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# MONETARY POLICY TRANSMISSION MECHANISM IN EMERGING COUNTRIES

Empirical  
study

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## Keywords

*Monetary policy*  
*Transmission mechanism*  
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## Abstract

*The transmission channels of monetary policy are used by central banks to accomplish the main objective of price stability in the context of sustainable economic growth. The importance of interest rate and exchange rate channels for the emerging countries Romania, Poland, Czech Republic and Hungary is analyzed by using Bayesian VAR approach with Diffuse priors over 1998Q1-2012Q3. Main result of the empirical study is that both channels are effective for the monetary policy transmission mechanism in Hungary and Czech Republic. In Romania and Poland they do not exhibit puzzles, but the impact of the macroeconomic variables is not very significant and shows very high volatility. In the context of monetary integration, exchange rate channel will become irrelevant when these countries adopt Euro currency. This change will lead instead to a powerful interest rate channel.*

## INTRODUCTION

The purpose of this research is to analyze the importance of the monetary policy transmission channels for the following emerging countries: Romania, Poland, Czech Republic and Hungary. The results are aimed to show whether the interest rate channel or the exchange rate channel has more influence on the evolution of the macroeconomic variables after an unexpected raise in the monetary policy interest rate. These countries were chosen to be part of this study because they intend to adopt the common European currency in the near future. As a result, the monetary policy strategy will be subject to changes and the above mentioned two channels won't have the same impact as they currently do.

The section *Monetary policy and current macroeconomic environment* describes the importance of a very good understanding regarding the transmission mechanism. The next section *Transmission channels and special features for each emerging country* offers general information regarding the functioning of interest rate and exchange rate channel and also a description of some special features for each one of the emerging country from the sample. Details about data transformation, general aspects regarding Bayesian Vector Autoregressions and impulse-response functions are described in section *Empirical evidence*. The final section concludes and provides ideas for further research.

### **Monetary policy and current macroeconomic environment**

The transmission of monetary policy to the economy is a subject of particular importance from the central's bank point of view. Without being aware of the monetary policy transmission mechanism, it is not possible to conduct good policy. The ultimate objective of economic policy is to achieve high and sustainable economic growth in the long run. From the central bank's point of view, this goal can only be achieved, by controlling inflation level and stability through the conduct of a credible and transparent monetary policy.

Price stability is defined as that level of inflation that does not negatively affect the

decisions of the economic agents such as investment and savings decisions. Based on classical and Keynesian theories, economic growth is mainly determined by demand factors in the short term while in the long term, the supply side has the main impact on the evolution of the economy. In order to smooth out fluctuations in output and inflation, monetary policy can only influence the demand, while in the long run, it has no impact. Realizing these imitations of the impact of monetary policy alongside the costs of inflation, an increasing number of countries define price stability as the ultimate objective of monetary policy.

Due to several crises that took place in the mid 1990s and demonstrated the increased vulnerabilities generated by fixed exchange rate, targeting the exchange rate fell out of favor and by 2005, inflation targeting become the most common monetary policy regime in emerging countries. As a consequence, fixed exchange rate and monetary targeting regimes were replaced by inflation targeting regimes with an exponentially growing rate.

Price stability is defined as low, but not zero, inflation rate. The need for positive nominal interest rate comes from to the risk of deflation. Based on these considerations, price stability is set around two-tree percent by the majority of central banks with inflation targeting regimes. The definition of European Central Banks regarding price stability establishes a level below two percent, but close to this level, over the medium term. There had been disapprovals during time regarding this definition, but it was finally accepted. A definition for the meaning of medium term does not exist, but this allows for an adjusting period according to the shock that the economies are subject to.

The global economy situation over the recent years is characterized by strong shocks. These shocks affected the macroeconomic conditions and inflation developments in most countries in the context of global integration and free movements of capital. Increased risk aversion, volatility of asset prices and exchange rates, increased indirect tax rates as a consequence of growing public debt shape the

image of the economy and contributed to a rise in inflation in many economies.

The shocks that lead to exchange rate depreciation in recent years, in emerging countries, are mostly due to the weakening of the economic situation abroad. Same factors had a decreasing effect on exports and, as a result, on the economic growth of the home countries. This situation has a contrary impact on the evolution of inflation level therefore the risk over inflation is mitigated. A very important aspect that should be considered as a consequence of the global financial situation is that monetary policy should also focus on limiting the risk implied by the worsening situation of financial system when striving to fulfill its goal of a stabilized level of inflation on the medium term.

#### **Transmission channels and special features for each emerging country**

The mechanism through which the monetary policy influences the economy is a two-step mechanism. First, monetary policy determines the behavior of market interest rates, exchange rate, asset prices, credit supply of the commercial banks and the expectations through policy rate. Second, demand, supply and the labour market will react based on the measures implemented in the previous step.

#### **Transmission channels for monetary policy**

There are a number of ways through which monetary policy actions may have an impact on output and inflation. Among these various channels, the most common used in qualitative and quantitative research are the interest rate channel, the asset prices channel, the exchange rate channel, the credit channel and the expectation channel. Monetary transmission in the emerging economies is mainly accomplished through the interest rate and exchange rate channels.

**interest rate channel.** is based on the relation between the short-term interest rate and domestic demand (consumption and investments).

In the first stage, the policy rate passes through to commercial banks rate and then, to household deposit and loan rate. It determines the short term yield curve for maturities ranking between overnight and two weeks or one month. From this point of view, monetary policy rate is

seen as a cost of opportunity for excess liquidity and influences directly the money market interest rate for same maturities. Expectations regarding future values of short-term interest rates are very important for the evolution of rates in the long-run.

In the second stage, an increase in the nominal rate of interest translates into an increase in real rate of interest and the cost of capital. This leads to a drop in the consumption growth rate according the theory of inter-temporal consumption substitution and liquidity constraints of householders. Also a higher level of cost of capital resulting from an increase in the interest rate lowers down the investment demand because of a reduced wish of investors for capital input.

Both consumption and investments evolutions lead to a fall in aggregate demand and, as a consequence, enterprises cut both wages and employment in order to regain the equilibrium between costs and prices based on an optimal labour input in relation to the level of output.

**exchange rate channel.** The empirically most challenging step of the exchange rate channel is the response of the exchange rate to interest rate movements. This is the first step of this channel. The theoretical modeling assumption behind the above mentioned relationship is the uncovered interest rate parity. An unexpected interest rate increase causes the spot exchange rate to appreciate.

The second step in exchange rate channel is related to the existing relation between domestic prices and exchange rate. For small open economies, the general agreed view is that price evolution is impacted by the tradable sector which strongly reflects the exchange rate movements. The exchange rate pass through to domestic variables was investigated in numerous papers. An issue that may rise is that the pass through coefficients estimates are not conditioned to a specific shock, therefore they may be considered as an average across the possible sources of shocks and not necessary generated by monetary policy.

#### **Special features for the emerging countries**

The interest rate channel and the exchange rate channel are very important channels for

monetary transmission policy for emerging countries. The study of their importance for Hungary, Czech Republic, Poland and Romania is motivated by the future adhesion to the European Monetary Union, being already members of European Union. The impact of this adhesion is double sided, just as described by Jérôme and Levasseur (2005) [1]. The first issue to be considered is the impact of the differences regarding monetary policy transmission mechanism between the members of the European Monetary Union and the new ones, on the behavior of the European Central Bank. An over-restrictive monetary policy decision may be adopted. The second issue of interest is that the differences between the monetary policy transmission mechanism between European Monetary Union members and forthcoming ones may slow down the real convergence process and may have destabilizing consequences on the whole European Union project.

The understanding of the monetary transmission mechanism in Hungary has been, until recently, mostly based on qualitative research. In the first part of 2004, the Magyar Nemzeti Bank launched a research project with the objective of providing quantitative results.

Hungary is a country with open capital market, with an important presence of foreign investors, which leads to interest rate and exchange rate being strongly influenced by the risk preferences of these investors. Therefore these two channels are of major importance for the monetary policy transmission mechanism. Tradable good prices and exchange rate are highly correlated. For this reason, a special attention is paid to exchange rate channel.

Most results of the analysis undergone lately indicate a slowdown of the economy after monetary tightening, as described by Vonnák (2008) [2]. This tightening is referred to as an increase in the interest rate or an appreciation of the exchange rate. The characteristics of new-Keynesian economy with sticky prices is: after a shock in the monetary policy, volumes react quicker, which means that gross domestic product response leads the price response. The behavior in Hungarian economy is not completely explained by this statement. The response of output is less than the response of interest rate, the reaction of prices is faster.

Most of the qualitative investigation is done using short term money market rate as policy rate instead of central's bank rate, one of the reasons being the lack of higher-frequency data. A more important reason is that short term interest rate contains more information like expectations about movements in the near future. Moreover, for a monthly or quarterly frequency, the policy rate and the three month market rates are strongly correlated.

Hungarian monetary policy has paid a special attention to changes in the exchange rate, due to the fact that there is a strong connection between tradable good prices and exchange rate movements. There is also empirical evidence that during the last years, monetary policy has been able to influence the exchange rate, an unexpected rise in the interest rate leading to immediate appreciation of the exchange rate.

Inflation targeting regime was implemented in Hungary in June 2001 and at that specific time the target was set for the period December 2001 – December 2002. Between 2001 and 2005 the target was set for a period of one year, two years before. In 2005, the central bank decided that, starting with 2007, the target should be set for the medium term and a level of three percent was set. It was also decided that after a period of three-five years, the level can be changed and during the first review from 2008, a decision was taken to keep the level of three percent for the medium term.

Czech National Bank joined the group of inflation targeting central banks at the beginning of 1998. Due to the crises of Czech koruna in 1997, monetary regime switched from monetary targeting and fixed exchange rate to inflation targeting. The role of exchange rate channel gained important significance when the exchange rate fluctuation band was widened. The monetary policy could have further been conducted through monetary targeting, but short term interest rate proved its importance even before the switch to a floating exchange rate.

The current model used for inflation forecasts is based on a small calibrated macroeconomic model and short term forecasts are based on expert forecasts. More details are provided by Niedermayer (2008) [3]. An important challenge in modeling the inflation process comes from the relatively high exchange

rate volatility. In the period preceding 2001, inflation target as set one year before and for a period of one year. Between 2001 and 2006, the target level was set to decreasing values in the short-run and during the period 2006 and 2009, the target was set to three percent. Since 2010, the National Central Bank of Czech Republic has been following an inflation target of two percent and it is aiming to keep this target until the adoption of the common European currency.

The core forecasting model of the National Central Bank of Poland is a quarterly macroeconomic model and it is operational since May 2005, as described by Pruski and Szpunar (2008) [4]. The theoretical foundation is based on both classical and Keynesian theories. This is a characteristic of most of the macroeconomic models used by central banks. The behavior of the economy is shaped by demand factors in the short-run, while in the long-run it is determined by the supply side. Monetary transmission in the core forecasting model is focused on the interest and exchange rate channel, same as for the other countries that were considered.

A very important concept for core forecasting model in Poland is cost-push inflation. Inflation is quantified through several indicators, but the core consumer price inflation index is most relevant. In this context, costs of production factors and also demand factors are main determinants of price levels. Demand higher than supply results in price level increase and vice-versa demand lower than supply results in price level decrease. Inflation targeting regime was adopted in Poland in 1998. In 2004, the National Central Bank established the inflation target for the long-run at a level of two and a half percent.

Inflation targeting was adopted in Romania in 2005 after a 16 months process of intensive preparation regarding the organizational and technical framework. Two different stages can be identified based on the level of the targeted inflation defined by the National Central Bank of Romania. First stage is characterized by decreasing levels of inflation targets for a period of two years between 2005 and 2012. This approach is justified by the necessity of reaching annual levels of inflation that were sustainable in the medium-run. Second stage is characterized by defining stationary

multiannual targets of inflation, starting with 2013. This approach is compatible with the European Central Bank view regarding price stability.

It is well known that a low level of inflation is not a sufficient condition for ensuring financial stability in the long-run. Therefore, all measures taken in order to reach the target should be established in a way that does not have a negative impact on financial stability and on the evolution of all macroeconomic variables.

Since these countries became members of the European Union, due to capital account liberalization, they have been confronted with massive capital inflows. As a consequence, exchange rate channel is of major importance for all of them.

### **Empirical evidence**

An econometric analysis is also undergone on the sample of the emerging countries described before regarding the transmission mechanism of monetary policy. Multivariate time series models such as VAR models, factor augmented VAR and time varying parameters versions of these models are frequently used by researchers.

One way to uncover the transmission of the monetary policy is by using structural vector autoregressive (SVAR) approach, the advantages brought by this method being represented by imposing the minimum amount of restrictions needed to identify the source of variation in a monetary policy, the system of equations capturing only the relevant macroeconomic dynamics. Structural VAR methodology has been largely applied, key of early implementation being Bernanke and Blinder (1992) or Sims (1992). These methods, generally deliver empirically plausible assessments of the dynamic response of key macroeconomic variables to monetary policy innovations and they have been widely used.

*Jérôme Héricourt* (2006) [5] analyzed if eight countries from non-euro area (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia) can be successful integrated in euro area. The purpose of the papers is to show the importance of the three transmission channels of monetary policy (interest rate, exchange rate and credit channel)

over 1995:1 – 2004:9. The exogenous variables vector includes EU-15 industrial production and money market rate, as well as broad commodity price index. The endogenous variable vector consists in industrial production, consumer prices, interest rate, nominal exchange rate. Monetary aggregate and domestic credit aggregate are alternatively included in the endogenous set to analyze the important role played by them. The results in each country show that monetary policy has similar to those from euro area analyzed by author in a previous article. The conclusion is that these countries can be successfully integrated in euro area.

*Marius Alin Andrie* (2008) [6] analyzed the transmission channels for Romania over 2000:1 – 2007:6. The exogenous variables vector includes world commodities price index, euro area real GDP and the consumer price index, also for euro area. In the first model VAR the endogenous variables vector, consists of real GDP, the consumer price index, the effective short-term rate and the effective exchange rate of the RON versus EUR and USD, computed as a weighted average of the USD/RON (30%) and EUR/RON (70%) exchange rates. For the second model he included the monetary aggregate M2 in the vector of endogenous variables. The results show that the interest rate shocks has significant influence on price levels for both models. Also, the level of exchange rate decreases. The response of production is not significant. The author also analyzed the effects of monetary policy shocks on other macroeconomic variables that were introduced in the first vector of endogenous variables: gross fixed capital formation, private consumption, import value for Romanian economy, export value for Romanian economy, monetary aggregate M1 and non-governmental credit. The conclusion is that after a shock in the interest rate level, the gross fixed capital formation level increases, the private consumption decreases, the import value decreases contemporaneously and the non-governmental credit decreases after a period of three months.

However, for small open economies, uncovering the transmission mechanism of monetary policy through this type of approach has proven to be an especially challenging task. In particular, initial VAR analysis has often

documented the presence of anomalies such as liquidity, price or exchange rate puzzles. The usual explanations for these puzzles are that some important variables are missing and that simple recursive identification scheme might not adequately identify these shocks.

Another issue raised by these models is the large number of parameters that have to be estimated. In order to overcome this problem of over-parametrization, Bayesian methods were developed. Shrinkage can be of great benefit and can take the form of imposing restrictions on parameters or shrinking them towards zero by prior information. The priors used in VARs differ and they can lead to analytical results for the posterior densities or Markov Chain Monte Carlo methods could be required to carry out Bayesian inference.

## DATA ANALYSIS

A set of eight variables was considered in order to complete the analysis. A short description of the variables can be found in appendix A. The Bayesian VAR is estimated using quarterly data over the period 1998Q1-2012Q3. Five of them are endogenous variables: gross domestic product, harmonized consumer prices index, the unemployment rate, the monetary interest rate and the nominal effective exchange rate. This order is kept when estimating the impulse response functions because structural shocks are recursively identified, by using the standard Choleski-decomposition. These assumptions assess that, in the short-run, shocks on interest rate and exchange rate have no contemporaneous impact on output, prices and unemployment due to a slow reaction of real sector to shocks in monetary and financial system. On the other hand, interest rate responds immediately to shocks in output and inflation. This response is seen as a response of monetary policy to shock in real sector.

Because all four economies are open and linked to other economies, their evolution is also impacted by variations of foreign factors. This aspect is considered by including exogenous variables such as gross domestic product of, the harmonized index of consumer prices and three-month money market interest rate, all of them

aggregated at the level of European Union comprising 27 countries.

Several transformations were done: gross domestic product, the measure of inflation and the exchange rate are used in logarithm. All series were seasonally adjusted, if needed and they were also verified for the existence of unit roots using Augmented Dickey Fuller (ADF) test and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test.

*Seasonally adjustment* of the series was done in Demetra+ by using TRAMO/SEATS method with RSA4 specification, which means that series as kept in level or in logarithm and the adjustment is done for working days, Easter and outliers by using an automatic model identification (Demetra+ automatically identifies and estimates the best Arima model) [7].

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

#### Several details regarding Bayesian VAR methodology

VAR(p) models can be written, as described by Koop and Korobilis (2009) [8][9], as:

$$y_t = \alpha_0 + \sum_{j=1}^p A_j y_{t-j} + \varepsilon_t \quad (1)$$

where:

- $y_t$  for  $t = 1 \dots T$  is an  $M \times 1$  vector containing observations on  $M$  time series variables

- $\varepsilon_t$  is an  $M \times 1$  vector of errors
- $\alpha_0$  is an  $M \times 1$  vector of intercepts
- $A_j$  is an  $M \times M$  matrix of coefficients
- $\varepsilon_t$  is assumed to be identically and independent distributed of normal distribution

with mean equal to zero and variance-covariance matrix  $\Sigma$

In matrix form, VAR can be written as:

$$y = (I_M \otimes X) \alpha + \varepsilon \quad (2)$$

where:

- $X = [x_1, x_2, \dots, x_T]'$  is a  $T \times K$  matrix,  $K = 1 + Mp$  is the number of coefficients in each equation of the VAR

- $x_t = (1, y_{t-1}, \dots, y_{t-p})'$

- $\alpha = \text{vec}(A)$  is an  $KM \times 1$  vector

- $A = (\alpha_0 \ A_1 \ \dots \ A_p)'$

- $\varepsilon \sim N(0, \Sigma \otimes I_T)$

The likelihood function can be derived from the sampling density  $p(y|\alpha, \Sigma)$  which can be divided in two parts: one corresponding to the distribution of  $\alpha$  conditional on  $\Sigma$  and the entire sample of observations and another one corresponding to the distribution of  $y$  conditional only on the sample of observation. It has a Wishart distribution:

$$\alpha | \Sigma, y \sim N(\hat{\alpha}, \Sigma \otimes (X'X)^{-1}) \quad (3)$$

$$y | \Sigma \sim W(S^{-1}, T - K - M - 1) \quad (4)$$

where:

- $\hat{A} = (X'X)^{-1} X'Y$  is the OLS estimate of  $A$

- $\hat{\alpha} = \text{vec}(\hat{A})$

- $S = (Y - X\hat{A})'(Y - X\hat{A})$

Natural conjugate priors have the property that prior, likelihood and posterior come from the same family of distributions. They have the large advantage that analytical results are available for posterior inference. However, it has drawbacks such as: it assumes that each equation has same explanatory variables, it restricts the prior covariance of the coefficients in any two equations to be proportional to one another.

Non-informative or diffuse priors are a particular case of natural conjugate priors. This setting leads to posterior results which are based on OLS quantities.

## RESULTS OF THE EMPIRICAL EVIDENCE

The pass through from short to longer maturities is fast in Hungary. The connection

between short-term money market *interest rate* and commercial banks rate is very strong, with the adjustment of corporate loan rates being the fastest. Although this pass through from short to longer maturities is found to be satisfactory, it is not necessary for an effective interest rate channel because the maturity of loans and deposits in Hungary is shorter than in developed countries and even if the maturity is longer in some cases, like corporate loans, the interest rate is linked to the three-month interbank rate.

This first step performs well and the further impact in aggregate demand evolution depends on the household and corporate sector.

Recent studies in Hungary demonstrate that the level of consumption does not decrease after a monetary contraction and one possible explanation is that the appreciation of the currency increases the wealth of households: the stickiness of nominal wages, the relatively quick exchange rate pass through and the lower level of inflation determined by the impact on the tradable prices lead to an increase in the real wage value.

Regarding the interest channel in Czech Republic, transmission between the policy rate and monetary market rates is quick, same as in Hungary. A different behavior is observed though regarding the transmission between money market rates and bank loan rates. For shorter maturities, interest rates adjust slowly, for medium maturities like three-years mortgage loans, interest rates adjust more quickly and for longer maturities up to ten years the adjustment is again not too significant.

The evolution of investments is opposite to the one of consumption. The reaction of firms is determined by the so-called profitability shock. After a positive sock in the interest rate level, the cost of capital increases and profitability decreases. The role of exchange rate is also important since investment goods are tradable. Therefore, the evolution of investment is likely to reflect both channels.

The results of the analysis of the interest channel are represented by the response of gross domestic product and inflation rate to a shock in the interest rate level. *The country level results are shown in Figure1 for Hungary, Figure 2 for Czech Republic, Figure 3 for Poland and Figure 4 for Romania.* The estimates are done in Matlab

by adjusting the source code provided by Koop and Korobilis. [10]

An unexpected rise of the interest rate leads to a decrease level of gross domestic product and inflation rate. Also the reaction of prices is faster. This behavior is explained by the opposite reaction of consumption which is determined by the relatively quick exchange rate pass through and the stickiness of the nominal wages.

The slightly different response of the gross domestic product to a shock in interest rate in Poland might be justified by the strong connection to Germany, Poland's main trading partner. The slowdown in economic growth in Germany is justified by the persistence of the consequences of the global financial crisis. Therefore it is advisable to adjust the VAR model by including a different variable that better reflects the strong link to Germany, or a variable that has a major impact for Germany's economic evolution.

In case of Romania, the impulse-response functions show strong volatility in the evolution of macroeconomic variables. This volatility is also justified by the exposure to external shocks and the instability of the global economy.

A decreasing level of demand coming from developed countries had a major impact on emerging economies, whose economic growth decelerated.

The reaction of *the exchange rate* to interest rate movements is also influenced by time-varying preferences. Therefore, investors require compensation not only for the loss in case of an expected depreciation, but also for holding domestic assets. The uncovered interest rate parity should be adjusted to consider an exchange rate risk premium if investors are risk-averse.

The results of the analysis of the exchange rate channel are represented by the response of exchange rate to a shock in the interest rate level. *The country level results are shown in Figure1 for Hungary, Figure 2 for Czech Republic, Figure 3 for Poland and Figure 4 for Romania.*

It can be concluded that during the past year, monetary policy has been able to influence the exchange rate: a negative response, which means an appreciation of the exchange rate after



a positive shock in the monetary interest rate. These results outline the importance of exchange rate channel for the sample economies.

Regarding the situation of the *labour market*, nominal wages are rigid, the bargaining power of trade unions and employees is weak compared to more developed European Union members. Nominal wages do not adjust immediately after a monetary policy shock, their response is lagged. One possible explanation could be that the disinflationary monetary policy is not entirely credible, the economic agents expecting the past level of inflation to return.

Also nominal wages decline slower than inflation rate and this behavior can be seen in the response of unemployment rate and inflation rate after a shock in interest rate. The unemployment rate returns quickly to the baseline. According to the estimates, lower employment pushes wages down and this allows firms to keep prices low even three or four years after the monetary shock.

These affirmations are particularly true for Hungary and Poland. In case of Romania, the sense of the response is correct, the difference is that it stabilizes faster and shows strong volatility in the evolution of macroeconomic variables, as it was already mentioned before. For Czech Republic, the impact of an interest rate shock to the unemployment rate leads to opposite response. It can be concluded that there might be other factors with greater impact on unemployment rate and further investigation needs to be done.

Both gross domestic product and inflation rate decrease after an increase in unemployment rate, the behavior being also in line with the theoretical point of view. *The country level results are shown in Figure 1 for Hungary, Figure 2 for Czech Republic, Figure 3 for Poland and Figure 4 for Romania.*

#### **Conclusions and further research**

Interest rate and exchange rate channel play a significant role in the monetary policy transmission mechanism for Romania, Poland, Czech Republic and Hungary. The exchange rate channel has a major impact for the short-run output and price effect of monetary policy. Due to the openness of the Hungarian and Czech economy, consumer prices react more quickly than in the euro area and even United States and

the response of output is smaller due to the lack of households' consumption response. Two special situations should be outlined. First, regarding the exchange rate channel in Poland, the evolution of the real exchange rate in the long run is determined by the major differences of potential output between Poland and its main trading partner, Germany. Second, impulse response functions in Romania show greater volatility in the evolution of the economy.

The interest rate and exchange rate channels are considered to be the most important channels for the monetary policy transmission mechanism in the sample emerging countries and for this reason they are incorporated in the core forecasting model of the each National Central Bank.

All four countries are members of the European Union. As a consequence, they are expected to adopt the common European currency. The adoption of euro supposes also that the most important channel will disappear. A question is rising of whether it is optimal for these economies to adopt euro and to remain without a possibility of smoothing shocks through this channel, which is the exchange rate channel.

It is pointed out though, that this change will lead instead to a powerful interest rate channel. One reason is that common monetary policy shocks in the euro area will influence each economy through foreign demand, which is now considered an exogenous variable. Another reason is that euro-denominated loans are impacted by European Central Bank's interest rate policy directly.

Further research might include the analysis of other variables such as gross domestic product components, monetary aggregates, as well as different priors for the Bayesian VAR approach. Also, for an evidence regarding the evolution of the monetary policy strategy, time-varying parameters VARs could be estimated. The role of the commercial banks as mediator between central banks and country economy could be a subject of debate.

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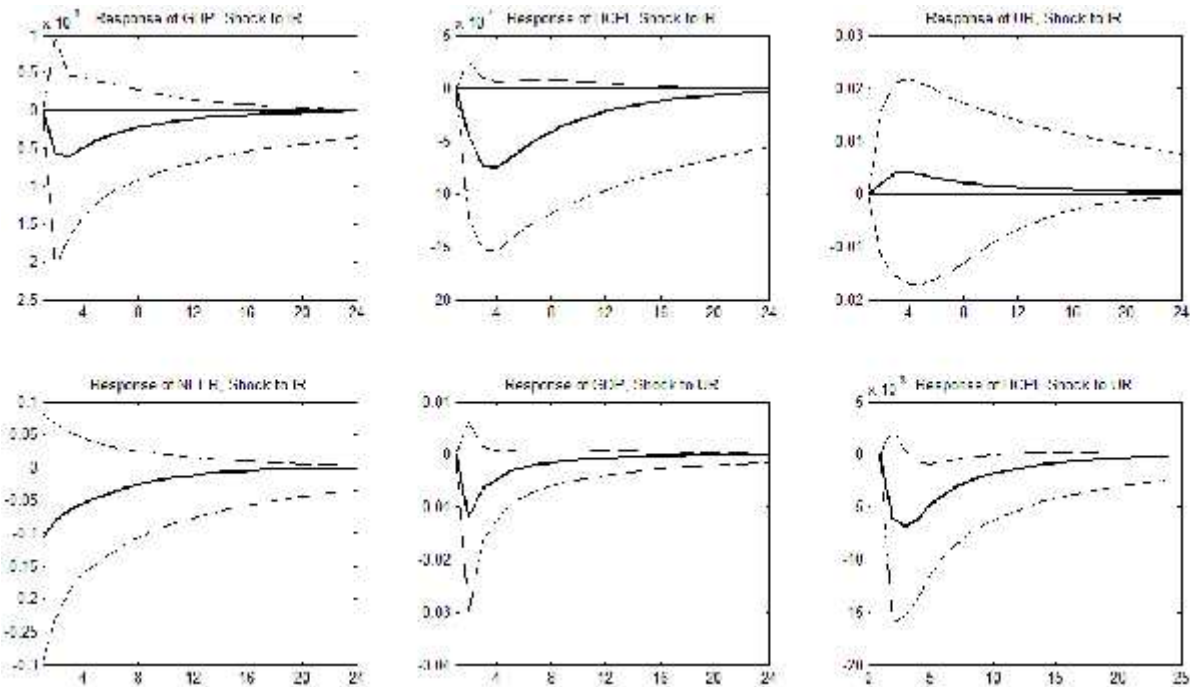
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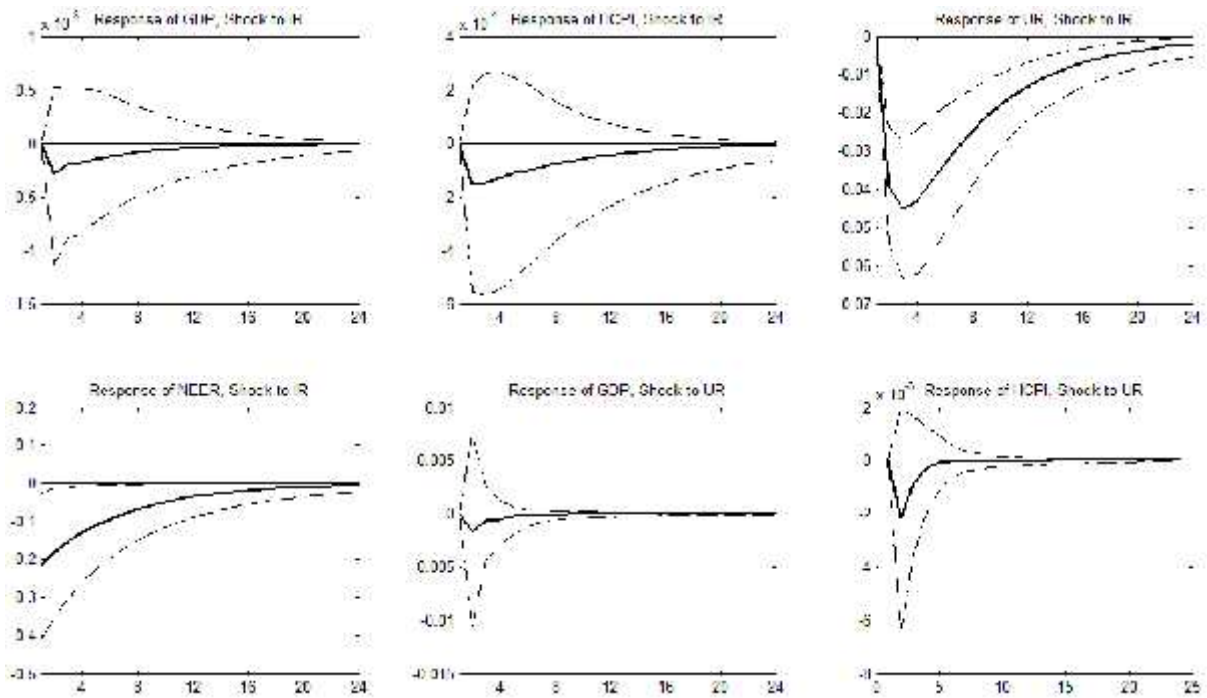
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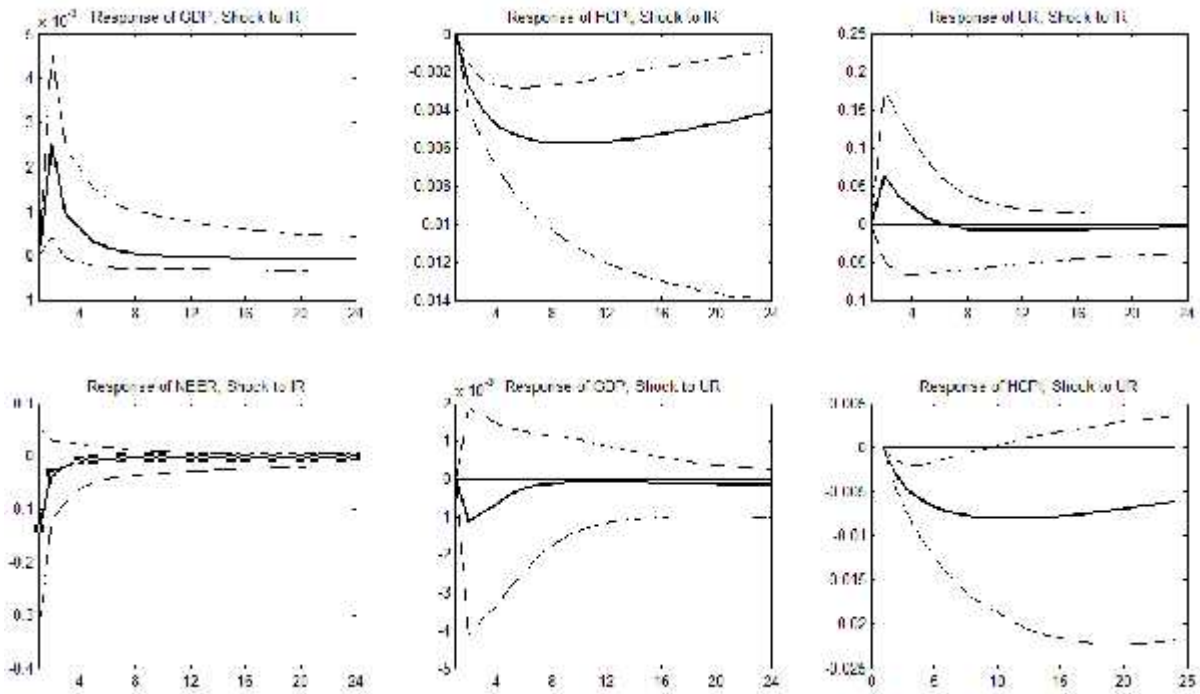
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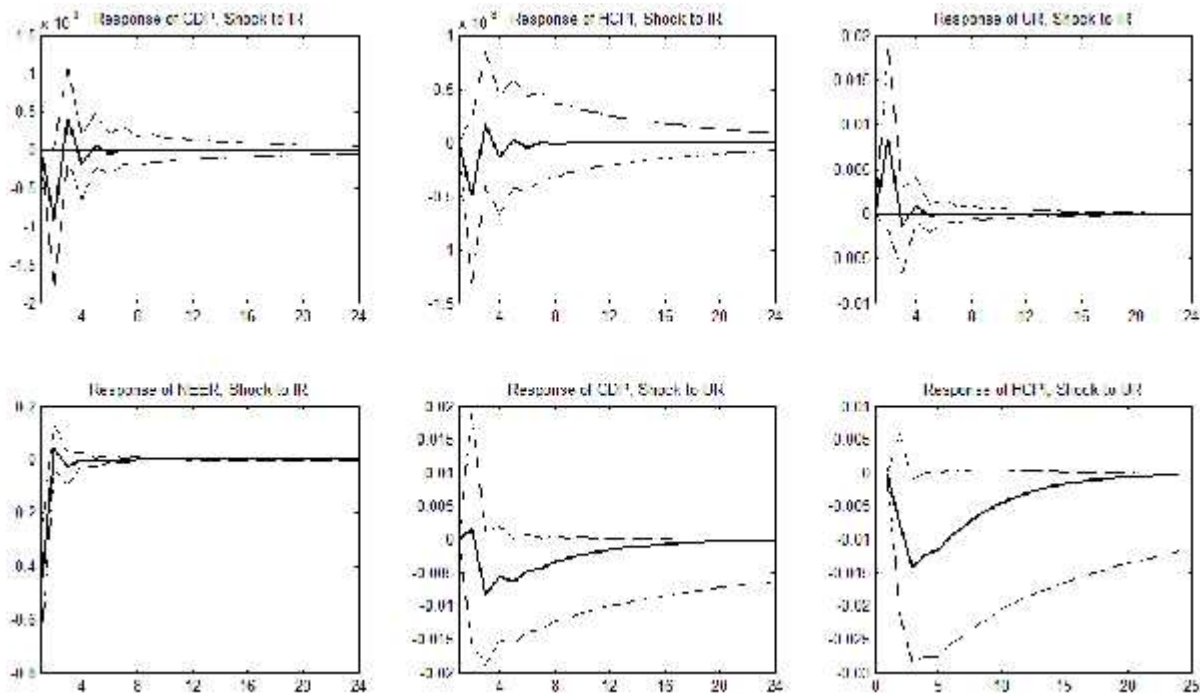
**Figure 1.** Impulse response functions for Hungary over a period of 24 quarters



**Figure 2.** Impulse response functions for Czech Republic over a period of 24 quarters



**Figure 3.** Impulse response functions for Poland over a period of 24 quarters



**Figure 4.** Impulse response functions for Romania over a period of 24 quarters

## **APPENDIX A: DATA (SOURCES AND DESCRIPTION)**

### Endogenous variables for Romania, Poland, Czech Republic and Hungary:

- GDP is the gross domestic product for each country.
- HCPI is the harmonized consumer price index for each country.
- UR is the unemployment rate for each country.
- IR is the short term interest rate for each country.
- NEER is the nominal effective exchange rate for each country.

Data for all endogenous variables were taken from Eurostat.

### European Union (27 countries) exogenous variables:

- EUGDP is the gross domestic product.
- EUHICP is the harmonized consumer price index.
- EUIR is the three- month money market interest rate.

Data for all exogenous variables were taken from Eurostat.

## **Biografy**

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