THE IMPACT OF MONETARY POLICY ON ECONOMY

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Abstract: Monetary policy represents one of the most powerful instruments of economic policy, via which economy is acted upon. The transmission mechanism is precisely the process via which monetary policy decisions move economy as a whole. From the central bank's point of view, the transmission of monetary policy to the economy is of distinguished interest among various topics of macroeconomics. Without being aware of the monetary transmission mechanism it is not possible to conduct good policy. This paper applies the identified VAR methodology to synthetic national data from 2000 till Q2 2007 to study the macro-economic effects of an unexpected change in monetary policy in Romania.

1. Introduction

Monetary policy represents one of the most powerful instruments of economic policy, via which economy is acted upon. The transmission mechanism is precisely the process via which monetary policy decisions move economy as a whole. In a simplistic approach, we could say that an increase in the currency offer ultimately determines an increase in the aggregated demand and thus, via various channels, an increase in GDP. One aspect on which most economists agree is the fact that movement is produced at certain time lags that are, regularly, long and variable. In order to fulfil monetary policy objectives, it is very important to know well the monetary policy transmission channels and mechanisms, so that the monetary authority could make the best decisions.

Starting from these premises, the current article tries to analyse the monetary policy transmission mechanism in the Romanian economy by using the VAR model (Vector Autoregressions). The VAR methodology is very often used in estimating the effects of the monetary policy on production and prices, and of the monetary policy transmission mechanisms, in the '90s. The use of VAR models started with *Sims'* work *(1980)*. Recently, *Leeper, Sims and Zha (1998)* and *Christiano, Eichenbaum and Evans (1999)* created a synthesis of the numerous reference works on monetary policy transmission mechanisms in the United States of America. In Europe, the VAR methodology was frequently used to analyse the differences at the level of the Euro zone member states regarding monetary policy transmission mechanisms. The results of these analyses are summarised in *Angeloni, Kashyap and Mojon (2003)*.

At the level of the Romanian economy, the problematics of the monetary policy transmission mechanisms was approached by *Antohi, Udrea and Braun (2003)* who attempted to identify the main characteristics of the monetary policy transmission mechanisms in Romania. The analysis of the two segments of the monetary transmission mechanism, namely the transmission of monetary policy impulses on financial variables and, respectively, the connexion between the financial sector and the real economy, is done by distinct methods. For the first segment of the monetary transmission mechanism, they resorted to an empirical evaluation based on the use of a Vector Error Correction methodology. Its results, however, were not very relevant due to a short series of available data. The results of the empirical analysis show that the

National Bank of Romania (NBR) directly influences interest rates practiced by banks for term deposits, via the interest rate of the sterilisation operations. Instead, the interest rate of bank credits does not seem to be directly sensitive to the NBR interest rate but to the interest rate of bank deposits.

In the case of the second major connexion, due to the incipient stage in the formation of NBR's monetary transmission mechanism, the authors designed a theoretical and intuitive approach that highlights the fact that the formation of traditional monetary impulses transmission channels is at an incipient stage due to the long process of eliminating financial intermediaries that the Romanian economy has been familiar with. Under these circumstances, the exchange rate channel, together with the NBR foreign currency purchase channel, continue to represent significant ways via which the operations of the monetary authority impact macroeconomic behaviours. Beginning with the year 2000, the authors noticed the reactivation of the credit channel and especially of the interest rate channel. However, the good operation of the credit channel continues to be undermined by the existence of liquidity excess in the system, by the phenomenon of national currency credit substitution with foreign currency credits, as well as by manifestations of moral hazard.

Although the VAR methodology is very often used in empirical analyses, its results are not generally accepted. This is so because the evolution of prices has featured the highest volatility among model variables while, as *Christiano, Eichenbaum and Evans (1999)* argue, the answer function to shock monetary policy whose variables, such as total production, was insignificant. In addition, it is useful to mention here that all VAR analyses contribute to the identification of monetary policy shocks (shocks regarded as unexpected deviations from the natural flow of the monetary policy, innovations) and to the quantification of their consequences; yet, they do not refer to the impact of the systematic component of the monetary policy on production or price level.

On the other hand, the effort to identify monetary policy shocks and the quantification of the effects of these shocks via the VAR analysis represents one of the few methods to understand the dynamics of the economy.

2. Monetary policy transmission channels

Over the last years most central banks in the emergent countries or countries in transition have developed or are developing structural models of the monetary policy transmission mechanism. An important element that must be considered in the case of these countries is the modification, sometimes even radical, of the monetary policy transmission channels as a result of the quick evolution of financial markets and of their integration in international markets. The construction of models can prove hard to achieve and even inefficient if there are no studies that have researched in advance the various monetary transmission channels, not only from a theoretical point of view, but also empirically.

Any decision at the level of monetary policy is transmitted in economy via several transmission channels, but their relative importance, as well as the system's general behaviour, depend very much on the specific features of the respective national economy, as well as on the structure of the financial system (market-based or bank-based) and the existing legal framework.

The importance of the financial structure is supported by an ample series of studies (for instance *Cecchetti (1999*)). Variations in the structure of the financial system lead to different responses to decisions and monetary policy modifications, both from the

point of view of how ample the response is, as well as from the point of view of the time interval needed for the emergence of this response. It is obvious that not all companies feature the same sensitivity to interest rate changes, and there are differences both in the same industrial sector and from one sector to another. Also, not all companies depend, to the same extent, on bank credit. A proof of these differences is the Euro zone. Numberless researchers (*Cecchetti (1999), Angeloni et al. (2003))* show that there are differences in monetary policy transmission channels from one country to another, although significant steps have been made in order to integrate the goods and services market, to apply levelled financial and monetary policies, and to synchronise economic cycles. These asymmetries among member countries of the monetary union makes the task of the European Central Bank much more difficult. The source of asymmetries that are characteristic to the financial structure is mainly the difference in the legislative framework (*Cecchetti 1999)*. But this is not all: a significant role is played by the different character of financial markets.

3. VAR Analysis of the monetary policy transmission mechanism

There is a large number of studies that use the Autoregressive Vector method in the analysis of macroeconomic effects of unexpected exchanges in the monetary policy interest, by the monetary authority, in the European Union countries. The use of VAR models started with *Sims'* works *(1980)*. Recently, *Leeper, Sims and Zha (1998)* and *Christiano, Eichenbaum and Evans (1999)* summarised numerous significant works concerning monetary policy transmission mechanisms in the United States of America. In Europe, the VAR methodology was frequently used for the analysis of differences, at the level of the Euro zone member states, regarding the monetary policy transmission mechanisms. The results of these analyses are presented in *Peersman and Smets (2001*) and *Mojon and Peersman (2001)*.

Over the last years several materials on monetary transmission mechanisms in the Central and Eastern European countries, have been written, see *Creel and Levasseur (2004), Egert and MacDonald (2006)* and *Darvas (2005)*. At the level of Romania's economy, the problematics of the monetary policy transmission mechanisms was approached by *Antohi, Udrea and Braun (2003)* who attempt to identify the main characteristics of the monetary transmission mechanisms in Romania.

a) Methodology used

The models used in the VAR analysis of the effects of monetary policy shocks, using Romania as a case study, are based on the model developed by *Peersman and Smets (2001*) and *Mojon and Peersman (2001)*.

*C*onsidering the position of the Romanian economy among the other European economies, namely that of an open economy, of a relatively independent monetary policy, we have estimated two VAR models described as follows:

$$Y_t = A(L)Y_{t-1}+B(L)X_t+\mu_t, \quad (1)$$

where Y_t – the endogenous variables vector, X_t –exogenous variables vector.

The exogenous variables vector contains the world comodities index (wpi), the real GDP for the Euro zone (y_eu12), the consumer price index in the Euro zone (cpi_eu12) and the domestic nominal short-term interest rate in the Euro zone (i_eu12)

$$X't = [wpi \;\; y\_eu12 \;\; cpi\_eu12 \;\; i\_eu12], \quad (2)$$

These variables were included so as to control changes in total demand and inflation at European level. The inclusion of these variables helps us solve the so called "price puzzle". By treating these variables as exogenous, we implicitly consider that

national variables do not influence variables at European level and we consider the current impact of exogenous variables on endogenous variables.

In the first model, the national endogenous variables vector (Y_t) includes the real gross domestic product (GDP) (y), the consumer price index (cpi) at the level of the Romanian economy, the effective short-term interest rate (i_ef) and the effective exchange rate (s) of the RON versus EUR and USD, calculated as a weighted average of the USD/RON(30%) and EUR/RON (70%) exchange rates.

$$Y'_t=[y \ \ cpi \ \ i\_ef \ \ s], \quad (3)$$

In the second model we also include the M2 monetary aggregate in the endogenous variables vector. The inclusion of the M2 monetary aggregate, can help us identify monetary policy shocks. In this case the endogenous variables vector is:

$$Y'_t=[y \ \ cpi \ \ i\_ef \ \ s \ m2 \ ], \quad (3')$$

In both cases the monetary policy shocks are identified by a standard Choleski decomposition with variables ordered as in (3) and (3').

The VAR model described by the equation (1) represents the reduced form of the system, a form that is derived from the VAR model that allows simultaneous influences among variables. The initial model can be represented as follows:

$$KY_t = AY_{t-1} + BX_t + \varepsilon_t, \ (4)$$

where:

the K matrix comprises all coefficients that describe simultaneous relations among variables; the A matrix comprises all coefficients that describe relations of certain lags among variables; matrix B comprises all coefficients that describe relations among endogenous and exogenous variables; ε comprises errors.

By multiplying the ARV system with the inverse of the matrix $K^{(-1)}$ we obtain:

$$Y_t = K^{(-1)}AY_{t-1} + K^{(-1)}BX_t + K^{(-1)}\varepsilon_t, \quad (5)$$

which can be rewritten under the simplified form in the equation (1).

$$Y_t = A(L)Y_{t-1}+B(L)X_t+\mu_t, \ (1)$$

where : $a = K^{(-1)}A$;
$b = K^{(-1)}B$;
$\mu = K^{(-1)}\varepsilon$.

The recursive Choleski type method is an identification of ε_t initial shocks by using the μ_t error vector. We can identify $\varepsilon_{t,}$ the initial shocks, via the recursive method only if we suppose that there are precisely $n^2 - [(n^2 - n)/2]$ simultaneous relations among variables, where n represent the number of endogenous variables. This supposes that the recursive method requires $(n^2 - n)/2$ supplementary restrictions in our model. This aspect can be solved by imposing a triangular structure to the K matrix with all elements above the main diagonal vector equal to zero. Thus we can choose an order of the endogenous variables that should reflect the situation in the economy.

The basic hypothesis in these models is constituted by the fact that, in a short term perspective, interest, exchange rate and monetary aggregate shocks do not have a contemporary impact on the consumer price index and on total production because of the weak reaction of the real sector to shocks in the monetary and financial sector. The interest rate reacts simultaneously to a total production and prices shock, which can be interpreted as a reaction function of the monetary authorities to shocks that affect the real sector. The exchange rate is immediately influenced by all types of shocks, except for a shock of M2, the monetary aggregate, in the case of the second model.

b) Used Data

In the analysis of monetary policies transmission mechanisms in Romania we have used monthly data gathered between January 2000 and June 2007. The data were seasonally adjusted, except for the exchange rate and interest rate, logarithmated and multiplied by 100, except for the effective interest rate variable.

The augmented Dickey-Fuller tests have proved that endogenous variables used in the model are non-stationary. We have chosen the use of the VAR model with variables expressed in levels (of initial specification), and not in differences, because some variables tend to be integrated of order 2 - I(2) - and there is co-integration among variables expressed in levels. The same methodology was used by *Peersman and Smets (2003), Darvas (2005), Vonnák (2006)* and *Arnoštová and Hurník (2005)*.

The choice of the number of VAR lags was grounded on the results of the error minimisation criterion given by Schwartz. According to this criterion, the chosen number of lags is 1.

c) Results of the estimation

Figure 1 shows the effects of a monetary policy shock, of standard deviation, on the real GDP, prices and the exchange rate, with a degree of trust of 95,44%, in the case of the first ARV model used.

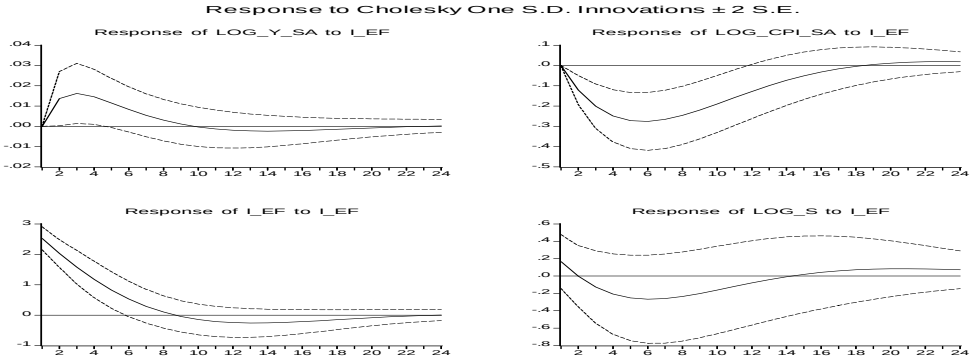

Fig. 1 The response of Y, CPI, I_EF and S variables to a monetary policy shock

The main effects of a monetary policy shock are:

- ✓ An unexpected increase of the effective short term interest rate is accompanied by a decrease of the consumption prices index. This decrease reaches the highest amplitude after 6 months;
- ✓ Also, the exchange rate registers a decrease, that is equivalent to the appreciation of the national currency, that reaches the maximum level after 6 months;
- ✓ GDP's response is not significant from a statistical point of view (the trust level includes level 0) and is contrary to intuitive analysis

In the case of the second ARV model (which differs from model 1 by introducing the M2 variable in the endogenous variables vector), we can notice that the results are similarly to those in the first model. An unexpected increase of the effective short term interest rate is accompanied by a simultaneous decrease of the monetary aggregate M2.

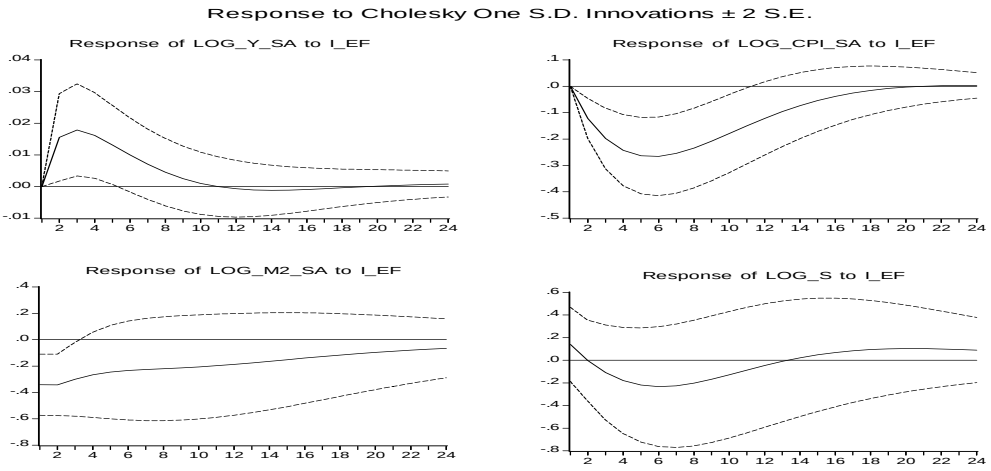

Fig. 2 The response of the Y, CPI, M2 and S variables to a monetary policy shock

In figure 3 we can notice that only a small proportion of the GDP variation is determined by an interest rate shock, irrespective of the time frame considered. The largest proportion of the GDP variation is determined by innovation (over 85%, irrespective of the time frame considered). A percentage of 40,48% from the CPI variation, over a 12 months, is explained by monetary policy shocks.

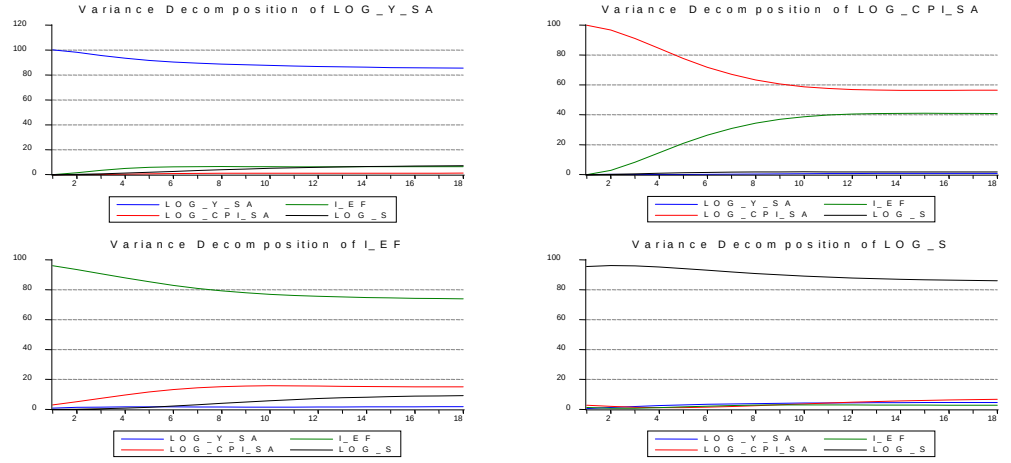

Fig. 3 (Variance) dispersion decomposition in model 1

Figure 4 shows the results of the decomposition of the dispersion of the five endogenous variables. One can notice that in this case, just in the previous model, a very large proportion from the CPI variation is determined by monetary policy shocks. The variation of the monetary aggregate is determined to significant proportions by exchange rate shocks. The GDP variation is determined, in this case as well, to very large proportions, irrespective of the time frame considered, by own innovations.

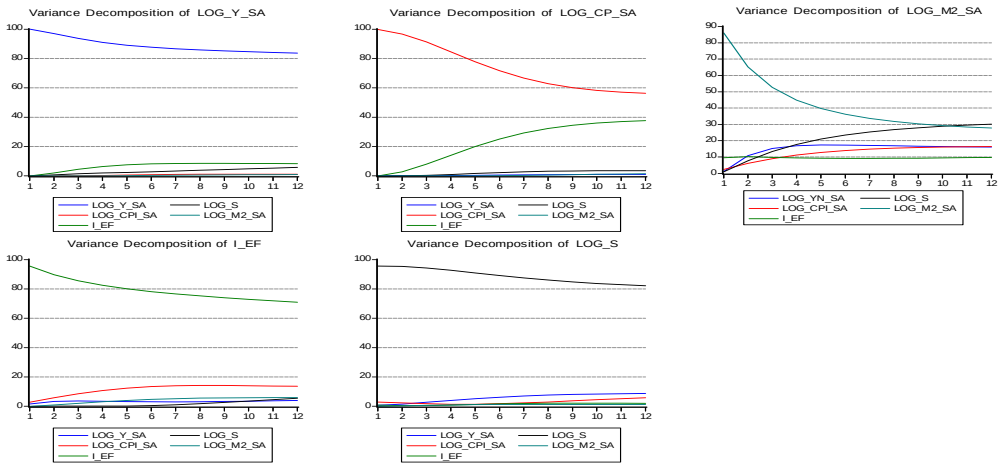

Fig. 4 Dispersion (variance) decomposition in model 2

By applying the Granger causality tests it is confirmed that *i_ef does Granger causes CPI* , but the hypothesis that *i_ef does not causes in the sense of Granger Y* is not refuted. On the contrary, the hypothesis that *Y does not Granger causes i_ef* is refuted. According to tests, CPI and M2 does Granger causes Y, whereas the effective interest causes in the sense of Granger only CPI and the exchange rate.

d) The effects of a monetary policy shock on other macroeconomic variables

In this section we will analyse the effects of a monetary policy shock on several macroeconomic variables, which are not included in the basic models. This effect is quantified by extending the basic VAR model 2, so that $Y_t^{'}$, the endogenous variables vector, should include the new macroeconomic variables. The method is adapted after *Peersman and Smets (2003).*

We have checked the impact of a monetary policy shock on the following macroeconomic variables: FGCF = gross fixed capital formation; CHN = private consumption; IMP = import value at the level of the Romanian economy; EXP = export value at the level of the Romanian economy; M1 = monetary aggregate, m1, or the monetary amount in a limited sense; PRIV_LOANS = non-governmental credit.

These variables are introduced in the basic VAR model and we suppose that the new variables do not influence the variables in the basic model, but are influenced by them. The data are for the period 2000m1- 2007m06 and they were adjusted every season, logarithmated and multiplied by 100.

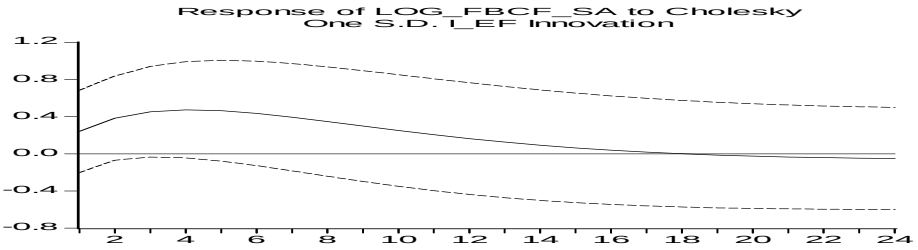

Fig. 5 The impact of a monetary policy shock on fix gross fixed capital formation variable (FGCF)

One can notice that the unexpected increase of the effective short term interest rate is accompanied, contrary to an inductive analysis, by the increase of the FGCF level.

This increase features reduced amplitude and reaches the maximum level in the fourth month.

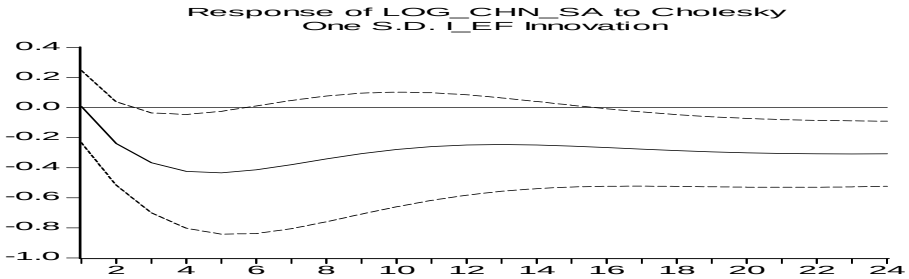

Fig. 6 The impact of a monetary policy shock on the private consumption (CHN) variable

A monetary policy shock is accompanied by the decrease of private consumption, which is in agreement with the theoretical and intuitive analysis. This decrease is due to the increase of real interests; thus, the cost of a loan increases for consumers and the population's tendency to save decreases, which leads to the decrease of the sums available for consumption.

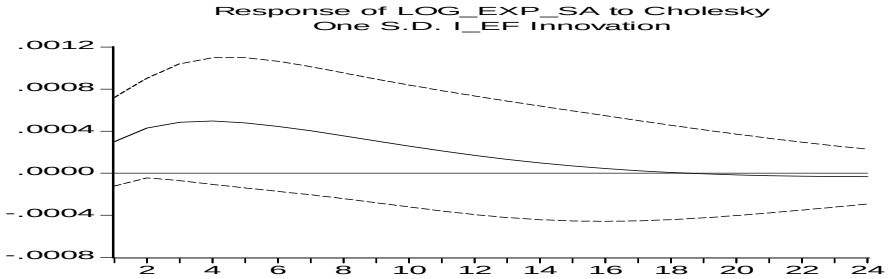

Fig. 7 The impact of a monetary policy shock on the exports (EXP) variable

In the case of a monetary policy shock the export levels slightly increase, which is contrary to the theoretical and intuitive analysis. This increase is of a narrow range and it can be due to the fact that the exchange rate reacts after a 1-2 months lag to a monetary policy shock .

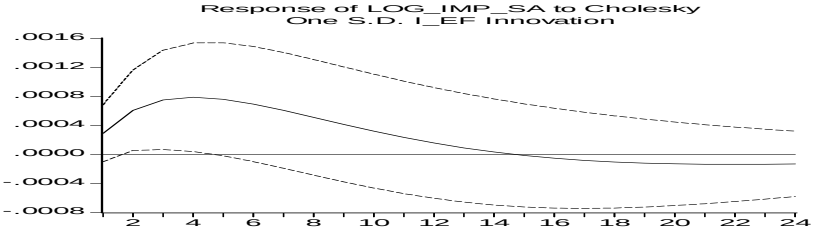

Fig. 8 The impact of a monetary policy shock on the imports (IMP) variable

From the chart above, which represents the imports response function to a monetary policy shock, one can notice that in the case of a monetary policy shock imports at the level of the Romanian economy register simultaneous increase. This increase reaches the maximum level during the fourth month after the shock. This

import increase can be due to the fact that imported products become cheaper by comparison with local products, due to the strengthening of the national currency.

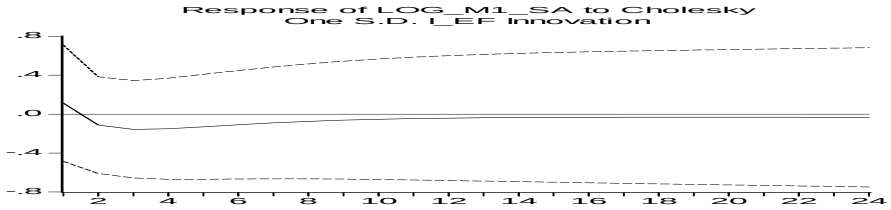

Fig. 9 The impact of a monetary policy shock on the M1 Variable

From the chart of M1's response function chart to a monetary policy shock we can notice the negative effect of an unexpected increase of the interest rate caused by the monetary policy on the monetary amount in a limited sense. This negative effect is not very significant and it is similar to the one on M2.

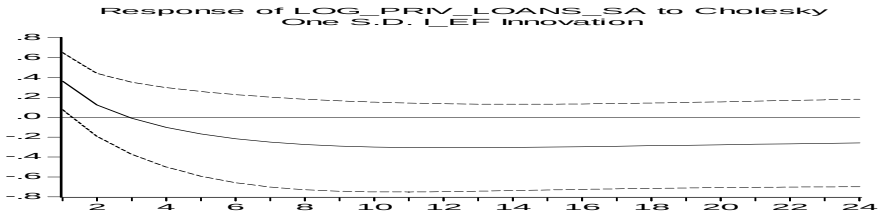

Fig. 10 The impact of a monetary policy shock on the non-governmental credit (PRIV_LOANS) Variable

One can notice that the unexpected increase of the effective short term interest rate is accompanied initially by the increase of non-governmental credit, followed by decrease after 3 months. This phenomenon can be due to the lag between the monetary policy interest increase and the decrease of interest for credits.

4. Conclusion

In this study we have aimed to analyse the monetary policy transmission mechanisms as a whole. The role and analysis of each transmission channel can constitute the topic of further research.

In the analysis of monetary policy transmission mechanisms we used the ARV methodology on the basis of two models that were identified. By using the Cholesky type recursive method to identify the response functions to a monetary policy shock, on the basis of data on the Romanian economy between January 2000 and June 2007, we have quantified the effects of an unexpected harshness of the monetary policy on the main macroeconomic variables.

On the basis of the analysis done we can conclude that the main effects of a monetary policy shock are:

- An unexpected increase of the effective short term interest rate is accompanied by a decrease of the consumption prices index. This decrease reaches the highest level after 6 months;

- Also, the exchange rate registers a decrease, that is equivalent with an appreciation of the national currency, that reaches the minimum level after 6 months;

- GDP's response is not significant from a statistical point of view and contrary to the intuitive analysis, it registers a slight increase after a monetary policy shock;

- An unexpected increase of the effective short term interest rate is accompanied, contrary to the inductive analysis, by an increase of the FBCF level;

- A monetary policy shock is accompanied by the decrease of private consumption;

- In the case of a monetary policy shock, imports at the level of the Romanian economy register simultaneous growth;

- An unexpected increase of the effective short term interest rate is accompanied by an initial increase of the non-governmental credit, followed by decrease after 3 months.

The results of the VAR analysis show, to a large extent, how monetary policies affect economy in general and how they must be interpreted in the context in which the Romanian economy was in the period analysed, namely an economy in transition, with a high inflation at the beginning of the period analysed and with major changes in the monetary policy. We referred to the passage to the direct targeting of inflation.

REFERENCES

1. Angeloni, I.; Kashyap, A. and Mojon, B. (2003) *Monetary Policy Transmission in the Euro Area,* Cambridge University Press;

2. Antohi, D.; Udrea, I. and Braun, H. (2003) *Mecanismul de transmisie a politicii monetare în România*, Caiete de Studii BNR, Nr. 13;

3. Arnostova, K.; Hurnik, J (2005) *The Monetary Transmission Mechanism in the Czech Republic (evidence from VAR analysis)*, CNB Working Paper Series;

4. Boţel, C (2002) *Cauzele inflaţiei în România, iunie 1997 -- august 2001. Analiza bazată pe Vectorul Autoregresiv Structural*, Caiete de Studii BNR, Nr. 11;

5. Cecchetti, S (1999) *Legal Structure, Financial Structure, and the Monetary Policy Transmission Mechanism*, FRBNY Economic Policy Review;

6. Christiano, L., Eichenbaum, M. and Evans, C. (1999) *Monetary Policy Shocks: What Have We Learned and To What End?* in Taylor, J., Woodford, M., eds., *Handbook of Macroeconomics.* North Holland;

6. Creel, J; Levasseur, S (2004) *Monetary policy transmission mechanisms in the CEECs: How important are the differences with the euro area?* http://ssrn.com/abstract=826284;

7. Darvas, Z (2005*) Monetary transmission in the new members of the EU: Evidence from time-varying coefficient structural VARs*, *http://www.ecomod.net/conferences/ecomod2005/ecomod2005_papers.htm;*

8. Égert, B.; Macdonald, R (2006) *Monetary Transmission Mechanism in Transition Economies: Surveying the Surveyable*, MNB Working Papers;

9. Leeper, E.; Sims, C. and Zha, T. (1998), *What Does Monetary Policy Do?* Brookings Papers on Economic Activity, (2), pp.1–78;

10. Mojon, B.; Peersman, G. (2001), *A VAR Description of the Effects of Monetary Policy in the Individual Countries of the Euro Area*, European Central Bank, Working Paper No. 92;

11. Obstfeld, M, Rogoff, K (1995) *The mirage of fixed exchange rates*, Journal of Economic Perspectives 9;

12. Peersman, G.; Smets, F. (2001), *The Monetary Transmission Mechanism in the Euro Area: More Evidence from VAR Analysis*, European Central Bank, Working Paper No. 91;

13. Sims, C. (1980), *Macroeconomics and Reality*. Econometrica, 48(1);

14. Sims, C, Zha, T (1998) *Does monetary policy generate recessions?*, Federal Reserve Bank of Atlanta, Working Paper 12;

15. Vonnak, B. (2006) *Estimating the effect of Hungarian monetary policy within a structural VAR framework*, MNB Monetary Transmission in Hungary.