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# THE TRANSMISSION MECHANISMS OF MONETARY POLICY IN ROMANIA

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- June, 2015 -

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# I. MOTIVATION & OBJECTIVES

- **Efficient monetary policy** - must be able to appreciate the magnitude and the direction of the effects of the measures taken, the timing and persistence of these effects.
- MPTM implication for Euro adoption and proper functioning within a monetary union, due to the fact that differences would imply a significant cost for losing monetary policy independence.
- Accounting for time variation is very important, especially for economies that have experienced significant structural and institutional changes over time.

## II. LITERATURE REVIEW

In the literature we can identify four types of TVP – VAR models :

- A. parameters treated as **latent variables that follow random walk without drift** and Kalman filter is used for estimation. Cogley and Sargent (2005 ), Primiceri (2005) , Canova Gambetti (2006) , Nakajima (2011) and Arratibel and Michaelis (2014).
- B. parameters **switch between regimes (back and forth)** driven by a latent variable that follows a Markov switching process. Sims and Zha (2006).
- C. parameters change **from one regime to another smoothly** (and permanently); specification is the multivariate extension of STAR model. He, Terasvirta and Gonzalez (2005).
- D. use of a **mixture innovations models**, that allow to estimate whether, where, when and how parameters have changed. Koop et al (2009).

# III. METHODOLOGICAL FRAMEWORK

## Time Varying Parameter VAR ( TVP - VAR)

- $Y_t = X_t' B_t + A_t^{-1} \sum_t \varepsilon_t$      $\text{Var}(\varepsilon) = I_n$
- $B_t = B_{t-1} + \vartheta_t$ ,     $\text{Var}(\vartheta_t) = Q$     ← VAR coefficients
- $\alpha_t = \alpha_{t-1} + \xi_t$ ,     $\text{Var}(\xi_t) = S$     ← Contemporaneous interaction
- $\log \sigma_t = \log \sigma_{t-1} + \eta t$ ,     $\text{Var}(\eta_t) = W$     ← Stochastic volatilities

$$A_t = \begin{bmatrix} 1 & 0 & \dots & 0 \\ \alpha_{21,t} & 1 & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ \alpha_{n1,t} & \dots & \alpha_{n(n-1),t} & 1 \end{bmatrix}; \quad \Sigma_t = \begin{bmatrix} \sigma_{1,t} & 0 & \dots & 0 \\ 0 & \sigma_{2,t} & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \dots & 0 & \sigma_{n,t} \end{bmatrix}; \quad V = \begin{bmatrix} \varepsilon_t \\ \vartheta_t \\ \xi_t \\ \eta t \end{bmatrix} = \begin{bmatrix} I_n & 0 & 0 & 0 \\ 0 & Q & 0 & 0 \\ 0 & 0 & S & 0 \\ 0 & 0 & 0 & W \end{bmatrix}$$

**Priors** are set to be :

$$B_0 \sim N(\hat{B}_{OLS}, 4 \cdot V(\hat{B}_{OLS})),$$

$$A_0 \sim N(\hat{A}_{OLS}, 4 \cdot V(\hat{A}_{OLS})),$$

$$\log \sigma_0 \sim N(\log \hat{\sigma}_{OLS}, I_n),$$

$$Q \sim IW(k^2_Q \cdot \tau \cdot V(\hat{B}_{OLS}), \tau), \text{ where } \tau = \text{size of the training sample, } k_Q = 0.05$$

$$W \sim IG(k^2_W (1 + \dim(W)) \cdot I_n, (1 + \dim(W))), \quad k_W = 0.1$$

$$S_b \sim IW(k^2_S (1 + \dim(S_b)) \cdot V(\hat{A}_{b,OLS}), (1 + \dim(S_b))), \quad k_S = 0.01$$

# IV. DATA AND ESTIMATION

**Sample length:** 156 monthly observations 2002M1 – 2014M12

Data sources : Eurostat, NBR, IMF.

Variables	Data handling
GDP	Monthly data obtained from quarterly data using Chow Lin method (Industrial Production as indicator variable). Data transformed in logarithms the first difference was used – I (0).
CORE 2 Inflation	Percentage change of CORE 2 from the corresponding month of the previous year - I (0).
Producer Price Index	Fixed base 2010=100. Data transformed in logarithms; the first difference was used – I(0).
Import Prices	Fixed base 2010=100. Data transformed in logarithms; the first difference was used – I(0).
ROBOR 3M	Filtered data – I(0)
Nominal exchange rate EUR/RON	Data transformed in logarithms; the first difference was used – I(0) (- shows an appreciation / + shows a depreciation of the national currency)

The model was estimated under a **Bayesian framework - Gibbs Sampling.**

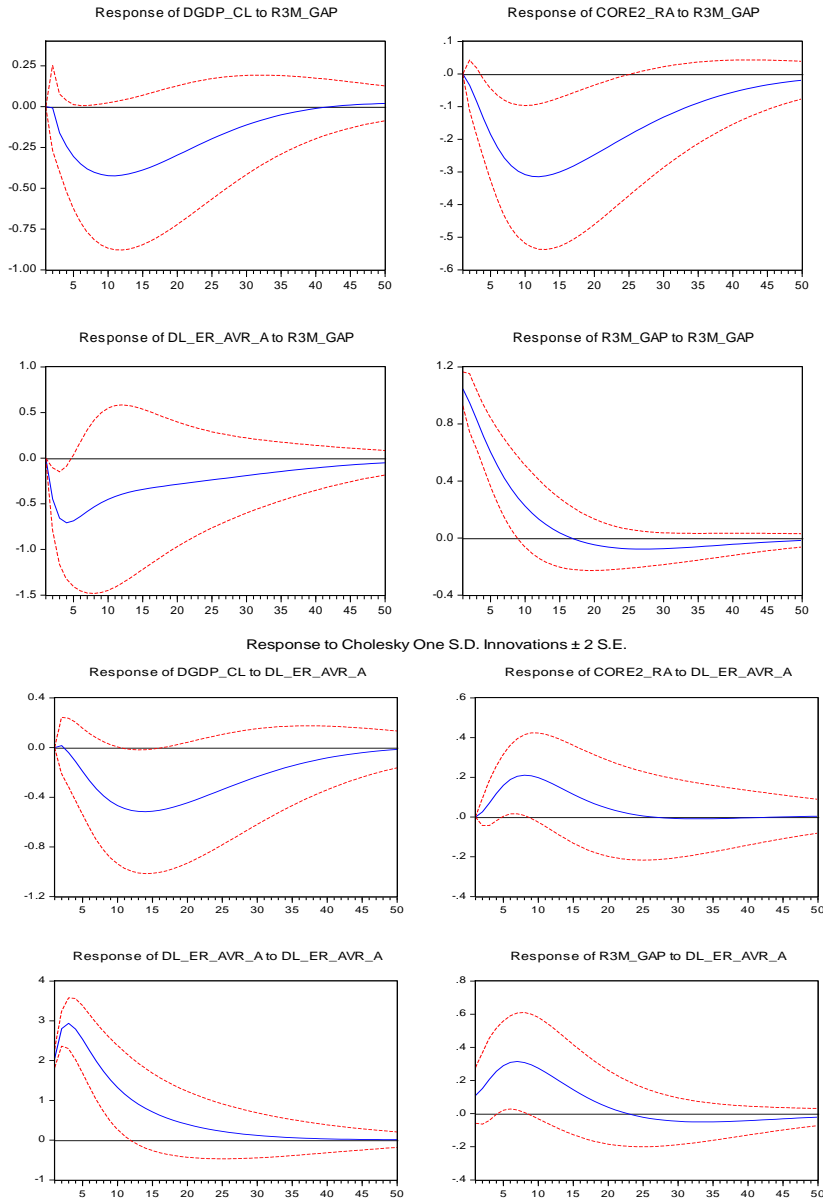
The first 40 data points were used to generate **starting values** for the algorithm.

The monetary policy shock was identified using **recursive identification (Cholesky).**

**Number of lags** used in the estimation: two.

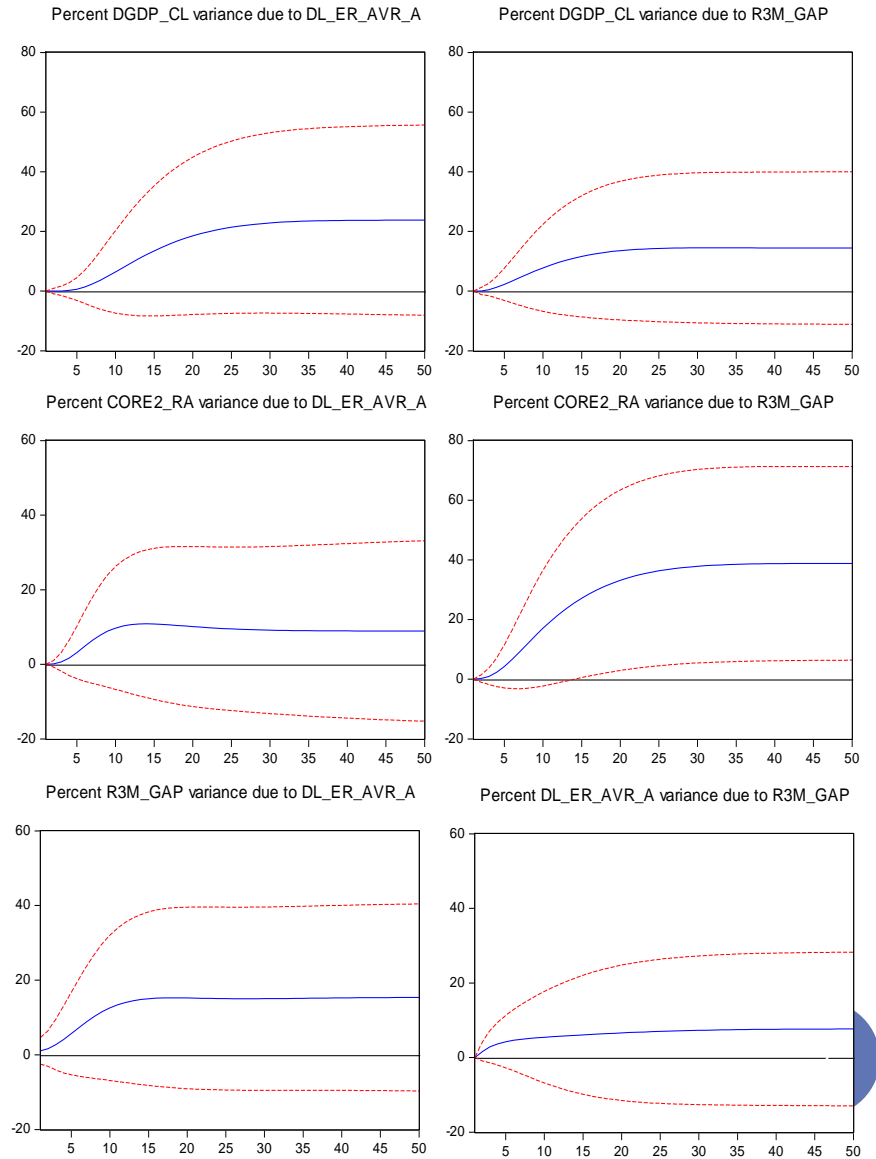
## Impulse Response Function

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

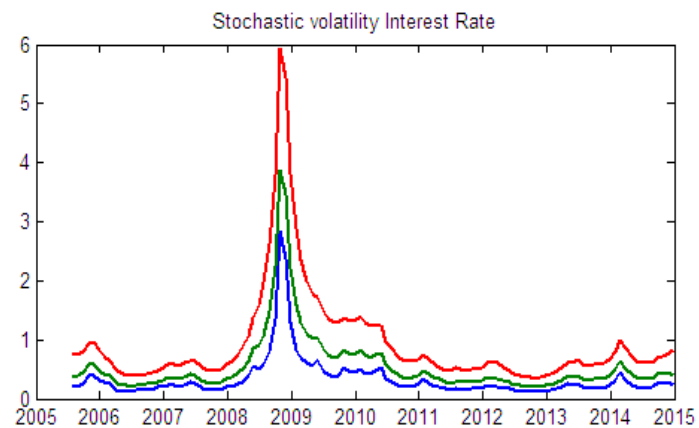
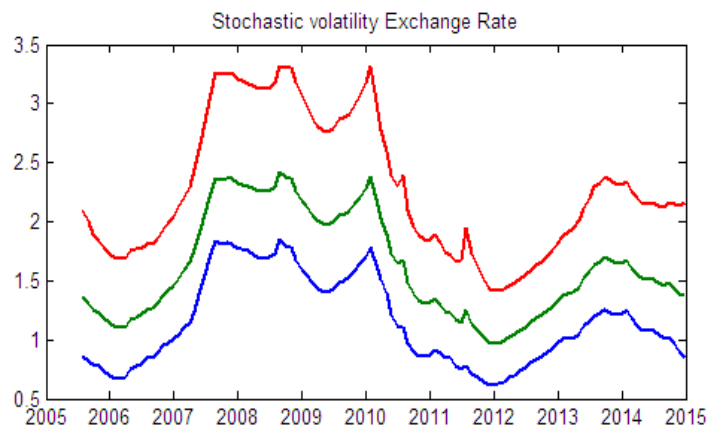
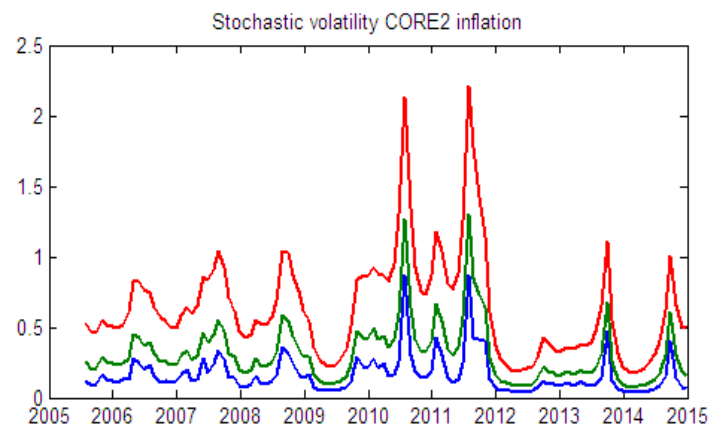
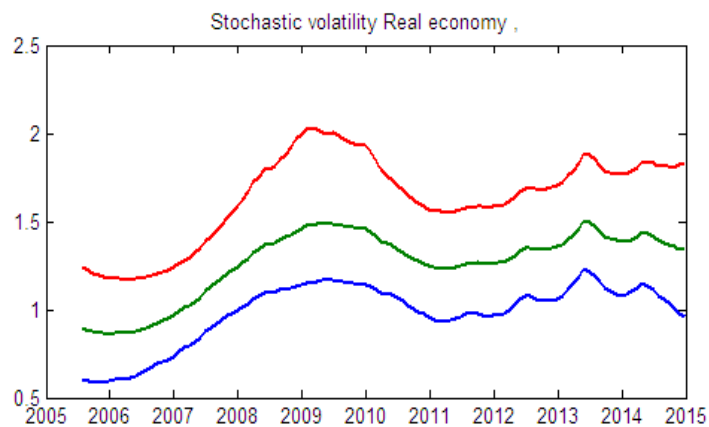


## Variance decomposition

Variance Decomposition  $\pm 2$  S.E.

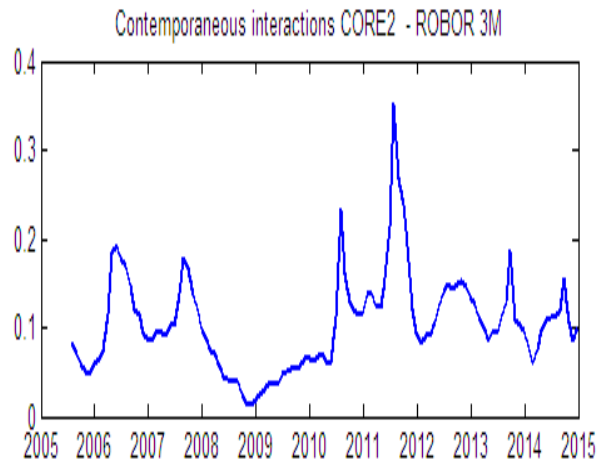
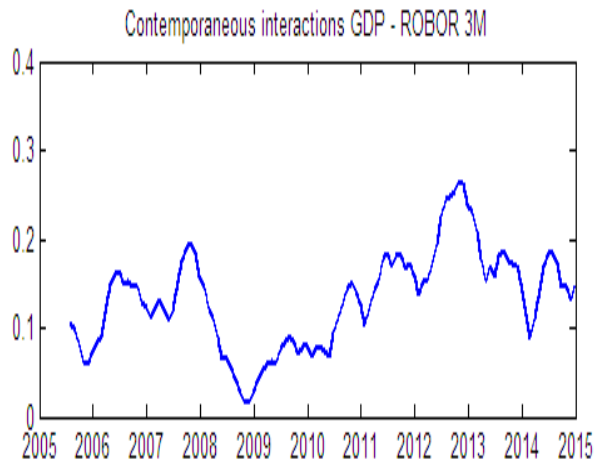


# VI. RESULTS TVP VAR – STOCHASTIC VOLATILITY

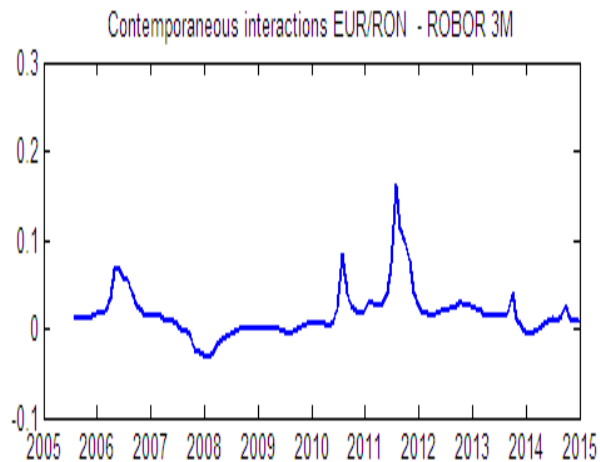




# VI. RESULTS TVP VAR - CONTEMPORANEOUS INTERACTION

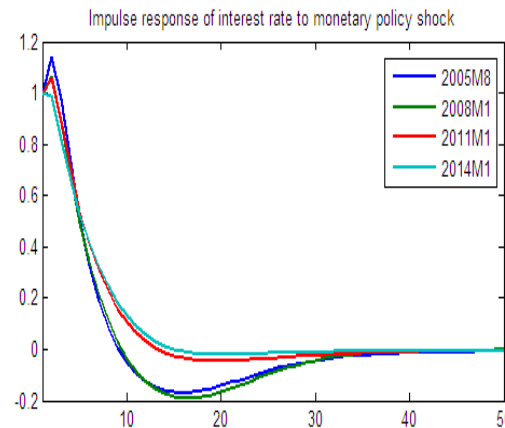
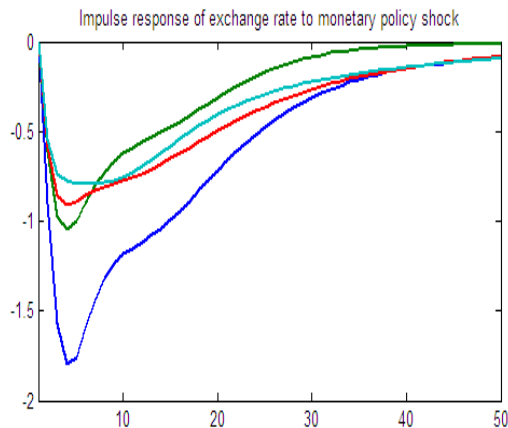
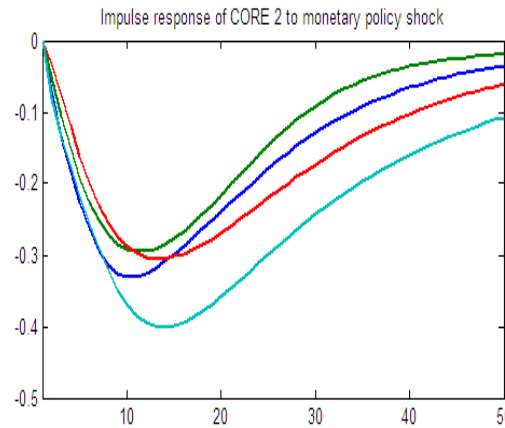
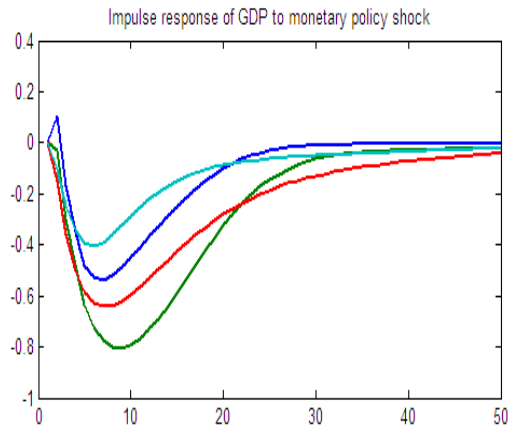


- Strong contemporaneous interaction between inflation and interest rate.



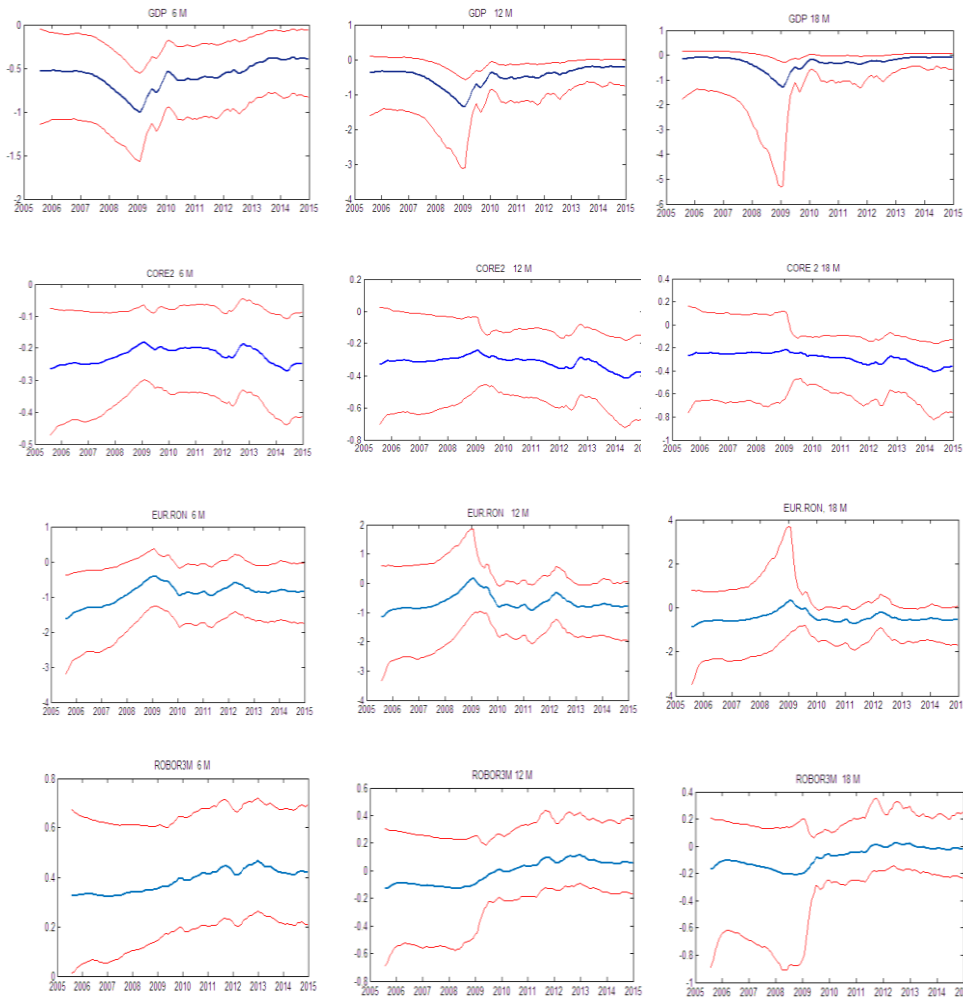
- Weak contemporaneous interaction between inflation and interest rate.

# VI. RESULTS TVP VAR - IMPULSE RESPONSES TO A MONETARY POLICY SHOCK



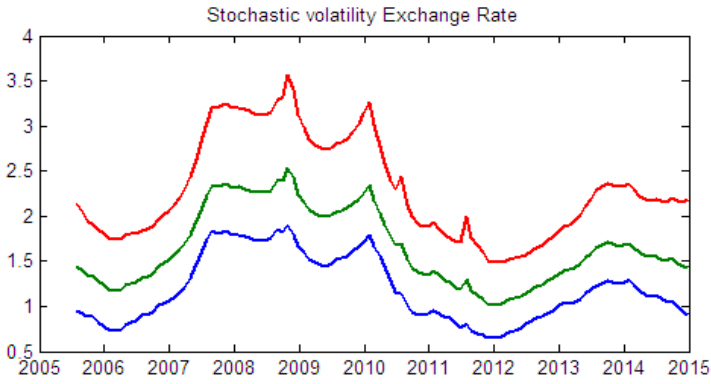
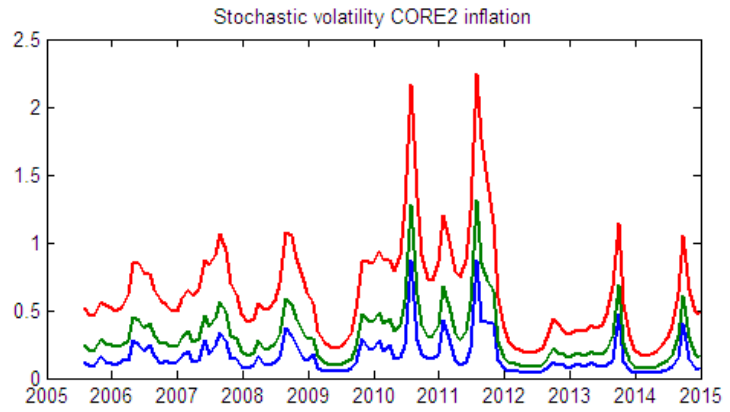
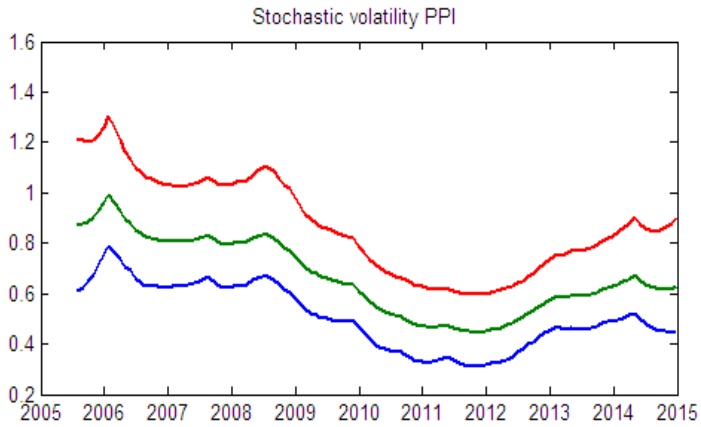
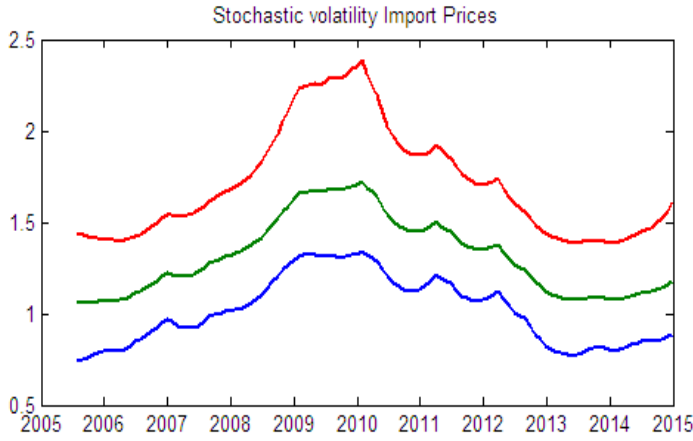
- Output more responsive before the financial crisis (7% cumulative response after 1 year in 2008 vs 3.5% in 2014, max response after 9 M 0.8% in 2008 vs 0.4% in 2014).
- Inflation more responsive after the financial crisis (3% cumulative response after 1 year in 2014 vs 2.2 % in 2011, max response after 11 M 0.38% in 2014 vs 0.29% in 2011 ).
- Exchange rate appreciation bigger at the beginning of the sample (5% cumulative response after 1 year in 2005 vs 8.1 % in 2014, max response after 5 M 1.75% in 2005 vs 0.8% in 2014 ).

# VI. RESULTS TVP VAR - IMPULSE RESPONSES TO A MONETARY POLICY SHOCK 6,12,18 MONTHS AHEAD



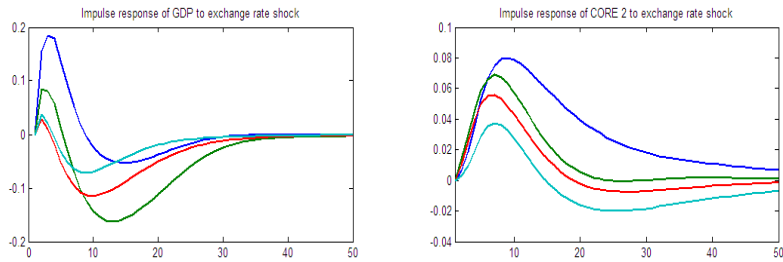
- Monetary policy shock costly to absorb during financial crisis;
- Persistence of monetary policy on prices is the highest;
- Exchange rate more responsive to interest rate shock on the beginning of the sample;

# VI. RESULTS TVP VAR - EXCHANGE RATE PASS THROUGH-PRICES VOLATILITIES

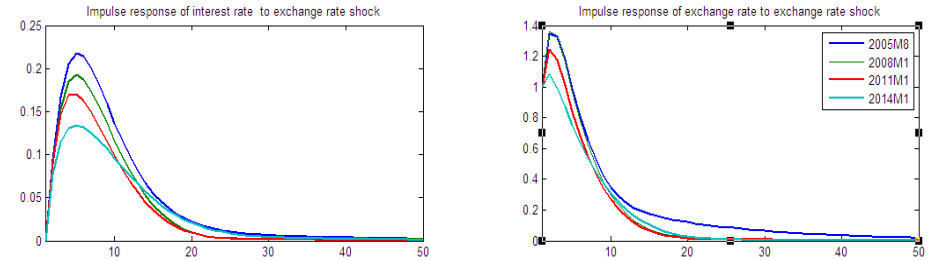
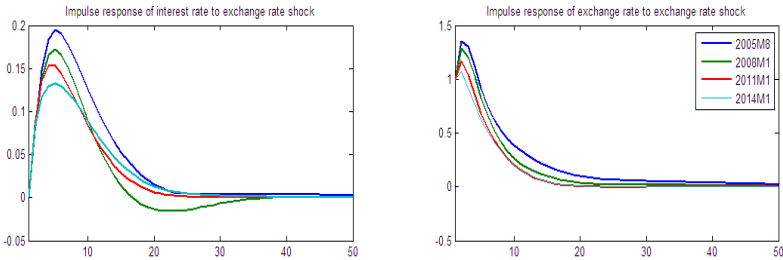
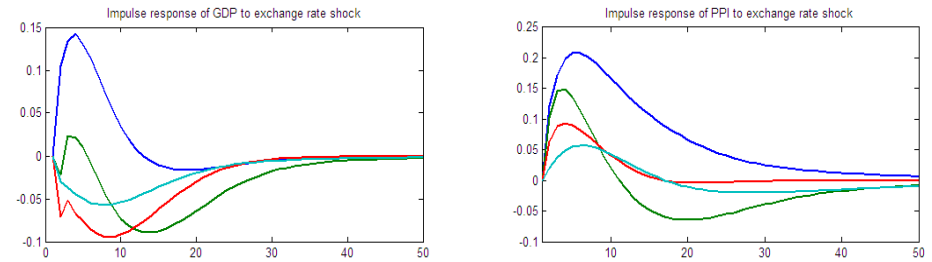


# VI. RESULTS TVP VAR - IMPULSE RESPONSES EXCHANGE RATE SHOCK

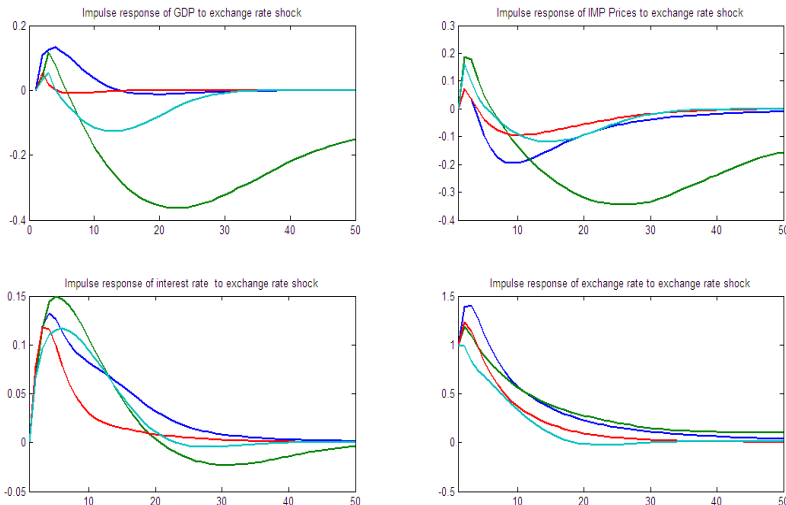
## TVP VAR CORE 2



## TVP VAR PPI



## TVP VAR Import Price



Exchange rate pass through has declined over time :

- CORE2 inflation 0.41% cumulative response after 9M in 2005 vs 0.2% in 2014 ;
- PPI inflation 1.37% cumulative response after 9M in 2005 vs 0.37% in 2014;

## VII. CONCLUSION

- Functional interest rate channel and exchange rate channel in Romania during 2005 - 2014 .
- The reaction of macroeconomic variables to monetary policy and exchange rate shocks varied across time in Romanian economy during 2005 - 2014 .
- The transmission of monetary policy shocks to the inflation rate was less effective during 2009- 2011.
- Exchange rate pass through has decline over time, with a bigger impact on producer prices , followed by consumer prices.
- The response of the inflation rate was, by far, the most persistent.

### **Topics for future improvements:**

- Estimate a Markov-Switching VAR to the same data, to test if a structural break in the parameters, caused by a shift in regimes, was responsible for the change in the behavior of impulse responses, or if the smoothing implied by TVP-VAR is a more realistic assumption.
- Estimate a TVP VAR as in Koop, Leon Gonzalez and Strachan (2008) using mixture innovation model - allows to estimate whether, where , when and how parameter change is occurring.

Thank you for your attention!

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