that is a national currency appreciation, we will assist to the prices decrease. The national currency appreciation will increase the exports price and will reduce the imports price. The decrease of the imported products prices will also lead, in a competitive economy, to the decrease of the autochthon products prices, resulting to prices diminution.

On the other hand, this response depends on the existent structure between the exports and the imports. The inflation diminution, as a consequence of a national currency appreciation will be more consistent if the imports are predominant in the national consumption. This argument seems to ply with the economy of Romania (Figure 2) where the inflation diminished as a result of the leu's appreciation between 2004 and the end of 2007, appreciation that took place on the background of a high consumption oriented towards the imports and the low saving, increasing both the current account deficit

and also the external debt. The national currency appreciation in a period in which the current account deficit was substantial can seem ungrounded. It is based preponderantly on the capital account liberalization and on the admissions of foreign currency in Romania, admissions that were sustained by the leu's positive interest differential against other currencies, mainly against euro. Along with the financial crisis outbreak, at the end of 2007 in United States, the foreign capital started was withdrawn from Romania, leading to a significant national currency depreciation. This depreciation would have led to a significant inflation growth if it had not been accompanied, due to the economic crisis, by a strong contraction of the production (a negative output gap) and of a current account correction (the consumption that was directed towards imported goods significantly diminished). This mixture of events determined the maintenance of inflation on the descending trend.

The deflationist impact of a positive shock of the real effective exchange rate is reabsorbed through a diminution of the interest rate on short term. This mechanism aligns with the "exchange rate-prices-interest rate" tridimensional relation. Indeed, the unexpected national currency appreciation incites the economic agents to hold an inferior currency stock, which determines an interest rate decrease on short term.

In an economy such as the Romanian economy which adopted the inflation target strategy, the absorption and the competitiveness deterioration (a real effective exchange rate appreciation) through the usual method, that is, the massive intervention of the monetary authorities on the exchange market through the accumulation reserve fund, is conflictual. This intervention, if possible, will generate a growth of the monetary offer and, implicitly of the inflationist pressures. In this way we can explain the central bank's non-intervention when the leu appreciated against the other currencies. Thus, the central bank will be exposed to the dilemma of practicing a new inflation target and the limitation of the national currency appreciation. Herman (2008) states that the monetary authorities' intervention in order to absorb the national currency appreciation within the inflation target system could be profitable only in the conditions in which the economy operates under its potential (negative output gap). Thus, an expansionist monetary policy generated by the intervention on the exchange market will favour the realization of the inflation target. This situation did not occur in Romania, because the output gap was far superior to the economy potential within the period 2004-2008. On the other hand, the adjustment of the national currency appreciation can be realized through an interest rate growth in order to fight against the inflationist pressures generated by the monetary authorities' intervention on the exchange market and the national currency depreciation. However, the interest rate growth will cause at its turn a national

Annex 1: The results of the BVAR model using Sims and Zha prior based on the following values of the hyperparameters ($\lambda_0 = 1, \lambda_1 = 0.6, \lambda_2 = 1, \lambda_3 = 1, \lambda_4 = 4; \mu_5 = 0, \mu_6 = 0$).
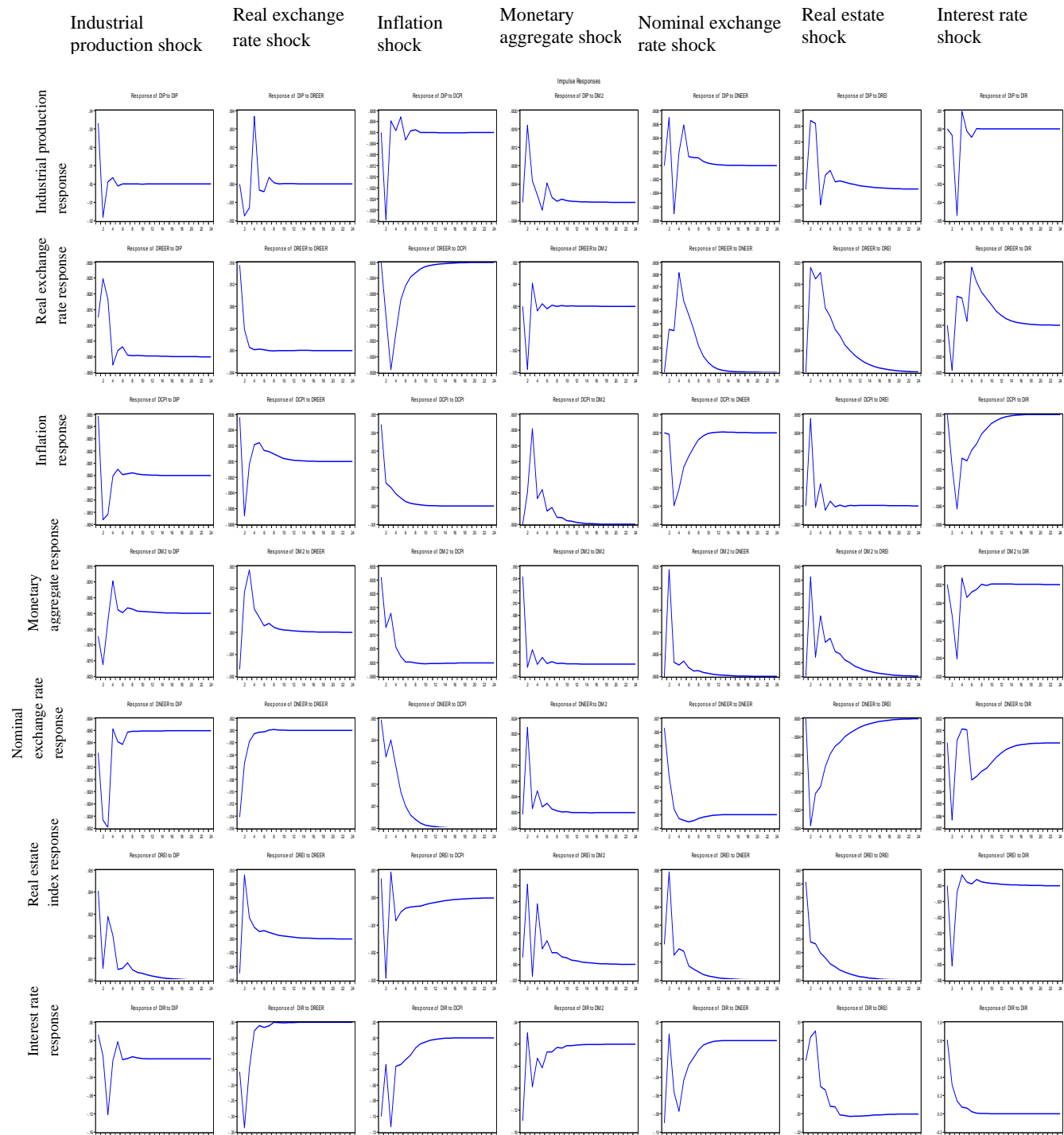

currency appreciation due to the attraction of the capital waves towards the economy, capital waves attracted by the high interest differential.

Montiel and Ostry (1991) underline the fact that, in the context of the free capital flow, the monetary policy task of acting against the inflation is very difficult. The offer of currency cannot be controlled very easy through a restrictive monetary policy (sterilization). As far as the economic agents can obtain foreign liquidities, the direct monetary instruments of enclosing the credit does not

Annex 2: The results of the BVAR model using KoKo Minnesota/Litterman prior based on the following values of the hyperparameters ($a_1 = 0.6, a_2 = 0.6, a_3 = 16$).
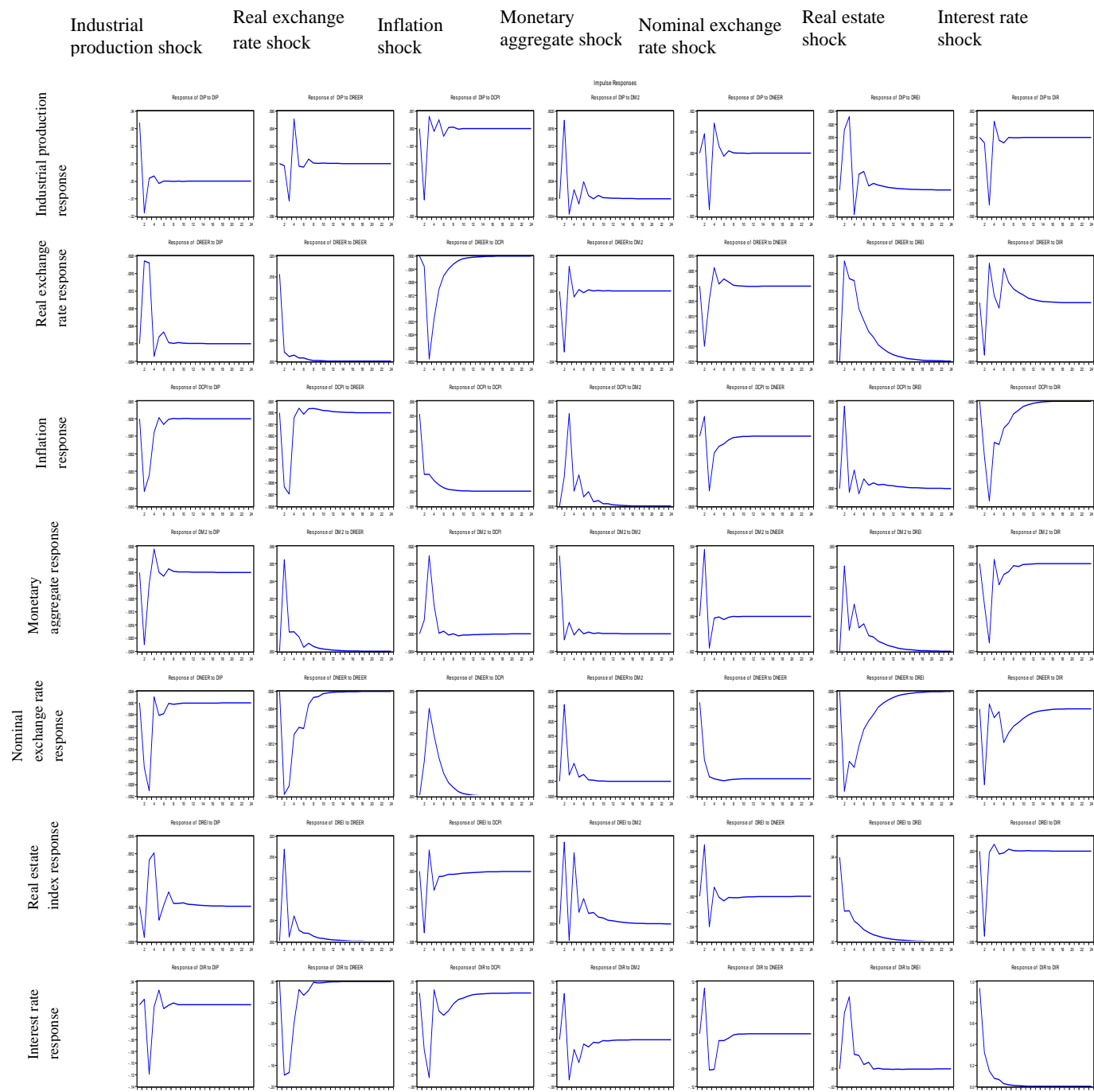
influence the money supply and thus the inflation. That is why the vocation of an inflation target strategy is one way of anchoring the inflationist anticipations of the population on a level as low as possible.

The positive shock effect of the real exchange rate on the production is disputed. If we take into account the aggregate demand side the decrease of the imports prices and the decrease of the autochthon goods demand, as a result of the national currency appreciation, will lead to a national production collapse. Thus, the
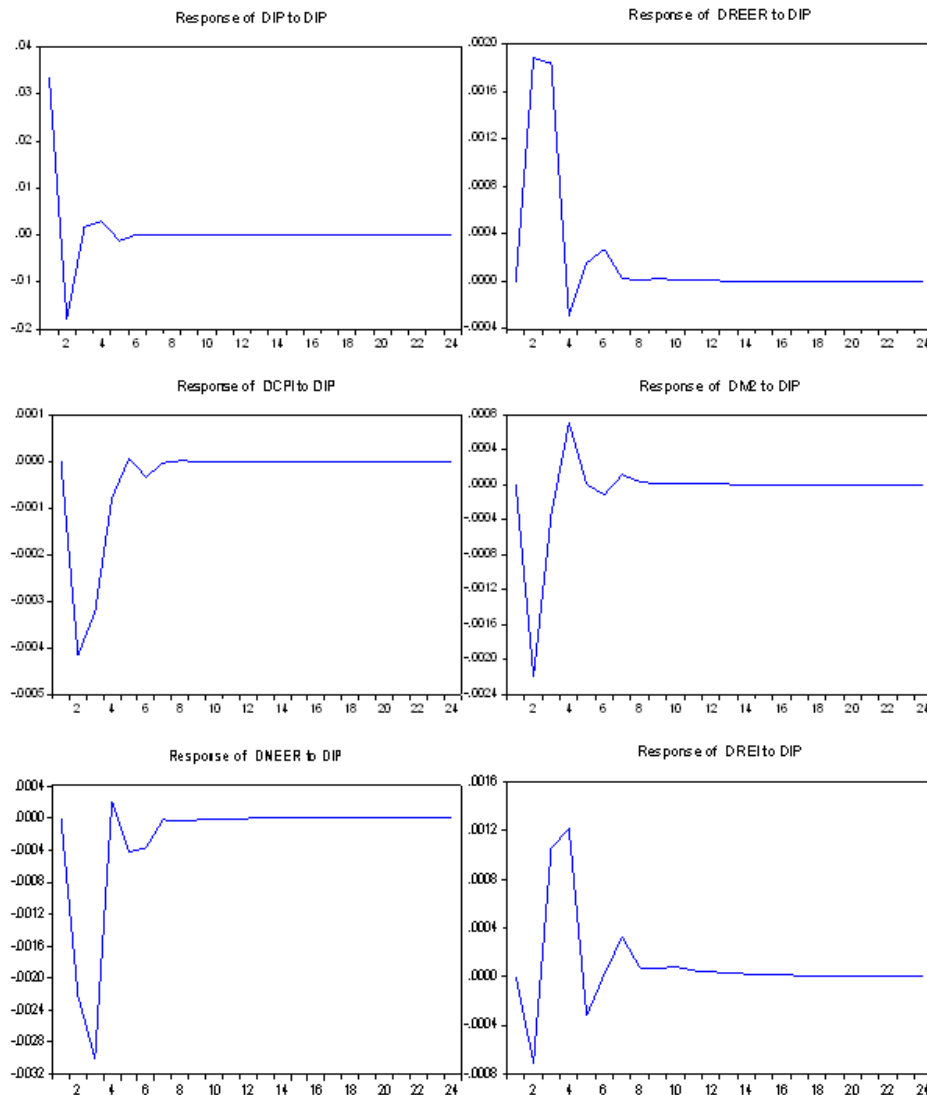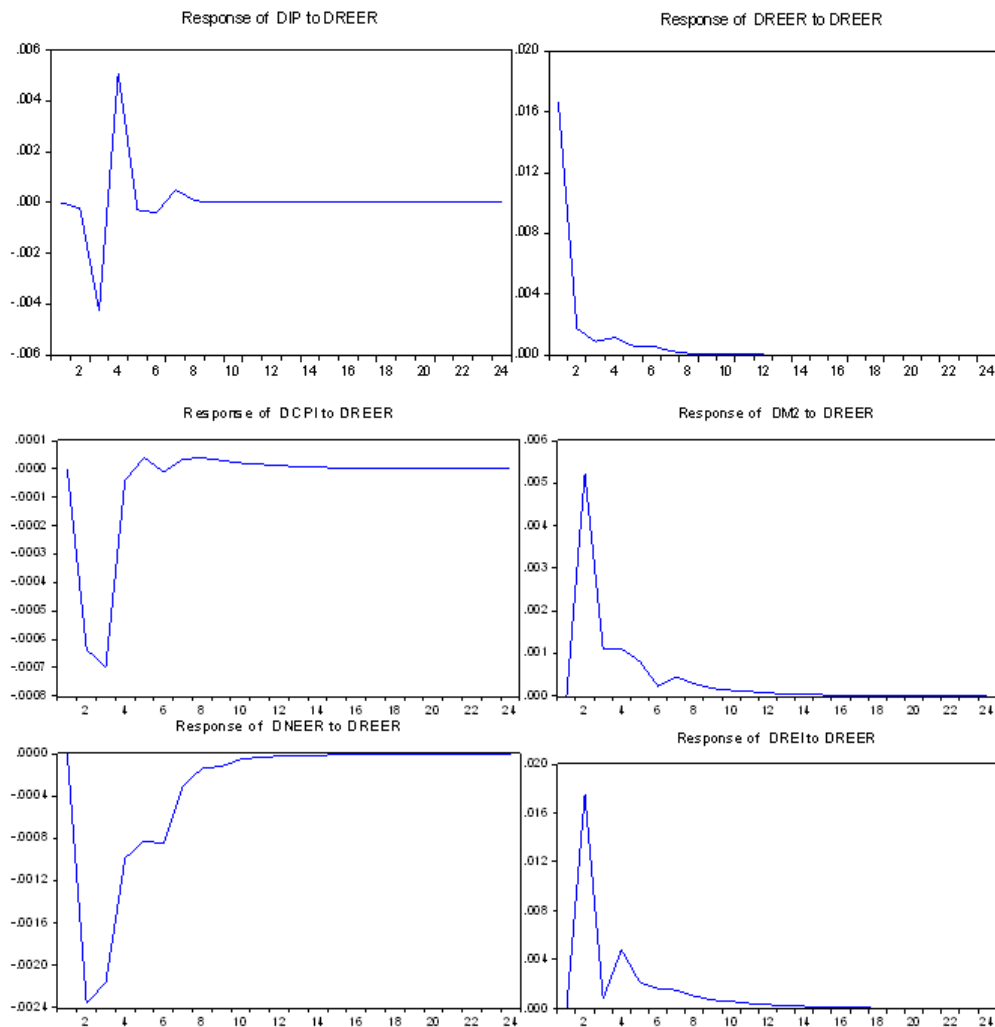
Figure 1. The impulse response functions of the variables to an industrial production shock.

deterioration of the competitiveness-prices of the autochthon goods on international level relation will lead to the exports decrease and will generate a production decrease. On the other hand, if we take into account the aggregate offer side, a national currency appreciation will generate a decrease of the imported intermediate goods prices included in the production factors and thus, in the production cost. Consequently, it will increase the labour force demand, but also the production. In Romania, the impact of the exchange rate real appreciation upon the industrial production seems to be dominated by the aggregate offer. Also, the positive variation of the real exchange rate will lead to an appreciation of the Leu in comparison to the Euro and will have a strong positive impact upon the real estate prices.

The response of the variables included in the analysis

to a positive shock of the inflation. The growth rate of the industrial production will reduce as a consequence of a positive shock in the inflation rate, the response being in accordance with the specialized literature. The response of the M2 monetary aggregate to an unexpected inflation growth (Figure 3) is the one of growing the money supply, unlike the theoretical hypotheses according to which a prices unexpected growth indicates a money supply decrease. However, this contradiction was also observed by Kim and Roubini (2000). The inflation persistence will disappear after 7 months. In response to an unexpected growth in the inflation, the nominal exchange rate between national currency and euro increases in line with the economy theory.

The response of the variables is included in the analysis to a positive shock of the monetary aggregate

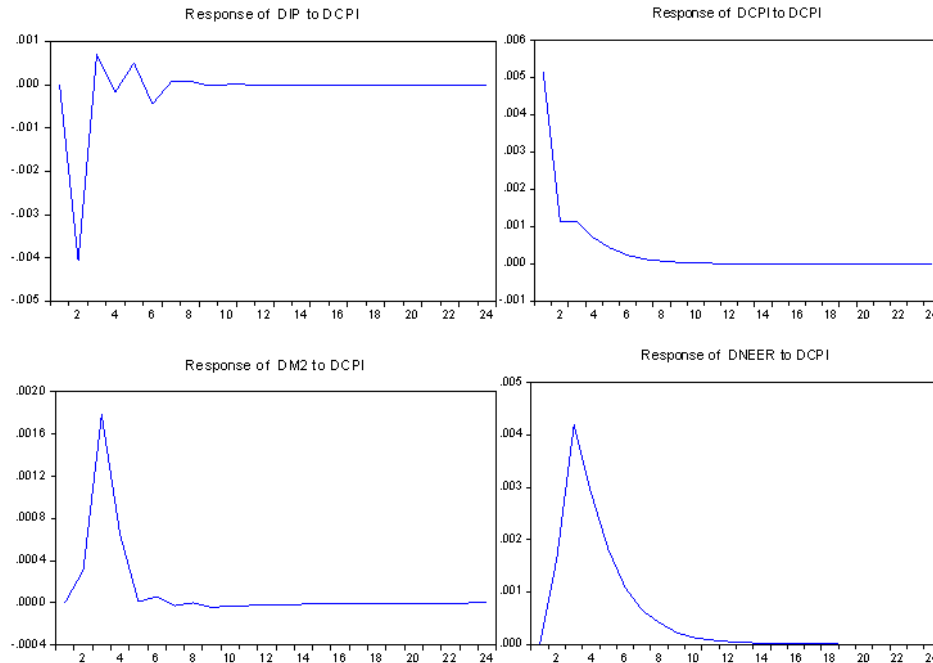**Figure 2.** The impulse response functions of the variables to a real effective exchange rate shock.

M2. A positive variation of the monetary aggregate M2 (Figure 4) will trigger an inflation growth and a depreciation of the national currency. As it can be observed, the growth in the monetary mass has a significant impact upon real estate prices.

In our opinion, two factors have contributed in an essential way to the speculative growth in the real estate prices between the years 2005-2008. Firstly, the appreciation of the national currency that leads to a growth in real estate prices (Figure 2) but also the descendent evolution of the reference interest rate has built up very optimistic expectations as regard to the economy behaviour on the long term. Secondly, both non-governmental credit and mortgage credit have grown spectacularly before 2009. This growth was determined by the descending interest rates in Romanian, the evolution of the exchange rate, but also the lax crediting rules of the commercial banks, Romanian National Bank legislation being very permissive in this respect.
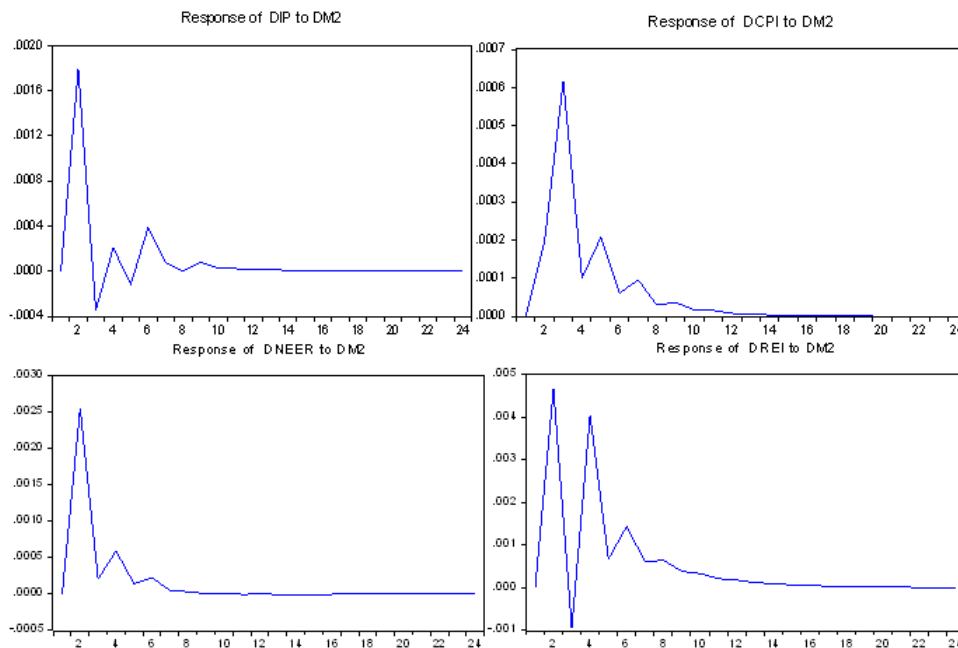
From the Figure 5, it can be observed that the depreciation of the national currency leads to a reduction of the real estate prices index this situation being a juncture one. This fact can be explained by means of two ways. Firstly, in an unusual way, the prices of this sector are expressed in the European currency, and a growth in the rate will determine a reduction of prices in Euro in order to maintain a constant value of prices in national currency. Secondly, the Romanian economy is strongly dependent on the Euro currency, the majority of mortgage credits being granted in foreign currency. Under these conditions, one the factors that sustained the high demand in the real estate sector, the real estate credit, was affected negatively in the last three years by the next factors: on the one hand, the appreciation of the European currency, USA dollar and the Swiss franc in comparison to the Leu, but also by the reduction in the crediting lines that Romanian banks beneficiated from.

In spite, the evident danger that the speculative key

Response of DIP to DCPI

Response of DCPI to DCPI

Response of DM2 to DCPI

Response of DNEER to DCPI

Figure 3. The impulse response functions of the variables to an inflation shock.

Response of DIP to DM2

Response of DCPI to DM2

Response of DNEER to DM2

Response of DREI to DM2

Figure 4. The impulse response functions of the variables to a monetary aggregate shock.

periods on the real estate market represent, there was the problem whether the central bank should have reacted to all this. Some economists consider that a monetary policy strategy that granted the necessary attention to the monetary evolution analysis, can generally determine the central bank to take indirect measures in order to deal with financial imbalances, being able to reduce their negative consequences on the long term. For this purpose, taking into consideration that such a policy can be difficult to communicate in periods of
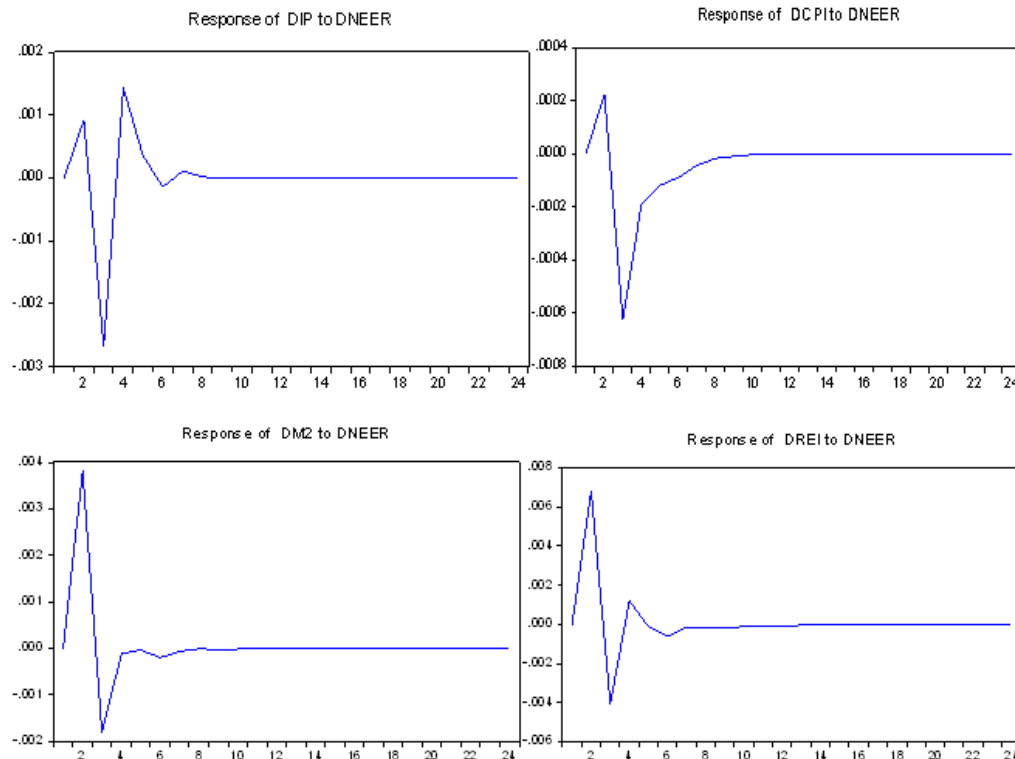
Figure 5. The impulse response functions of the variables to a nominal exchange rate shock.

stable low inflation, as well as the problem of the regional differences of the real estate prices and the evolution of the credit (problems that can be solved through monetary policy as long as the aggregates of the entire zone are shown). Goodhart and Hofmann (2008) suggest to take into consideration a secondary financial instrument that refers directly to the connections between the real estate prices and the monetary variables and that could be used regionally and in case of the monetary union. This instrument could be an administrative countercyclical limit for the relation between the credit and the value of the mortgage credit, limit that could be raised in case of a low rate or of the decline of the mortgages volume (and of an inflation generated by real estate prices), or reduced during the periods of strong expansion.

Mishkin (2007) rejects to grant a special attention to the real estate prices while leading the monetary policy, without neglecting them. A prudent central bank will take measures to counteract the negative macroeconomic effects emerged, before an important decline of the active prices. A modality by which the central bank can prepare itself for a quick reaction is by analysing different scenarios of the activity of evaluation of reaction ways to a diversity of shocks, including the reduction in prices on the real estate market, in order to attain a maximum degree in sustainable employment and prices stability.

The response of the variables included in the analysis to a positive shock of the nominal exchange rate. A positive shock of the nominal exchange rate (Figure 5), concretized in a leu's unexpected depreciation against euro will lead to an inflation growth in the first two periods, but then the positive effect is absorbed through an increase in the interest rate, and to a money supply growth. Also, as we have mentioned before, the depreciation of the national currency will have a negative impact upon the real estate prices. As we see, the channel of exchange rate is quite important in the relation of influence over the other variables included in the study. Taking into account this observation, and also the fact that the process of monetary convergence into Euro Zone is a complex process that includes the inflation convergence, and also the exchange rate stability and interest rates convergence, a strict form of inflation targeting being insufficient because it does not ensure the exchange rate stability. Thus, a more flexible way of inflation targeting in needed, that allows the targeting of inflation differential predictions in comparison to the Euro zone and a stability of the exchange rate (Jonas and Mishkin, 2003).

The response of variables included in the analysis to a positive shock of the interest rate. A positive aspect that emerges from the analysis carried out is represented by the response function of the production and of inflation to a positive variation of the interest rate (Figure 6). A shock of the interest rate will lead to a higher price of money, which will determine people to request less consumption
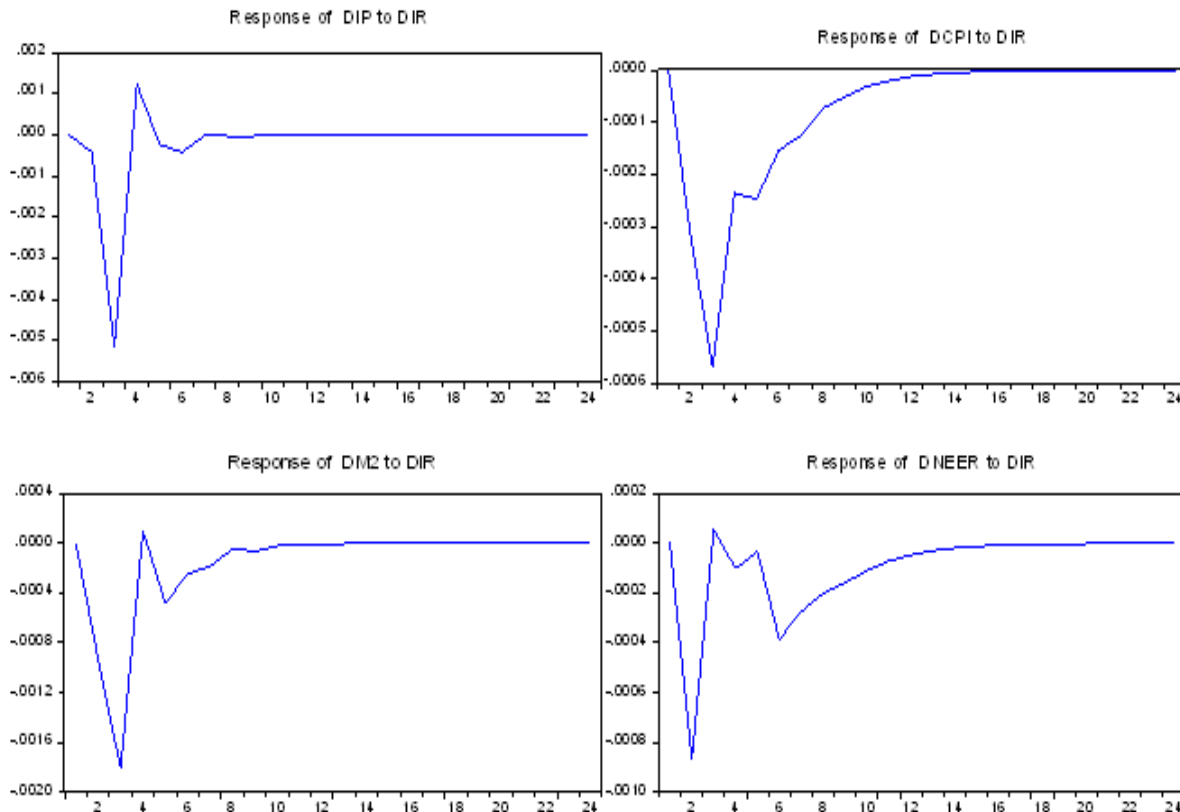
Figure 6. The impulse response functions of the variables to an interest rate shock.

and investments loans, so that both the inflation and the production will diminish, and they will gradually recover after the interest rate shock have disappeared. This answer consolidates the interest rate channel and supports the inflation targeting strategy. Also, a growth in the interest rate will trigger an appreciation of the national currency and a reduction in the monetary aggregate M2, these functions of response being in accordance with the theoretical hypotheses.

Conclusion

This work had as objective to provide new empirical results in the transmission mechanisms of monetary policy in Romania, using modern techniques. Therefore, we have estimated the Bayesian autoregressive vector using the methodology imposed by Sims and Zha, and also the KoKo Minnesota/Litterman technique that highlights the main factors that influenced Romanian economy in the last ten years. That's why, we have included in the analysis variables that emphasize the industrial production evolution, the exchange rate, the inflation, the real estate prices, the monetary aggregate M2 and the interest rate. Also, in order to consolidate the validity of the data obtained we have carried out a double check. Firstly, the analysis shows important conclusions.

The exchange rate remains an important mechanism that influences significantly the variables of the real economy. Among the factors that contributed to the appreciation of real estate prices, we have identified the monetary aggregate M2, but also the appreciation of the national currency. The positive aspect that emerges from this study is related to the absence of output puzzle and price puzzle, the channel of the interest rate being more and more consistent in the last years.

Definitely, this study will foster new research directions. One of these directions is represented by the extension of the analysis to a broader research of the monetary policy by means of a DSGE model that includes among the variables the gross domestic product evolution and the realization of a comparison between the results obtained in the two models.

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REFERENCES

Berger H, Österholm P (2008). Does Money Matter for U.S. Inflation? Evidence from Bayesian VARs. International Monetary Fund Working

Paper/08/76.

Brandt PT, Freedman JR (2006). Advances in Bayesian Time Series Modelling and the Study of Politics: Theory Testing, Forecasting, and Policy Analysis. Polit. Anal. 14:1-36.

Fratzscher M, Straub R (2009). Asset Prices and Current Account Fluctuations in G7 Economies. European Central Bank Working Paper Series 1014.

Goodhart C, Hofmann B (2008). House Prices, Money, Credit and the Macroeconomy, European Central Bank Working Paper 888.

Herman K (2008). Is Central Bank Intervention Effective Under Inflation Targeting Regimes? The Case of Colombia. International Monetary Fund Working Paper/08/88.

Jarociński M, Smets F (2008). House Prices and the Stance of Monetary Policy. European Central Bank Working Paper Series 891.

Jonas J, Mishkin F (2003). Inflation Targeting in Transition Countries: Experience and Prospects. NBER Working Papers 9667.

Kim S, Roubini N (2000). Exchange Rate Anomalies in the Industrial Countries: a Solution with a Structural VAR Approach. J. Monet. Econ. 45(3):561-586.

Koop G, Korobilis D (2010). Bayesian Multivariate Time Series Methods for Empirical Macroeconomics. Foundations and Trends in Econom. 3(4):267-358.

Litterman RB (1980). A Bayesian Procedure for Forecasting with Vector Autoregressions. Unpublished mimeo. Massachussets Institute of Technology.

Mallick KS, Sousa R (2009). Monetary Policy and Economic Activity in the BRICS. NIPE Working Paper Series 27.

Migliardo C (2010). Monetary Policy Transmission in Italy: A BVAR Analysis with Sign Restriction. AUCO Czech Econ. Rev. 4(2):139-167.

Mishkin F (2007). Housing and the Monetary Transmission mechanism. Proceedings Federal Reserve Bank of Kansas City. 359-413.

Montiel P, Ostry J (1991). Macroeconomic Implications of Real Exchange Rate Targeting in Developing Countries, Int. Monetary Fund Staff Paper 38(4):872-900.

Sims CA, Zha T (1998). Bayesian Methods for Dynamic Multivariate Models. Int. Econ. Rev. 39(4):949-968.