THE MACROECONMIC PASS-THROUGH EFFFECTS OF MONETARY POLICY THROUGH SIGN RESTRICTIONS APPROACH: IN THE CASE OF ALBANIA

by

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Contents

- Introduction

- Methodology

- Results

- Conclusions

Introduction...(1)

- Bank of Albania (BoA) has been responding to the Global Financial Crises (GFC) effect by:

  - Cutting interest rates to historical low levels;

  - Embarking upon some macro-prudential and balance sheet MP, such as:

    - Provide liquidity to banking system and lowered the reserve required ratio in support of deposit withdraws and deteriorating non-performing loans;

    - Expand its exposure to government bond financing through higher financing level and by shifting shorter instruments to longer debt financing;

    - Orientate the banking system towards bank lending in domestic currency, an option that would lower risk exposure to exchange rate volatility and un-hedged bank lending;.

- The aim of these policies objective has been to:

  - Improve inflation expectation to their objective target and boost the economic growth recovery;

  - Repair the monetary transmission mechanism (MTM) and to restore alone, confidence in the financial system, through higher bank liquidity and low bank and sovereign credit risk;

Introduction...(2)

- **BUT**, these policies have been complementary rather than substitute for interest rate policy instrument.

- Further, since 2000s, but most importantly in the 2013 – 2015 Medium-Term Strategy, BoA's MP will:

  - Use indirect market instruments to achieve MP objectives;

  - Develop appropriate policies and inter-institutional cooperation consistence to bank system risks.

  - Priority aims to enhance the MP efficiency by acquiring thoroughly the MTM channels and MP lags, which are constantly changing due to internal patterns of the Albanian economy and GFC.

- MTM has been an integrated part of empirical study at the BoA [See also Muço, Sanfey and Luçi (2001); Muço, Sanfey and Taçi (2003); Samiei (2003); Peeters (2004); Luçi and Vika (2005); Istrefi and Semi (2007)] and it is vital to re-analyse the pass-through effect of MP channel, for two reasons:

  - Kolasi, Shijaku and Shtylla, (2010) try to evaluate the effect of MTM channels on the real output and inflation and core inflation. **BUT**, since then little is known especially after the GFC.

  - No paper yet so far has analysed the MTM through means of conventional and balance sheet variables, associated especially with the periods in the aftermath of GFC.

- This research work supports the Medium-term Development Strategy of the Bank of Albania for 2013-2015, as it expands further the information base on :

  - Different MP instruments considered by the BoA's Governing Council.

  - The properties of the changing structure of MTM in the verge of aftermath GFC.

- In the verge of slower economic and bank lending growth level, it is of high interest to understand the effect of both conventional and balance sheet MP instruments;

- Improves research quantitatively and qualitatively;

- The paper explores the fact that BoA uses mainly its regular MP rate channel to implement its MP strategy, even though it was accomplished by some macro-prudential and balance sheet MP changes.

- The main question to be address in this paper will focus on:

  "…What are the macroeconomic pass-through effects of MP changes with regards to conventional and balance sheet MP instruments…".

Methodology...(1)

- This paper follows a VAR specification by Gambacorta, Hofmann and Peersman (2012), as follows:

$$\chi_t = \beta_0 + \sum_{i=1}^{p} \beta_i \chi_{t-1} + \varepsilon_t \qquad\qquad (1)$$

Where:

χ_t — a vector of endogenous variables such as output, prices, central bank assets, MP instrument and the stock market volatility of the national stock market index;

β_0 — is a vector of constant term;

β_i — are the matrixes of the coefficients measuring lagged effect of variables on each-other;

ε_t — is the vector of disturbance term and $\varepsilon_t \sim$ iid $(0, \sigma^2)$;

- The benchmark VAR model has been modified, as to include:

  - An endogenous banking lending [Peersman (2011)] and an exchange rate indicator;

  - Two exogenous variable, such as to account for the trade partners' MP instrument [Glocker and Towbin (2011)] and for the GFC effects;

  - Estimating the model includes only one MP instrument at a time.

- The model takes the following representation:

$$\chi_t = \beta_0 + \sum_{i=1}^{p} \beta_i \chi_{t-1} + \sum_{i=0}^{p} \beta_i Z_{t-1} + \varepsilon_t \qquad (2)$$

Where: χ_t is a vector of endogenous variables, as:

GDP - Log of seasonal adjusted of the real quarterly GDP (annualised);

Price - Log of seasonal adjusted of the CPI;

Lending - Bank lending in domestic currency to GDP ratio;

Overnight - BoA's MP instrument the real overnight rate;

EX - Log of seasonal adjusted of the real effective exchange rate;

FSI - An index of systematic financial stress taken from Shijaku (2014a);

Z_t is a vector of exogenous variables, as:

i^{ECB} - ECB's MP instrument – the real EONIA rate;

CRISIS - Dummy taking the value of 1 during the period 2008 M09 – 2011 M03, 0 otherwise;

- The VAR follows a sign restriction approach does not drop any contemporaneous effects (the variance – covariance is full) and utilises the properties of the residuals from reduced model to get the variance – covariance matrix and transform into candidates of orthogonal eigenvalue-eigenvector decompositins, T*.

- The structural identification in this six VAR model specification uses a combination of a total 15 (N(N-1/2)) restrictions bivariate Givens rotation matrices admissible (i=1,....,15) to construct the candidate Q's. These candidate Qs are then used to generate the candidate T*'s, which in this six-variable system are expressed as follows:

$$
\begin{aligned}
Q = \ & Q_{1,2}(\theta_1) \ * Q_{1,3}(\theta_2) \ * Q_{1,4}(\theta_3) \ * Q_{1,5}(\theta_4) * Q_{1,6}(\theta_5) \ * \\
& Q_{2,3}(\theta_6) \ * Q_{2,4}(\theta_7) \ * Q_{2,5}(\theta_8) \ * Q_{2,6}(\theta_9) \ * \\
& Q_{3,4}(\theta_{10}) * Q_{3,5}(\theta_{11}) * Q_{3,6}(\theta_{12}) \ * \\
& Q_{4,5}(\theta_{13}) * Q_{4,6}(\theta_{14}) \ * \\
& Q_{5,6}(\theta_{15}),
\end{aligned} \tag{5}
$$

Where, each $Q_{m,n}$ is an identity matrix with the (m, m) element replaced with $\cos\theta$; (n, n) element replaced with $\cos\theta$; (m, n) element replaced with $-\sin\theta$; and (n, m) element replaced with $\sin\theta$, as follows:

$$Q_{3,4}(\theta_j) = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & cos\theta_j & -sin\theta_j & 0 & 0 \\ 0 & 0 & sin\theta_j & cos\theta_j & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \quad (6)$$

Where, each θ_j is a radian angle measure between $(0 < \theta_j \leq \pi)$ for the row m and n. Each Q will be unique depending on the values of θ_j.

- The candidate Q's matrices (rotation matrix) can be generated by conducting random normalised draws of θj, which are taken to be uniformly distributed over (0, π).

- Then sign restrictions are imposed on the short-run co-movements of variables based on important information provided by theory on the signs of the cross-correlation between variables i and j as prescribed by theoretical economic signs.

- Finally, the summarised range of possible results follows the common strategy of sorting the impulse responses and reports the median value.

Methodology...(5)

- The analysis is based on a theoretically intuitive minimal set of sign restrictions imposed only on MP variable [Migliardo (2010); Endut, et. al., (2015)].

- Following a Taylor rule, in a sticky prices framework, a stimulus MP shock leads to:

  - Lower cost of capital, increasing private investment or bank lending and finally increases aggregate output and price level [Kolasi, et. al., (2010)];

  - Decreases price of money [Migliardo (2010)], making people hold more of it and borrow more for consumption and investment, so both inflation and output gap increases, but it may also be subject to the wealth or the substitution effect is picks up [Tanku (2006)];

  - Depreciation of the domestic currency in foreign exchange markets [Kolasi, et. al., (2010)];

  - Lower pressure into the financial market, but also may put more via the exchange rate channels due to unhedged bank lending and higher ratio of public foreign borrowing;

- Sign restrictions only to those variables upon which the theory is clear on the excepted results.

- The horizon over which the sign restriction is binding is set to 3 periods.

Methodology^{...}(6)

- The model makes a 100000 draws and the impulse responses are built on those that satisfy the restrictions and discard the ones that do not.

- Sensitive analysis through alternative modelling choices by considering four alternative variables to the benchmark VAR, that includes:

  - REPO rate instead of the overnight rate;

  - Money market (M_2 or M_3) instead of credit market variables;

  - Central bank financial assets (*BoAFA*) variable instead of MP rate instrument;

  - Monetary base (M_0) instead of central bank financial assets;

- Sensitive analysis also includes estimation through changing the number of:

  - Horizons over which sign restrictions are imposed;

  - Variables under sign restrictions;

- Sample Time is based on monthly data [2002 M01 – 2014 M12];

Methodology...(7)

- (*GDP*), (*M₂* or *M₃*), (*BoAFA*) are deflated by CPI, while (*Overnight*) and (*i^{ECB}*) are transformed into real terms by subtracting the domestic and ECB inflation rate.

- The data's source are as follows:

  - (*GDP*) and (*Price*) are taken from the Albanian Institute of Statistics;

  - (*Lending*), (*M₂* or *M₃*), (*Overnight*) and (*EX*) are taken from the Bank of Albania;

  - (*FSI*) are taken and updated from Shijaku, (2014a) and (*i^{ECB}*) is taken from the ECB website;

- The VAR model is estimated, as follows:

  - Variables are the cycle component of a HP filter estimation, besides (*Overnight*), (*FSI*) and (*i^{ECB}*);

  - Bank lending variables are to GDP ratio and as cycle component of a HP filter estimation;

  - (*Overnight*) and (*FSI*) as the annual growth rate and (*i^{ECB}*) entered the model in level;

  - SIC and diagnostics support a VAR model with 1 lag of the endogenous variables;

  - Results analysed through means of impulse response function (IRF);

Results...(1)

Figure 1. Non-accumulated impulse response to a 1pp shocks on i^{ON}, with $h_0 = 3$ and 5 variables under sign restriction.
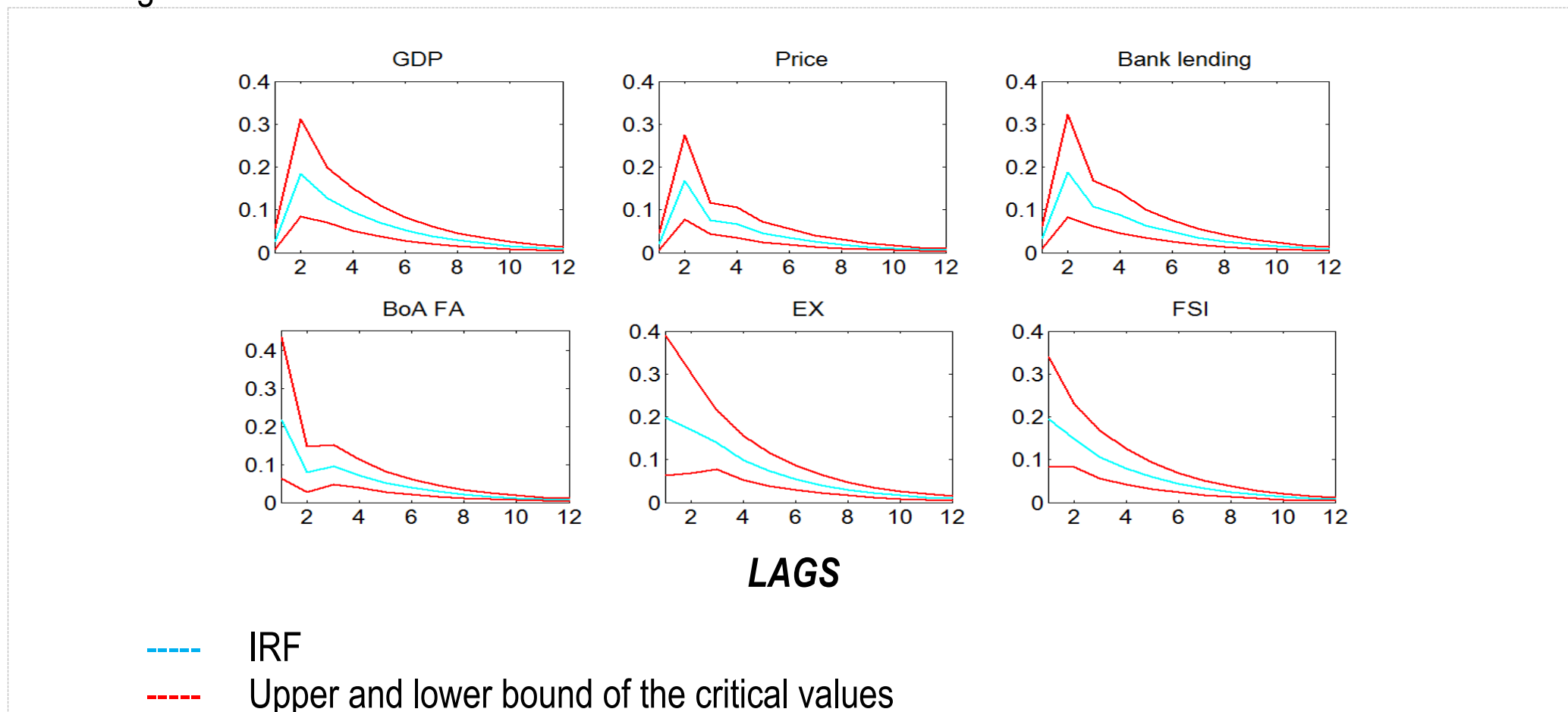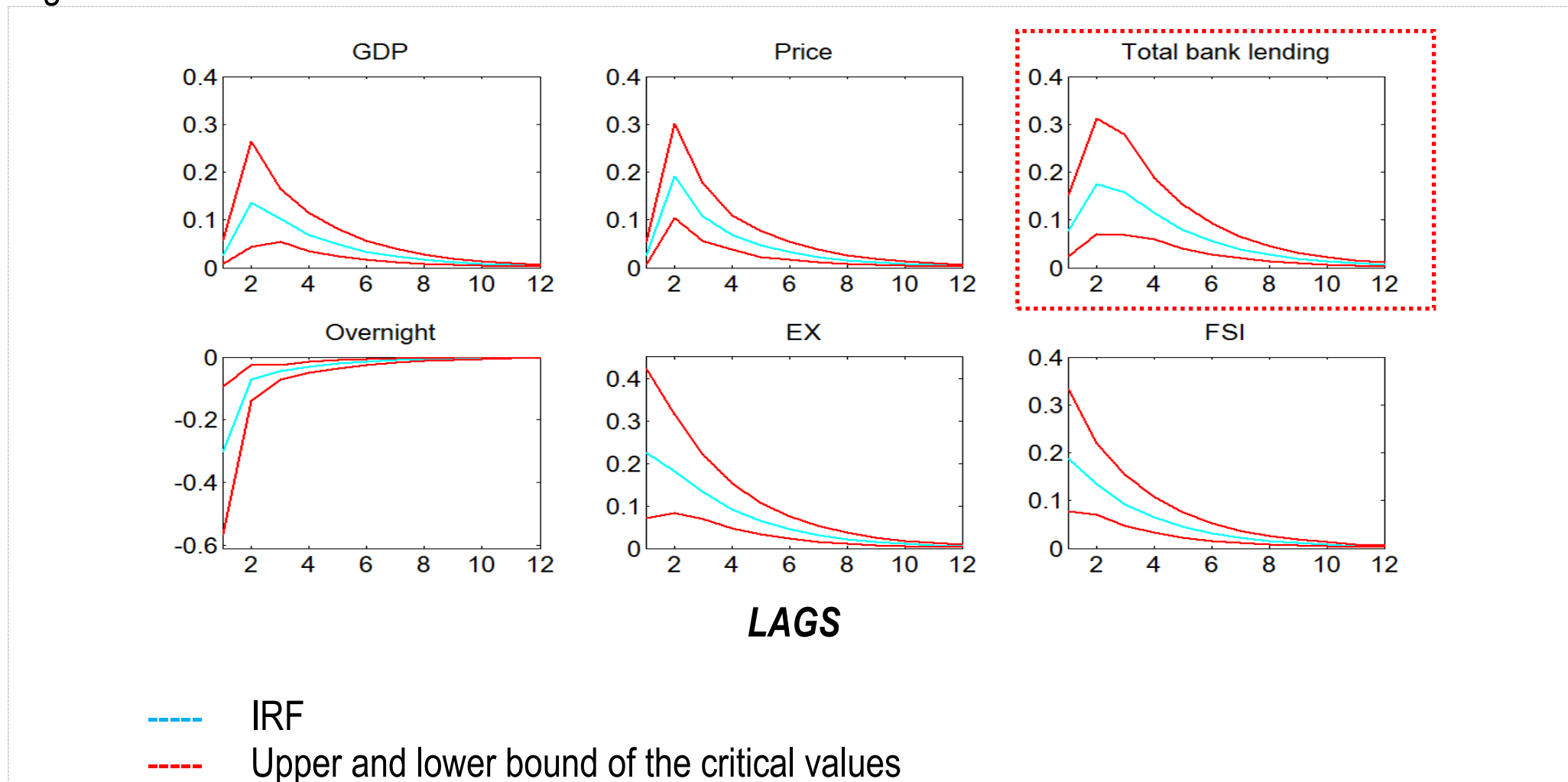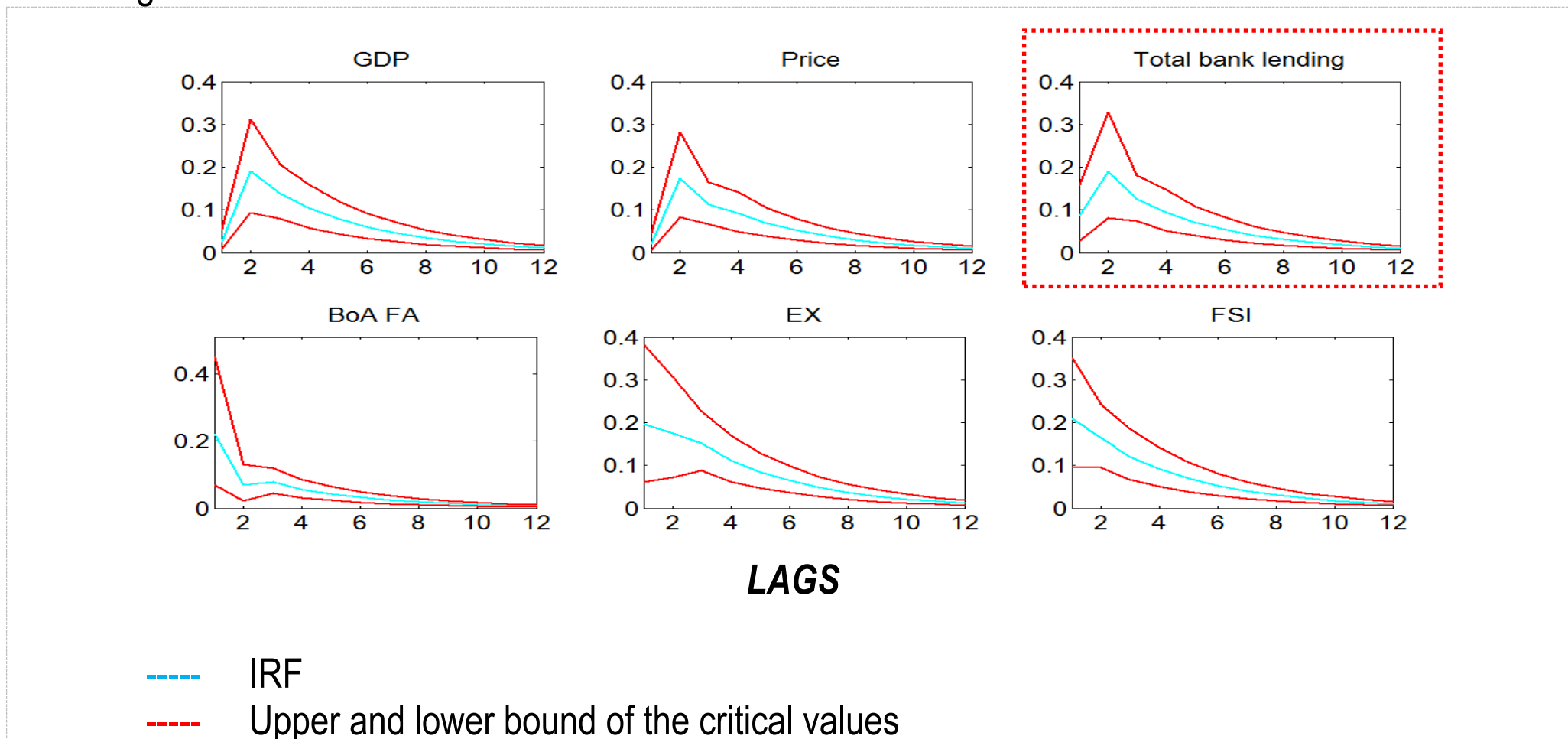

LAGS

---- IRF

---- Upper and lower bound of the critical values
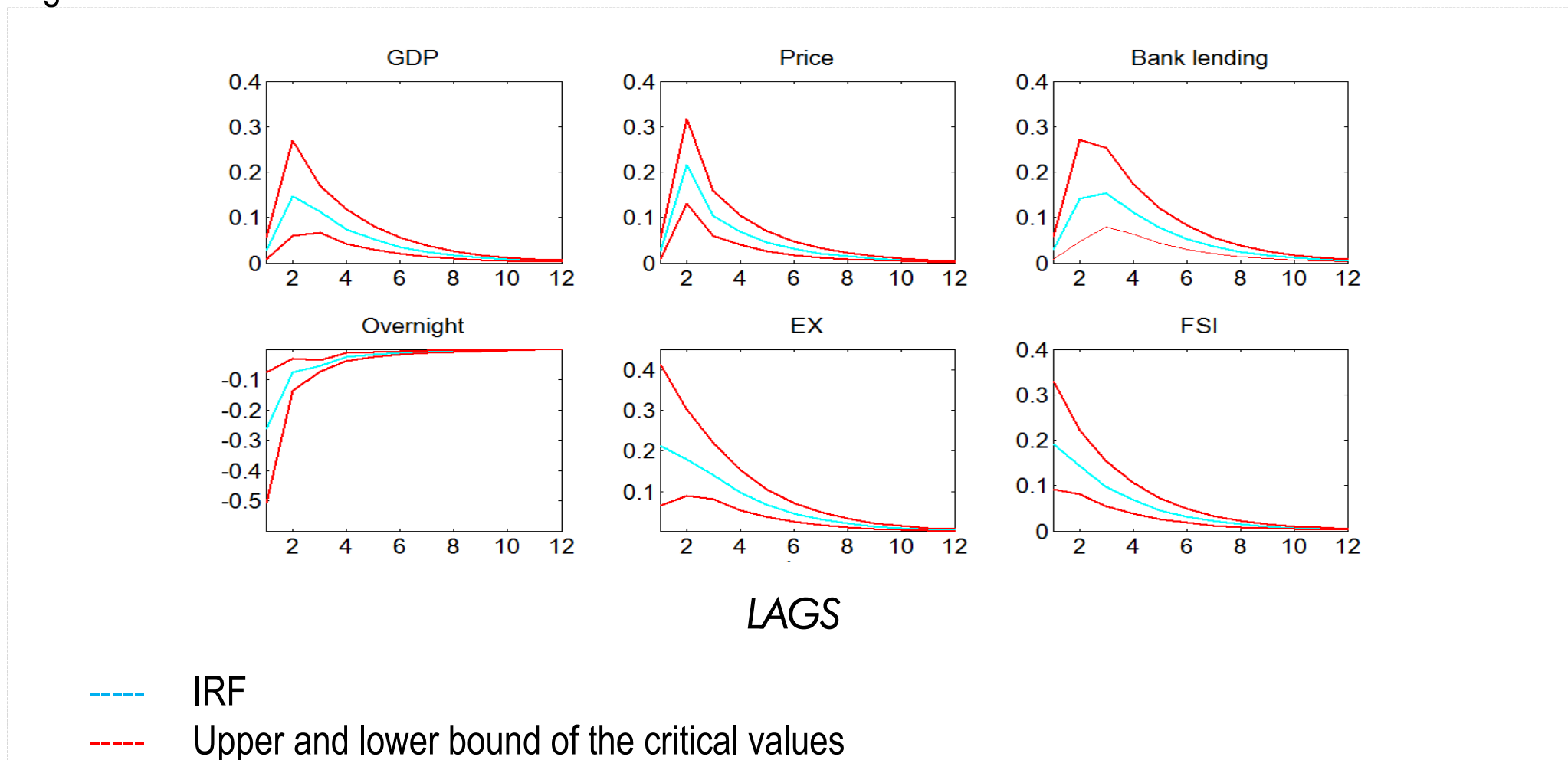
Source: Author's Calculations

Figure 2. Non-accumulated impulse response to a 1pp shocks on BOA^{FA}, with h_0 = 3 and 5 variables under sign restriction.

----   IRF

----   Upper and lower bound of the critical values

Source: Author's Calculations

Figure 3. Non-accumulated Impulse response to a 1pp shocks on i^{ON}, with h_0 = 3 and 5 variables under sign restriction.

----- IRF

----- Upper and lower bound of the critical values

Source: Author's Calculations

Figure 4. Non-accumulated impulse response to a 1pp shocks on BOA^{FA}, with $h_0 = 3$ and 5 variables under sign restriction.
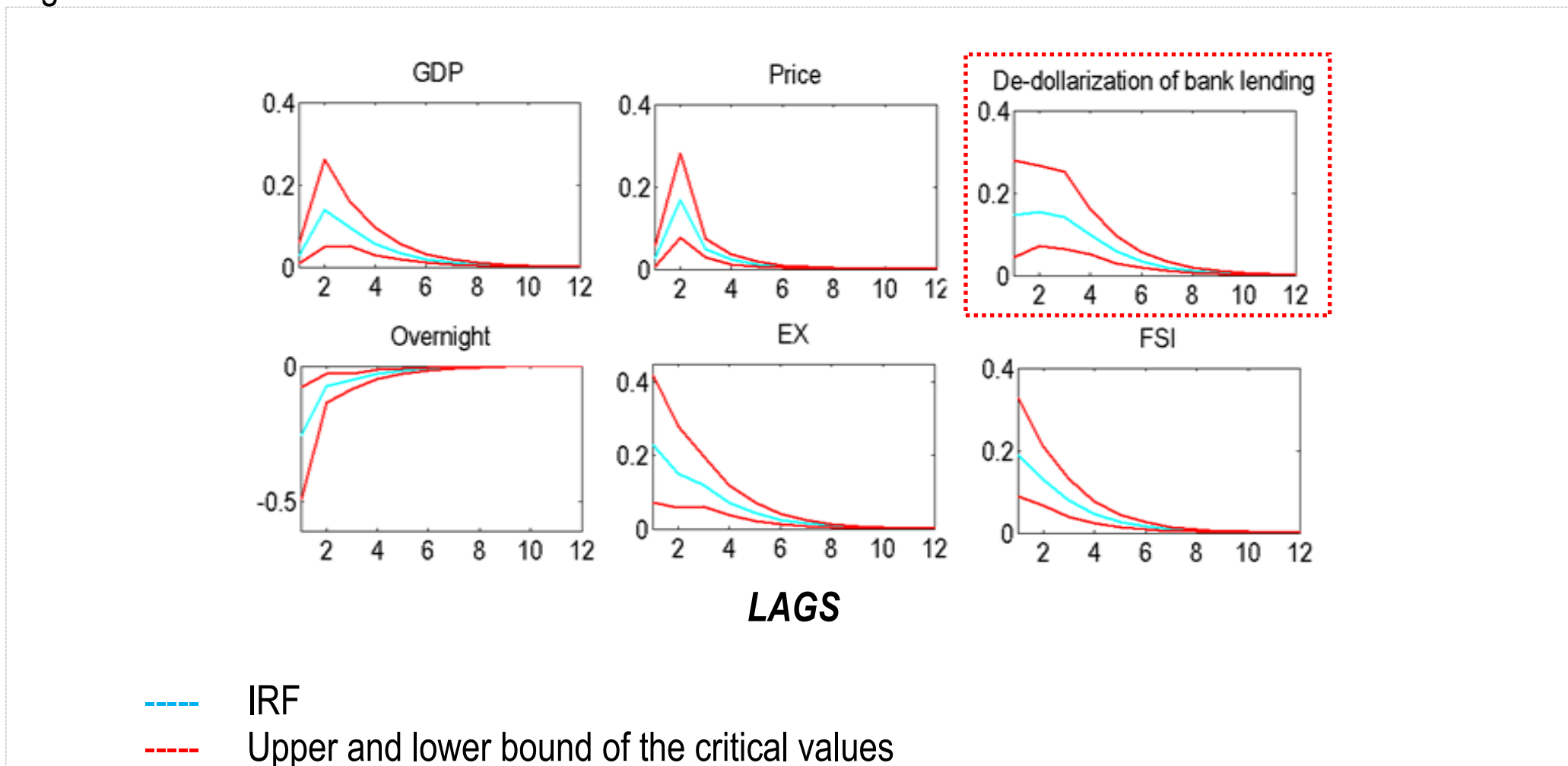

- - - - IRF
- - - - Upper and lower bound of the critical values

Source: Author's Calculations

Figure 5. Non-accumulated impulse response to a 1pp shocks on i^{ON}, with $h_0 = 3$ and 5 variables under sign restriction.

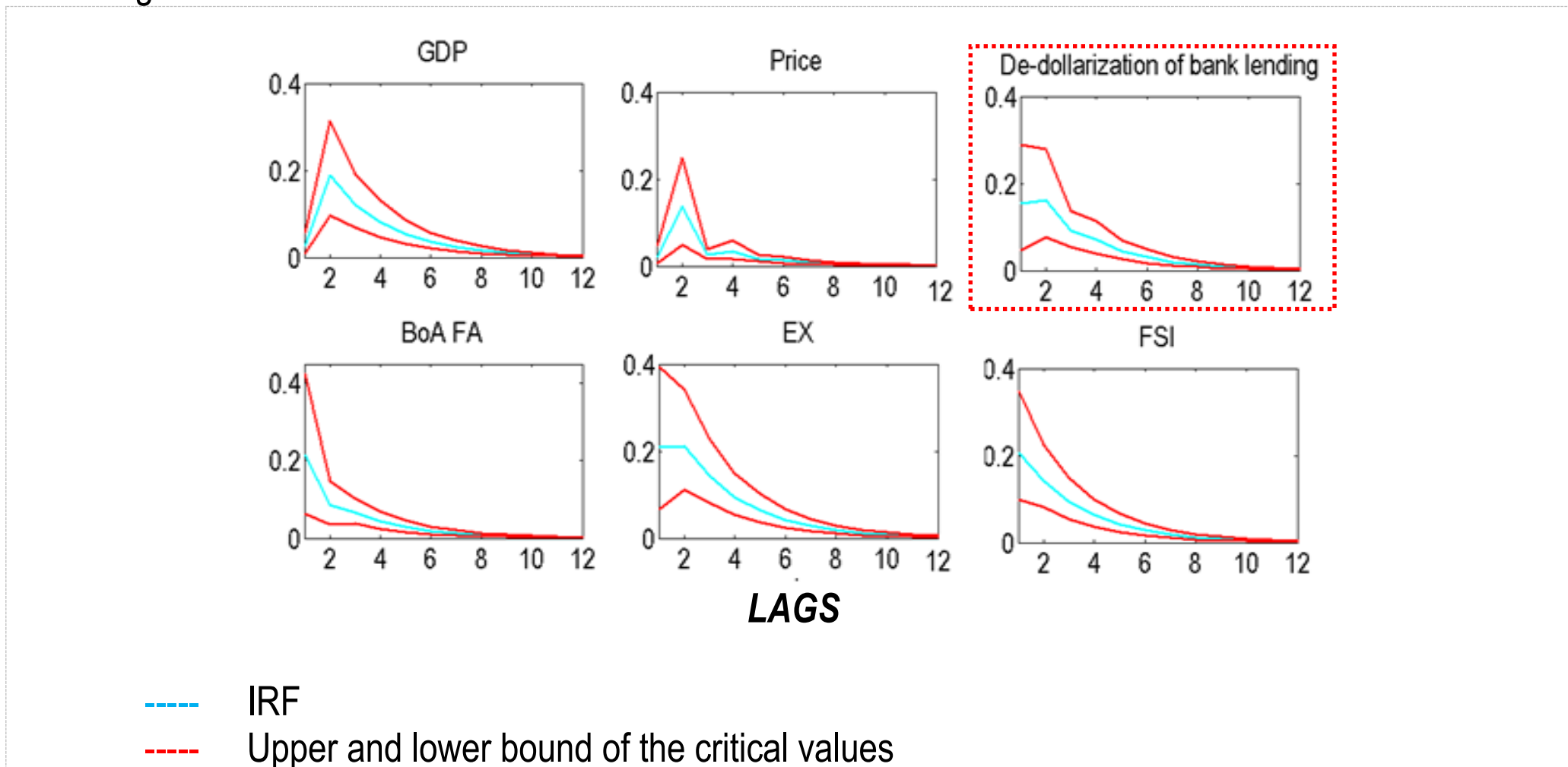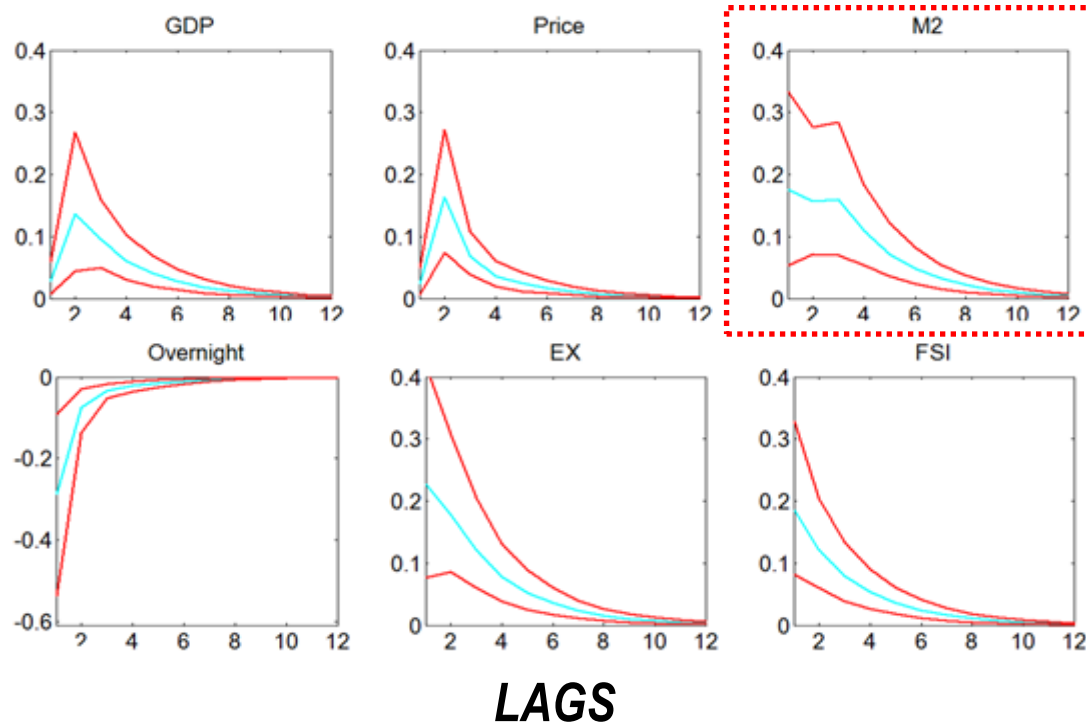Source: Author's Calculations

Figure 6. Non-accumulated impulse response to a 1pp shocks on BOA^{FA}, with h_0 = 3 and 5 variables under sign restriction.

- ---- IRF
- ---- Upper and lower bound of the critical values

Source: Author's Calculations

Figure 7. Non-accumulated impulse response to a 1pp shocks on i^{ON}, with $h_0 = 3$ and 5 variables under sign restriction.

- - - - IRF
- - - - Upper and lower bound of the critical values

Source: Author's Calculations

Figure 8. Non-accumulated impulse response to a 1pp shocks on BOA^{FA}, with $h_0 = 3$ and 5 variables under sign restriction.

---- IRF

---- Upper and lower bound of the critical values

Source: Author's Calculations

Results...(9)

Figure 9. Non-accumulated impulse response to a 1pp shocks on i^{ON}, with $h_0 = 3$ and 5 variables under sign restriction.
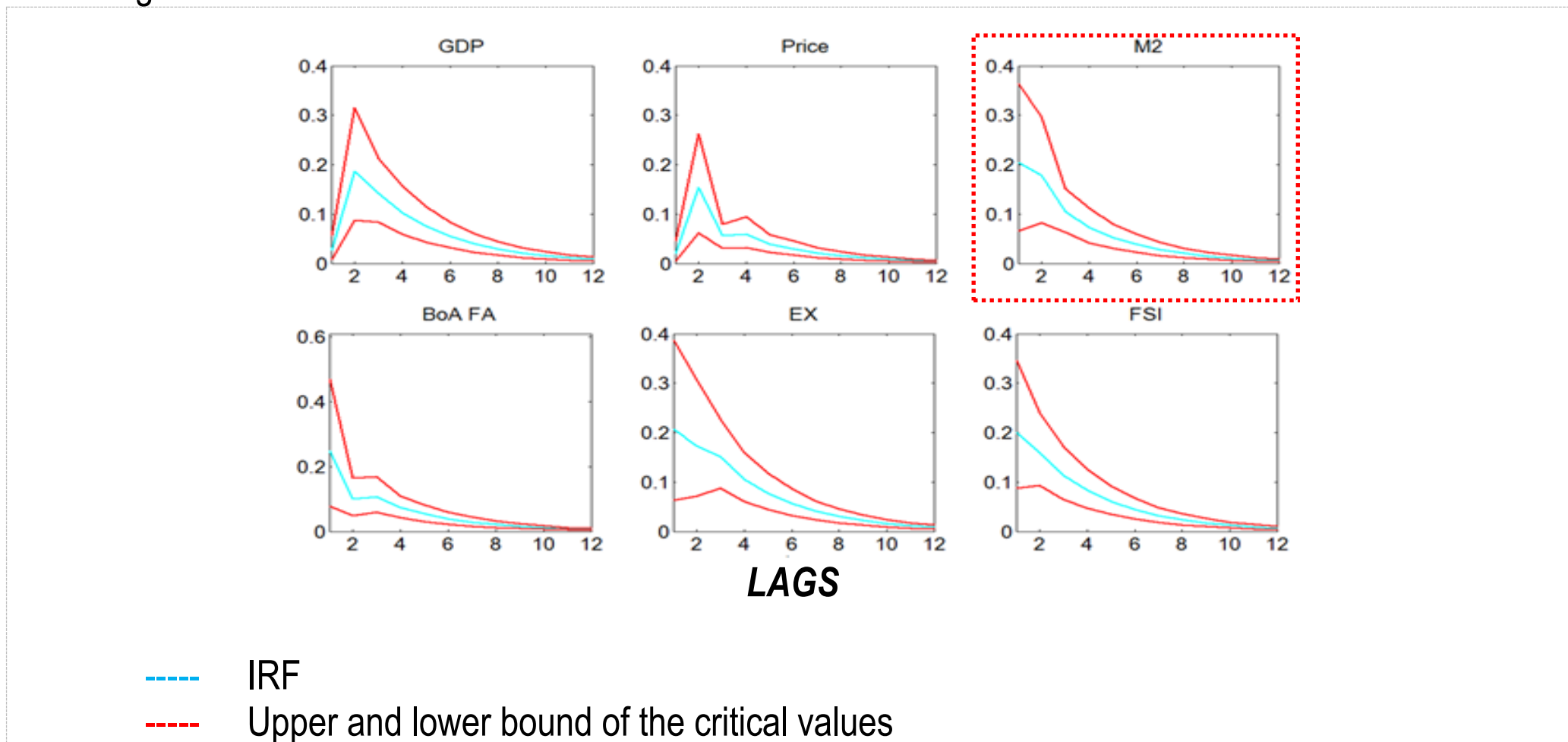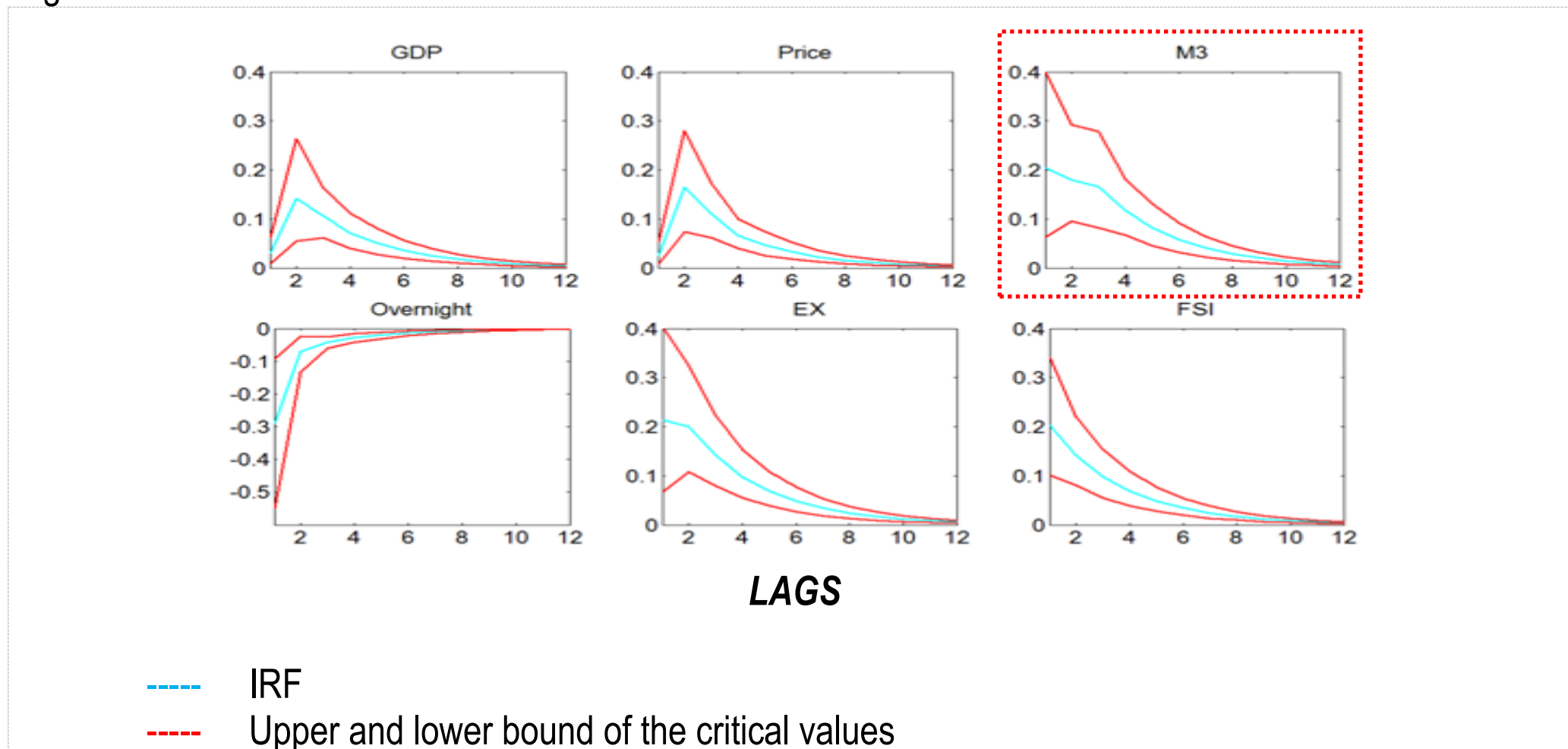

---- IRF

---- Upper and lower bound of the critical values

Source: Author's Calculations

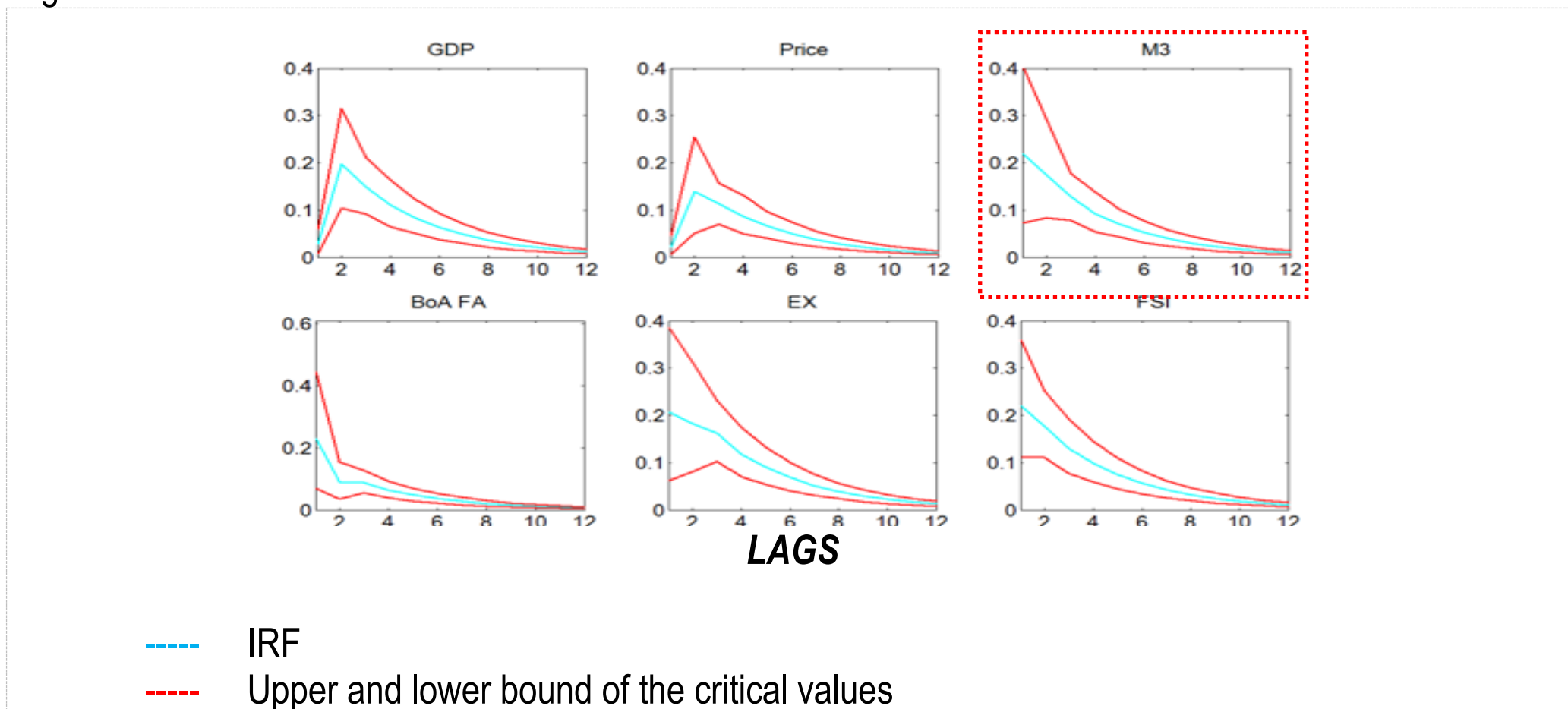*Figure 10. Non-accumulated impulse response to a 1pp shocks on i^{ON}, with h_0 = 3 and 5 variables under sign restriction.*

----   IRF

----   Upper and lower bound of the critical values

Source: Author's Calculations

Results...(8)

- Sign restrictions from 1 to 2 periods do not change the final outcome. **BUT**, increasing them or the number of variables under sign restriction lowers the number of accepted draws.

- The macroeconomic pass-through effects of MP is found to be:

    - Statistically significant and longer than the periods imposed by the sign restrictions.

    - Higher than in other studies and take place at horizons above 6 – 12 periods.

- The greatest impact of the MP shock is on fast moving variable (*EX*) and (*FSI*) followed by the effects on bank lending and money market channel.

- *GDP*, *Price* and *Lending* are found to be initially effected slightly, but the effects peak in 2 periods.

- The greatest impact, through means of policy rate is on *Price*, *Lending* and money market and through means of the liquidity effect is on *GDP*, *EX* and *FSI*.

- Accommodating MP contribute also more to the bank lending in domestic currency (de-euroisation).

- Output exhibits more persistence that price level, even though the persistence was even greater at the other fasting moving variables.

Conclusions...(1)

- This paper analyses macroeconomic pass-through effects of conventional and possible balance sheet MP type instruments, through VAR with sign restrictions approach.

- Results show MP shocks are statistically significant and maximise at horizons above 6 – 12 periods.

- The pass-through effects and the inertia of the MP shock are found to be relatively strong with respect to these variables and under this sample approach.

- MP stimulus, through interest cuts or/and balance sheet policies:

    - Boost output, price level, bank lending (mostly lending in domestic currency) and money stocks.

    - Depreciates the price of domestic currency.

    - Has a strong effect and puts more pressure on financial market condition.

- Finally, the greatest impact, through means of policy rate is on price level, bank lending and money market and through means of the liquidity effect is on output, exchange rate and financial market.

Conclusions...(2)

- FUTURE RESEARCH, can consider either of the followings:

  - Look at the effectiveness of different types of macro-prudential or/and balance sheet policies.

  - Either considering the effectiveness of balance sheet MP especially during the crisis period

  - Or splitting the sample between pre-crisis and after the crisis.

  - Robustness checks through additional variables that might have a bearing on the analysis, e.g.:

    - The outstanding debt of the government or the fiscal stance;

    - Longer term interest rate;

    - Core inflation or the inflation expectations;

  - Another possible solution might be to consider the pass-through effects of MP (either policy rate or balance sheet policy) changes on asset prices.

Thank you for your attention!!!

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