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**The macroeconomic pass-through effects of
monetary policy through sign restrictions
approach: in the case of Albania**

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THE MACROECONOMIC PASS-THROUGH EFFECTS OF MONETARY
POLICY THROUGH SIGN RESTRICTIONS APPROACH:
IN THE CASE OF ALBANIA

Gerti Shijaku*
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ABSTRACT

This paper examines the transmission mechanism of monetary policy in Albania during 2002 M01 - 2014 M12. The main question addresses the macroeconomic pass-through effects of a monetary policy shock, with regards to a conventional interest rate and possible different balance sheet policy changes. The analysis is based on a structural vector autoregressive model for Albanian economy that includes means of the Cholesky identification scheme and the sign restrictions approach. The former produces mixed results, that are either statistically insignificant or show a puzzle behavior. The latter is found to reduce bias, albeit with some supportive significant clear cut robustness evidences of the short run macroeconomic pass-through effects of a stimulus monetary policy that materialises within twelve periods. A stimulus monetary policy is found to support economic activity and increase price level. The effect is positive with regards to bank lending and monetary money stock variables. Exchange rate depreciates, accomplished by some higher stress on financial market condition. Both of these variables show a contemporaneously stronger response compared to the other variables. Analyses show that the greatest impact, through means of policy rate, is found to be on price level, bank lending and real money stock. In contrast, the greatest impact, through the liquidity effect, is on output, exchange rate and financial market conditions.

Keywords: Monetary transmission mechanism, financial market condition, VAR, sign restriction identification.

JEL Classification: C11, C32, E12, E13, E52, E58

I. INTRODUCTION

The domestic effectiveness of a highly accommodative monetary policy to repair, on the one hand, the monetary transmission mechanism and, on the other hand, to help restoring alone confidence in the financial system, through higher bank liquidity and low bank and sovereign

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credit risk, and to boost the economic growth recovery, has dominated policy discussion over the recent years². These policy discussions have intensified since in the wake of the global financial crises, many central banks have been responding to turmoil by cutting interest rates to historically low levels and by embarking on what Cour-Thirmann and Winkler (2013) called the non-standard (unconventional) monetary policy response actions in order to counter the risks to economic and financial stability. This saw monetary authorities using policy instruments that changed the composition and expand the size of their balance sheet as the main policy instruments³. Basically, these policies replaced or/and accomplished interest rates as the main policy instrument, even though, they have differed significantly across central banks. This is what Lagarde (2012) believes that another key aspect of the new financial architecture is the role of central banks, while the crisis has prompted a fundamental reassessment of their macroeconomic and financial responsibilities.

In this context, besides cutting interest rates, the central bank in the case of Albania has also been embarking upon some macro-prudential and balance sheet monetary policies. First, it has been providing liquidity to the banking system. This was followed by lowering the reserve required ratio in support of deposit withdraws and deteriorating non-performing loans. Second, it has also expanded its exposure to government bond financing through higher financing level and by shifting shorter instruments to longer debt financing. Third, it has employed upon macro-prudential policies to discourage or/and orientate the banking system towards bank lending in domestic currency, an option that would lower risk exposure to exchange rate volatility. The aim of these policies objective has been to repair the monetary transmission mechanism and restore alone, confidence in the financial system, through higher bank liquidity and low bank and sovereign bank lending risk. It was also believed that this would help to anchor economic agents' expectations to the 3.0% inflation target. In return, this could directly contribute to the improvement of the monetary policy efficiency and the economic growth recovery through bank lending channel and consumer confidence.

Then again, as in the case of the ECB, this approach to date appears to stand out in that the macro-prudential or these balance sheet policies were not aimed at providing additional direct monetary stimulus to the economy, but primarily at supporting the efficiency of the banking system and the transmission of its conventional monetary policy instrument. Hence, in the case of Albania, these policy measures can be seen as a complement to rather than substitute for standard interest rate policy instrument. Further to that, in the 2013 – 2015 medium-term strategy⁴, the central bank's monetary policy will remain orientated toward achieving and maintain price stability. The central bank will continue to rely on market instruments to achieve its monetary policy objectives. At the same time, it will consider developing appropriate policies and inter-institutional cooperation that relates to the identification and implementation of measures for preventing, restraining and handling the financial systemic risks. To that, the

² See Bernanke (2012); Fawley and Neely (2012); and Rajan (2014).

³ Several bold initiatives includes the Bank of Japan's Asset Purchase Program, Quantitative Easing (QE1, QE2 and QE3) by U.S. Federal Reserve, and the European Central Bank's unconventional policies (Supplementary Long Term Refinancing Operations, Securities Market Program, Outright Monetary Transactions bond-purchasing program and lately expanded asset purchase programme).

⁴ The medium – term development strategy 2013 – 2015 of the Bank of Albania aims to ensure that the institution's activities focus on fulfilling its legal duties, particularly those relating to monetary and financial stability – the two pillars of modern central banks.

priorities to enhance the monetary policy efficiency will be followed by acquiring thoroughly the transmission mechanism channels and monetary policy lags, which are constantly changing due to internal developments of the Albanian economy and global financial crisis.

For a small open economy such as Albania, understanding the transmission mechanism of monetary policy to inflation, output and other real economic variables is a key issue for the central bank to conduct monetary policy effectively. Indeed, the monetary transmission mechanism has been an integrated part of empirical and analytical study at the central bank⁵ and it is vital to re-analyse the pass-through effect of monetary policy channel for two reasons. First, a previous study by Kolasi, Shijaku and Shtylla, (2007), tried to identify the monetary transmission mechanism and evaluate the pass-through effects of monetary policy channels on the real output, inflation and core inflation. However, since then, little is known about macroeconomic pass-through effects of monetary policy, especially after the global financial crisis. Second, to the best knowledge no paper has yet so far analysed the monetary policy transmission mechanism through means of conventional or/and balance sheet monetary policy variables, associated especially with the periods in the aftermath of global financial crisis. Therefore, it is worthwhile to update previous results reflecting the pass-through effects of monetary policy changes, to utilize on longer times series and, on the top of that, to incorporate conventional and balance sheet variables into the analysis. Third, this paper provides supportive evidence to the Bank of Albania's "Two-Pillar Approach" strategy. On the one side, it sheds more lights on supportive evidence on the outlined priorities considering the Medium-term Development Strategy of the Bank of Albania for 2013-2015. Therefore, it should guide the Governing Council's strategic decision-making by expanding further the information base on the suitability of different instruments used in decision making to achieve the monetary policy's objectives. At the same time, it provides some informative evidences on the properties of the changing structure of monetary transmission mechanism in the verge of the aftermath of global financial crisis. Finally, it improves research quantitatively and qualitatively and 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.

This paper analysis these issues by exploring the fact that central bank uses mainly its regular channels to implement its extraordinary policy measures, even though the aftermath of the global financial crisis the decision making considered also some measures that consisted of macro-prudential and balance sheet policy type instruments. The main question to be address in this paper focuses on the macroeconomic pass-through effects of conventional monetary policy and whether it is more effective compared to an alternative balance sheet policy changes. The paper intends to address these questions through a structural vector autoregressive (SVAR) model for the Albanian economy. Importantly, identification of structural shocks is based on Cholesky identification approach and on the sign restrictions approach motivated by theory. To that, the analysis is extended to the inclusion counterfactual components to quantify the relative importance of different transmission channels that could be employed by the central bank to achieve the policy objective and to boost the economic growth recovery through inflation expectations, market confidence and bank credit channels.

⁵ See also Muço, Sanfey and Luçi (2001); Muço, Sanfey and Taçi (2004); Peeters (2005); Luçi and Vika (2005); Istrefi and Semi (2007), Tanku, Vika and Gjermani (2007).

Empirical analysis show that the Cholesky identification approach provides some mixed results. The impulse responses are either statistically insignificant or show a Puzzle behaviour. In contrast, the sign restriction approach paints a relatively similar picture under different model specification, albeit with some clear information on the magnitude of the macroeconomic pass-through effects of a stimulus monetary policy changes. Monetary policy changes are found to have real short run effect. The macroeconomic pass-through effect of the monetary policy change materialises within twelve periods. Positive monetary stimulus boosts output and prices level due to the demand side effect. Real money balances and bank lending channel reacts positive to a stimulus monetary policy, mainly through greater response on domestic currency counterpart. To that, real price of domestic currency depreciates, which all together with the accommodating monetary policy puts more pressure to the financial market conditions. The persistence on price level is relatively smaller than what is found for output. The fast moving show an even stronger persistence is response of monetary policy changes. Finally, the greatest impact, through means of policy rate, is found to be on price level, bank lending and real money stock and the greatest impact, through the liquidity effect, is on output, exchange rate and financial market conditions.

The paper is organised as follows: The second section presents the theoretical and methodological issues link to specified model. Section 3 summarizes the results. The paper concludes in section 4.

II. THE METHODOLOGY AND THE DATA

A. MODEL SPECIFICATION

There is extensive empirical literature studying using the VAR techniques as a tool to analyse the transmission mechanism of the pass-through effects of the monetary policy shock innovations⁶. A typical model in the monetary transmission mechanism literature, as Endut, Morley and Tien, (2015) suggest, consists of variables that represent (i) immediate target or policy instruments; (ii) intermediate targets, i.e. transmission channels; and (ii) the final targets such as output and price level. To that, this paper follows the empirical work by Gambacorta, Hofmann and Peersman (2012) to explore the dynamic pass-through effects of conventional and balance sheet type monetary policy instrument shocks. The model, a VAR specification, has the following representation:

$$X_t = \beta_0 + \sum_{i=1}^p \beta_i X_{t-1} + \varepsilon_t \quad (1)$$

Where, X_t is a vector of endogenous variables such as output, prices, central bank assets, monetary policy instrument and the level of implied 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

⁶ See also Sims, Stock and Watson, (1990); Stock and Watson (2001); Canova and De Nicolo (2002); Lanne and Luetepohl (2006); Bjørnland and Leitemo (2009); Dumičić, Čibarić and Horvat (2010); Glocker and Towbin (2011); Peersman (2011); Baumeister and Benati (2012); Kimura and Nakajima (2013); Arias, Rubio-Ramírez and Waggoner (2014); Fratzscher, Lo Duca, and Straub, (2014).

lagged effect of variables on each-other; ε_t is the vector of disturbance term and $\varepsilon_t \sim iid(0, \sigma^2)$. The authors imply that this model aims to grasp the main features of the monetary transmission mechanism under the financial market confidence.

The study extends the benchmark VAR specification by including also two additional variables. First, as in the case of Eurozone area, borrowing and lending in Albania predominantly take place through the intermediation of the banking sector. Therefore, both conventional and balance sheet policy measures taken by the central bank as a response of the crisis primarily aimed at fuelling the bank lending. This means that monetary policy disturbances are obviously expected to affect the bank lending channel and vice versa. Thus, following Peersman (2011), the model is extended by including an endogenous banking lending variable.

Second, the monetary policy is conducted under the inflation targeting and floating exchange rate regimes. Following Smets and Wouters (1999), the model specification considers also an exchange rate variable. This is assumed that it helps to analyse properly the conduct of monetary policy on the contest of these regimes. This is of considerable interest. First, the conventional interest rate impact is supplemented by significant effect of the exchange rate variable. At the same time, Albania is an import country and a significant ratio of deposits and bank lending is conducted in foreign currencies.

Third, the Albanian economy is also expected to be affected by decision making of the monetary authorities in its trading partners. Therefore, following Glocker and Towbin, (2011), the model specification includes also an exogenous variable to control for external effects of the monetary policy changes in the trading partners. Further to that, the model specification includes a dummy variable to account for the effect of the global financial crisis. The model has the following representation:

$$X_t = \beta_0 + \sum_{i=1}^p \beta_i X_{t-1} + \sum_{i=0}^q \beta_i Z_t + \varepsilon_t \quad (2)$$

Where, X_t is a vector of endogenous variables representing a scale variable on the economic activity (*GDP*), the general price level (*PRICE*), the bank lending (*CREDIT^{ALL}*), the monetary policy instrument (*i^{on}*), which is latter replaced by a central bank balance sheet variable (*BOA^{FA}*) to conduct of the pass-through effects of a possible balance sheet policy changes⁷; the exchange rate (*EX*) and the financial market condition (*FSI*). The exogenous variables, under the vector (Z_t), consist of the foreign monetary policy rate (*i^{ECB}*) and a dummy variable to account for the effect of the global financial crisis (*CRISIS*). The others are as previously defined.

The model is specified following also some other assumptions. Following Canova and De Nicolo (2002) the VAR model is specified in real terms, as opposed to nominal ones, for two important reasons. First, the estimated model has important implications for real variables. Second, the

⁷ Based on Gambacorta, et. al., (2012) the empirical analysis on the pass-through effect of policy rate and balance sheet policy is done separately on the assumption that a VAR specification with both of them is at the potential caveat risk e.g. that on variable (balance sheet changes) might capture in part the effects of the other variable (interest rate cuts), and vice versa.

responses of real variables allow distinguishing monetary from other types of real demand disturbances. At the same time, the approach intends to utilize better among the country specific dynamic behavior factors and the purpose of the main research question. Therefore, the dynamic behaviour of variables such as *GDP* and *Prices* are supposed to capture the macroeconomic dimension of the crises [Gambacorta, et. al., (2012)]. The crisis effects are assumed, also, as in the case of Peersman, (2011) to be reflected on the bank lending behaviour, given the prominent role of bank lending as a source of external finance in Albania. The latter represents the bank lending in domestic currency on assumption that any policy rate changes would priority mostly affect this counter-part.

At the same time, the monetary transmission mechanism identifies monetary policy shocks as innovations to the baseline interest rate or to some monetary aggregates [Luporini, (2008)]. To that, the Albanian monetary authority uses the open-market interest rate as the main policy instrument to transmit monetary policy signals⁸. This policy rate instrument is obviously also expected to influence the state of the economy and bank lending channel since the official policy rate is not yet at the zero low bound level. Peersman, (2011) suggests the bank system overnight rate is a better gauge of monetary policy rate. On the other hand, the benchmark model is estimated also to investigate the effect of alternative monetary policy instrument at the disposable of monetary authority. Therefore, the benchmark model is re-estimated, by including the central bank balance sheet variable instead of policy rate, to account for the pass-through effects of a possible balance sheet policy shock innovations. This variable, as Gambacorta and Hofmann, (2012) suggest, represents a monetary policy type instrument⁹ and as a quantitative policy it is a better gauge of balance sheet monetary policy during the crisis than the monetary base (M_0)¹⁰.

In addition, the exchange rate channel has always received particular attention in research work in the case of Albania. The focus has been to analyse the role played by the exchange rate as a channel through which monetary policy affects aggregate demand¹¹. To that, including the exchange rate supplements the effect of the monetary policy channel. It captures also the effects of different components e.g. bank lending, government borrowing and other issues linked to

⁸ Since 2000 Q03, the monetary policy of the Bank of Albania is implemented through the use of indirect instruments that consist of a base reference rate such as the repurchase agreements of seven-day maturity, applied in the regular weekly auctions of the Bank of Albania, which are respectively known as repo and reverse repo. Smaghi (2009) implies that ultimately what matters for investment and spending decision is the real interest rate.

⁹ Bernanke and Reinhart (2004) and Smaghi (2009) suggest that an alternative way to conduct monetary policy is by expanding the size of the central bank's balance sheet, even before policy rates have been cut to their lower bound.

¹⁰ However, the authors argue that the use of the BoA^{FA} as the balance sheet monetary policy instruments fail to take possible composition effects. It does not grasp announcement effects of the balance sheet monetary policy, even though it is not much clear how such effect could be capture in the VAR set-up. Thus, the model is also analysed on robustness arguments by including the M_0 instead of the central bank assets. The latter is defined as the sum of banknotes in circulation and bank reserves.

¹¹ Kolasi, et. al., (2010) suggest that for the exchange rate channel to work within the monetary transmission framework, two relationships must hold. First, there must be a link between monetary policy and the exchange rate, and second, the exchange rate must influence output and inflation. Istrefi and Semi, (2007) and Tanku, et. al., (2007) found that the exchange rate pass-through effect exists, but the power of pass-through effects of exchange rate to domestic prices weakens considerably during periods of low and stable inflation and virtually disappears during the period that the Bank of Albania sets its inflation rate objective between 2 to 4 percent. To that Kolasi, et. al., (2010) conclude that the exchange rate channel is not as strong as reported in previous works, and that central bank should pay attention to the exchange rate fluctuations, as they seem to have an adverse impact on real output fluctuations. Exchange rate developments are found to play a significant role on monetary aggregates [Shijaku, (2007); Tanku (2006); Shijaku 2013] and for credit channel [Shijaku, (2013); Shijaku, G., and Kalluci, I., (2013)].

the unhedged lending and to deteriorating non-performing loans in foreign currency¹². Finally, the implied financial market condition index is commonly referred to as a 'fear index' [Whaley (2009)] for possible financial market turmoil and economic risk aversion over the sample period. Therefore, this should capture also the core mechanism that involves financial intermediaries and the uncertainty shocks that have been an important driver of macro-financial dynamics behaviour during the global financial crisis¹³. In fact, the inclusion of this variable should correctly distinguish monetary policy from financial shocks [Ciccarelli, Maddaloni and Peydró, (2013)].

B. IDENTIFICATION STRATEGY SCHEME

The study uses a recursive identification scheme in a model that analyses the responses to a monetary policy shock innovation. The innovations have been identified by Cholesky techniques and means of sign restrictions.

i. CHOLESKY APPROACH

The Cholesky identification imposed on the model follows the causality order of the variables reflecting the decision making at the central bank and some other assumptions about the links in the economy. *GDP* and *PRICE* are placed at the top of the ordering [Migliardo, (2010)]. The former is ordered first assuming that it will only be affected by exogenous fiscal policy contemporaneously. The latter is ordered second assuming that it is supposed to react immediately to an output shock innovation. Both these variables are supposed do not react contemporaneously to the monetary policy shocks, but instead it is the monetary authority through its policy instrument that set up the policy rate subject to the macroeconomic patterns¹⁴. The variable *CREDIT*^{ALL} follows up, since it is expected to respond faster to the real economy as well as reacting to policy rate variable only with one lag rather than vice versa [Peersman (2011)]. *EX* is ordered after policy rate on two assumptions. First, from a decision making prospect, as Tanku, et. al., (2007) states, the monetary policy is conducted under a flexible exchange rate regime. Second, it also assume that the relative price of domestic and foreign money depends on expectations about domestic and foreign interest rates and inflation, which may themselves be affected by a policy change of both domestic and foreign monetary conditions. Besides, this variable is ordered before financial market indicator given that the latter is an index that includes the exchange rate market information within it. Hence, different patterns to the price of both domestic and foreign money shocks should be reflected to financial market. The variable on financial market condition is ordered last¹⁵ following the arguments that financial variables can respond contemporaneously very quickly to all types of shocks in the system [Li, (2010)] and slower moving variables such as policy rate are better

¹² The unhedged foreign currency lending is seen as a major threat to financial stability and risk of systemic crises in South Eastern European countries, in case of exchange depreciations and interest rate changes [Brown and De Haas (2010)]. Unhedged foreign currency lending is as high as 60% of total foreign currency lending in the case of Albania [Shijaku, (2013)].

¹³ See also Gambacorta, et. al. (2012); Afonso, Baxa and Slavik (2011); Bruno and Shin (2013) and Shijaku (2014b).

¹⁴ See also Afonso, et. al. (2011), Mallick and Sousa (2011), Mancellari (2011), Shijaku (2014b).

¹⁵ See also Afonso, et. al., (2011); Afonso and Silva, (2014) and Shijaku, (2014b).

candidates to be ordered before fast moving variables such as financial or market condition index [Bruno and Shin (2013)]¹⁶.

Further to that, this paper employs a structural Cholesky VAR identification approach based on the recursive approach introduced by Sims (1980). The relationship between the reduced-form residuals and the structural shocks, is expressed as follows:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} u_t^1 \\ u_t^2 \\ u_t^3 \\ u_t^4 \\ u_t^5 \\ u_t^6 \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix} \begin{bmatrix} e_t^1 \\ e_t^2 \\ e_t^3 \\ e_t^4 \\ e_t^5 \\ e_t^6 \end{bmatrix} \quad (4)$$

Where, u_t [$u_t^1, u_t^2, u_t^3, u_t^4, u_t^5, u_t^6$] represent the reduced-form disturbances or the corresponding innovations; e_t [$e_t^1, e_t^2, e_t^3, e_t^4, e_t^5, e_t^6$] is the vector of structural shocks, which are assumed to be uncorrelated with each other; a_{ij} are shock parameters, based on the matrix of VAR parameters and b_{ij} structural matrix associated with innovations.

Finally, the study follows the identification scheme introduced by the Blanchard and Perotti (2002), extended by Perotti (2005) to get the elasticity of some shock parameters estimated outside the VAR model. Among them are the shock innovations such as ($a_{12}=-0.196$) and ($a_{31}=0.129$)¹⁷, taking the following relationship between the reduced-form residuals and the structural shocks:

$$\begin{bmatrix} 1 & -0.196 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ 0.129 & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} u_t^1 \\ u_t^2 \\ u_t^3 \\ u_t^4 \\ u_t^5 \\ u_t^6 \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix} \begin{bmatrix} e_t^1 \\ e_t^2 \\ e_t^3 \\ e_t^4 \\ e_t^5 \\ e_t^6 \end{bmatrix} \quad (5)$$

The structural VAR scheme is identifying based on the work by Christiano, Eichenbaummy and Evans (1999). They are built upon some assumptions that identify the different structural shocks through a series of contemporaneous restrictions of the effects of the shocks onto the variables. The shocks identity a_{41} and a_{42} are set to zero on the assumption *GDP* and *PRICE* are among a block of 'slow moving variables' that does not react contemporaneously to monetary shocks, while there might be a simultaneously feedback from the macro environment to monetary variables¹⁸. To that Peersman (2011) imply also there is a lagged impact of credit shocks on γ and ρ , that is the contemporaneous impact with respect to a_{13} and a_{23} are restricted to zero. In

¹⁶ Gambacorta, et. al., (2012) that ordering policy variables after financial market indicators is inadequate and potentially biasing since monetary policy interventions should be allowed to immediately influence financial market sentiment.

¹⁷ This elasticity are calculated based on an Ordinary Least Square (OLS) approach and can be provided upon request. See also Mancellari (2011) and Shijaku (2014b). The study considered also an alternative scheme with ($a_{\gamma\phi}=-0.128587$) and ($a_{\gamma\delta}=-0.3587$) and found the results were not sensitive to this assumption.

¹⁸ See also Bjørnland and Leitemo (2009) and Glocker and Towbin (2011).

contrast, shocks on *GDP* and *PRICE* are allowed to have an immediate impact on *CREDIT^{ALL}*, which in return should distinguish shocks that are specific to the credit market. Further, Gambacorta, et. al., (2012) assume that there is also a lagged impact of shocks to *EX* and *FSI* on *GDP* and *PRICE* and therefore the contemporaneous impact on both variables [$a_{15}, a_{16}, a_{25}, a_{26}$] is set to zero. However, shocks to *GDP* and *PRICE* are assumed that they have an immediate effect on *EX* and *FSI*. On the other, it assumed that central bank would respond immediately through monetary instruments to mount financial market uncertainty, but shocks with respect to a_{46} are set to zero. Moreover, shocks to *EX*, i^{ON} and *FSI* are assume that have no contemporaneous impact on *CREDIT^{ALL}*, but credit market are allowed to have impact on them. Following this argument, shocks to *EX* are supposed to have no contemporaneous effect on i^{ON} assuming it will be affected by a policy change of both domestic and foreign monetary conditions, while policy decision is taken after data publication. The shocks to *FSI* are assumed to have no contemporaneous effects of *EX*, but it will be the shocks to *EX* that will affect *FSI* given the way it is constructed.

ii. SIGN RESTRICTIONS APPROACH

In contrast to the conventional identification that imposes the upper triangular part of the innovation matrix to zero, the sign restriction approach does not drop any contemporaneous effects (the variance – covariance is full)¹⁹. To that, it can be employ to pin down also a particular orthogonal decomposition. This involves extracting orthogonal innovations from the reduced model, which in principle, have no economic interpretation, but have the property of being contemporaneously and serially uncorrelated. Next, as in Endut, et. al., (2015), the signs of the theoretical co-movements of selected variables in response to an orthogonal innovation based on macroeconomic theory are used to study the information content of the disturbances, which then allows us to assign a structural interpretation to them.

This approach first utilises the properties of the residuals from reduced model to get the variance – covariance matrix. These residuals are transform into candidates of orthogonal eigenvalue-eigenvector decompositins, T^* . Following Fry and Pagan, (2011), the structural identification in this six VAR model specification reflects some short run restricted type assumptions [$Ae=Bu$ where $E[uu']=I$] emplaced. Therefore, the approach makes use of a combination of a total 15 ($N(N-1/2)$) restrictions bivariate Givens rotation matrices admissible ($i=1,\dots,15$) to construct the candidate Q s. These candidate Q s are then used to generate the candidate T^* 's, which in this six-variable system are expressed as follows:

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

¹⁹ See also Canova and De Nicoló (2002); Uhlig (2005); Migliardo (2010); Fry and Pagan (2011).

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:

$$Q_{3,4}(\theta_j) = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & \cos\theta_j & -\sin\theta_j & 0 & 0 \\ 0 & 0 & \sin\theta_j & \cos\theta_j & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \quad (7)$$

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 . Therefore, candidate Q matrices can be generated by conducting random normalised draws of θ_j , where θ_j are taken to be uniformly distributed over $(0, \pi)$. Then to search through the space of T^* for particular decompositions of Σ , sign restrictions are imposed on the short-run co-movements of variables based on important information provided by theory on the signs of the pair-wise dynamic cross-correlations between certain variables in response to a structural shock. Therefore, by making use of that information, it is possible to locate candidate decompositions and for any given orthogonal candidate, it is possible to check whether the shock produces an impulse response that corresponds to the sign of the cross-correlation between variables i and j as prescribed by theoretical economic signs.

The approach through Matlab routine, as in Migliardo (2010) and Endut, et. al., (2015), works as follows. First, it builds matrixes Π and D . it checks if the sign of the shocks match the expected responses. If this does not occur, the algorithm assembles a new matrix $\Pi_{m,n}(\theta_j) = \Pi * Q_{m,n}(\theta_j)$ using several values of m , n and θ_j . The vector of identified shocks is a particular transformation of sine and cosine functions, the rotation matrix Q defines the selected identification and Q is an explicit function of the sines and cosines of an angle. Therefore, the sign restriction achieves identification by restricting the signs of the structural responses and eliminates any kind of possible puzzle by construction²⁰. Finally, the summarised range of possible results follows the common strategy of sorting the impulse responses and reports the median value. This is a good approximation of the central tendency of the impulse responses across the estimation. Therefore, this paper uses a full matrix with a minimal set of sign restrictions that are robust across the theoretical models. This means that the impulse response function analysis is based on a sign restriction method that has been employed to identify the pass-through effects of monetary policy shock innovations and leave shocks with respect to other variables blanked. The sign restrictions, as in Endut, et. al., (2015), are motivated by theory and are imposed only on the monetary policy variable, as listed in Table 2 to 5, which are fairly generic and intuitive.

Theoretically, following a Taylor rule, Kolasi, et. al., (2010) believes that an stimulus (accommodating) monetary policy approach by the central bank, i.e. a decrease in the official nominal interest rate or expansion of the balance sheet, is followed by a fall in real interest rates (given rational expectations and sticky prices framework), which in turn leads to lower cost of

²⁰ Migliardo (2010) suggests that in contrast to the conventional Cholesky decomposition identification, that drops some contemporaneous effects by construction, the SVAR with sign restriction that does not drop any as the variance-covariance matrix is full. For more details see Canova and De Nicolo (2002).

capital and increases businesses and consumers investment or bank lending, and finally increases aggregate output²¹. This should also be followed by an increase of the price level in the short run. Migliardo (2010) assumes that stimulus monetary policy decreases price of money. This makes people hold more of it and borrow more for consumption and investment, so both inflation and output gap increases. However, Dreger, Reimers, Roffia, (2006) believes the effect would be negative²². To that, based on findings by Vika (2007), it is expected that balance sheet policy, linked to the liquidity of the banking system, would influence the banking lending channel via the amount of liquid assets held by commercial banks and thereafter the economic activity and price level. It could also influence the banking lending channel via the option to the purchasing of government debt. This should in return stimulated economic activity positively through higher private consumption and investment level. Then such demand side effects finally provide higher inflation pressure.

Policy-induced changes through stimulus monetary policy are also expected to affect the exchange rate. With a flexible exchange rate regime and perfect capital mobility, based on Kolasi, et. al., (2010), other things being equal, an official interest rate cut induces an outflow of capital out of the country, leading to an immediate depreciation in the value of domestic currency relatively to the other currency²³. Finally, the precise impact on financial market stress of a stimulus monetary policy is uncertain. On the one hand, this policy should low pressure into the financial market as either cost of lending and borrowing are lower or because of the liquidity provided following an increase of the in the central bank balance sheet policy. On the other hand, such changes might put more pressure to financial market via the exchange rate channels and the reason is twofold. First, a considerable amount of bank lending is provided in foreign currency, for exporting type firms and mortgages purposes by individuals, and nearly 60% is considered unhedged. Therefore, exchange rate depreciation will be expected to increase cost of lending or the probability to default²⁴. Second, the financial market stress index is constructing including the foreign exchange market information and depreciation of price of domestic currency will be reflected in this index.

To this theoretical argumentation, the model is estimating by placing a sign restriction only to those variables upon which the theory is clear on the expected results. Therefore, an accommodating monetary policy by cutting interest rate (expanding balance sheet) is expected to decrease policy rate (increase in balance sheet), increase the output, price level and bank lending (money stock) and depreciate the exchange rate²⁵. The horizon over which the sign restriction is binding is set to three periods. The model makes a 100000 draws (possible candidate matrixes) from the posterior distribution of the SVAR coefficients and from the space of rotation matrices. Then the impulse responses are built on those that satisfy the restrictions and discard the ones that do not. This process is repeated until a sufficient number of impulse

²¹ See also (Mishkin, 1996).

²² To that, Tanku (2006) accept it to be positive, but there is also the possibility of a negative effect due to the possible pass-through effect of the accommodating monetary policy to the alternative investments and credit and to the wealth or the substitution effect is picks up. See also Shijaku (2013).

²³ This effect would be similar to an accommodating balance sheet monetary policy.

²⁴ Shijaku, (2013) shows that most of the non-performing loan is under the foreign currency lending.

²⁵ An alternative scheme of a sign restriction set up included the possibility that accommodating monetary policy would $PRICE > 0$ and other restrictions being unchanged. But, in all the cases there were not enough number of draws that satisfied the restrictions upon which impulse response would be build. The results on that can be provided upon request.

responses have been achieved upon which impulse responses are drawn and reported as median value.

C. THE DATA

The study analysis the monetary transmission mechanism through SVAR method based on the sign restrictions. The variables are output, prices, bank lending, policy rate or balance sheet policy, exchange rate and a financial market condition index. This dataset consists of monthly observations for the period 2002 M01 – 2014 M12.

The variables are approximated as follows. *GDP* represents the annualised real GDP. *PRICE* represents the Consumer Price Index. *CREDIT^{ALL}* is the volume of bank lending in domestic currency to the private sector. *BOA^{FA}* is the volume of the Bank of Albania financial assets. *i^{ON}* consists of the banking system overnight interest rate. *EX* is the real effective exchange rate of domestic currency against the five main trading partner's currencies²⁶. *FSI* is proxy by a systemic financial stress index taken from Shijaku (2014a) and extended to the end of 2014 M12. The foreign policy rate (*i^{ECB}*) represents the European Central Bank ENONIA rate²⁷. The dummy variable (*CRISIS*) takes the value of 1 during the period 2008 M09 – 2011 M03, and 0 otherwise. The *CREDIT^{ALL}* and *BOA^{FA}* are deflated by CPI. Together with, *GDP*, *CPI* and *EX* are seasonally adjusted and log-transformed. This facilitates the interpretation of the coefficients as elasticity. Then, following Migliardo, (2010), the data entered the model as the cyclical component estimated by the Hodrick – Prescott (HP) filter. Further, *i^{ON}* and *i^{ECB}* instruments are transformed into real terms by subtracting the respective inflation rate.

The VAR model is estimated in levels based on Endut, et. al., (2015). The data on output and domestic CPI are taken from the Albanian Institute of Statistics. The data on foreign policy rate are taken ECB website. The rest of the data are taken from the Bank of Albania.

III. ESTIMATION RESULTS

A. THE BENCHMARK MODEL

The normalised benchmark SVAR model is analysed on the following procedure. First, endogenous and exogenous variables are analysed for stationary properties through means of unit root (Augmented Dickey-Fuller and Phillips-Peron) tests. Results reported in Table 1 in Appendix, does not reject the null hypothesis on the stationary $I(0)$ at a conventional significance statistical level, besides while *i^{ON}* which enters the model as a first difference. Second, the lag-length selection is based on the usual stringent Schwarz Information Criterion, which suggested a VAR with three lags. However, the benchmark model with sign restrictions includes only 1 lag of the endogenous variables given the relatively higher volatility behaviour to the higher lags and the loss to the degree of freedom. Finally, model specifications are analysed through means of impulse response function (Figure 1 – 9, in Appendix). The solid lines are the “median”

²⁶ The real effective exchange rate is an index. Hence, an increase in the exchange rate is a depreciation of the Albanian Lek (ALL), while a decrease is an appreciation of the Albanian Lek (ALL).

²⁷ The ECB mainly conducts its policy through either the minimum bid rate of variable rate tenders or the rate applied to fixed rate tenders in its main refinancing operations.

impulse response functions and the dashed lines are the 84% symmetric bootstrapped bands. Because all the impulse responses are produced using the same candidate decomposition, it facilitates comparisons across variables.

i. CHOLESKY APPROACH

Empirical results with the standard identification are present through Figure 1 and 2. A monetary shock is identified as follows. Figure 1 show the shock effect of 1 percentage point (pp) shock innovation to i^{on} . A glance at the results shows that following a Taylor rule approach, an accommodating monetary policy shock dictated by an interest rate cut by the central bank that would lead to a negative 1pp shock in the i^{ON} is associated by an initial accumulated decrease of nearly -0.011pp in following period. This effects doubles at nearly 0.022pp in three periods and stabilises at nearly 0.016pp in ten periods. This effect is found to be statistically significant, but based on the magnitude, the persistence is relatively small.

At the same time the accumulated effect with respect to *GDP* is relatively small. For a given 1pp negative shock on i^{on} , *GDP* responses is found to be relatively close to zero. The accumulated effect peaks up after, five periods to reach at nearly 0.005pp. Thereafter, the effect stabilises at nearly 0.002pp. Surprisingly, there is a Price Puzzle situation with respect to *PRICE*, as it is found to decrease to a negative shock on i^{on} . Initially, *Price* does not react to shock on i^{on} , but the accumulated effect is found to get to nearly -0.001pp after nearly six periods in response of 1pp shock on i^{on} . Then the response stabilises at nearly 0.0015pp. However, with respect to both *GDP* and *PRICE* the magnitude responses are found to be statistically insignificant.

Other results show a clear cut with respect to the fast moving variables. To a negative shock on i^{on} , *EX* depreciates and surprisingly it is accomplished by an increases in *FSI*, but under the expected augmented theoretical response²⁸. Initially, *EX* does not react contemporaneously, but it increase slightly in the following periods even though it does not exceed 0.03pp in response. At the same time, *FSI* is found not to response contemporaneously to a shock on i^{on} . The effect peaks at nearly 0.07pp in nearly ten periods and stabilises at around 0.09pp in 15 periods. However, the accumulated impulse responses are found to be statistically insignificant and the persistence is considered to be slow.

Figure 2 displays the impulse responses under the alternative benchmark model specification. That considers the response of the variables of interest to a standard deviation of the balance sheet policy changes. The results display relatively a different behaviour. An accommodating monetary policy caused by a positive 1pp shock on BoA^{FA} is found to be followed by a small contemporaneously, calculated to be at nearly 0.008pp. This magnitude nearly more than doubles in nearly two periods. It then stabilises by peaking at nearly 0.06pp in ten periods. This impulse response behaviour is statistically significant through the period, but the magnitude is relatively small.

²⁸ The analysis considered also a scenario with sign restrictions such as ($GDP > 0$; $PRICE > 0$; $CREDIT^{ALL} > 0$; $i^{ON} < 0$; $EX > 0$; $FSI < 0$), but found no accepted draws that satisfied these restrictions.

Considering other variables, GDP shows a Puzzle behaviour. Initially it does not react contemporaneously. The accumulated response reaches at nearly 0.03pp in nearly six periods. However, surprisingly the effect diminishing and after nine periods it becomes negative. This negative effect reaches at nearly -0.05pp in 13 periods, but it stabilises at nearly -0.04pp. However, the magnitude of the accumulated impulse response function is relatively small and statistically insignificant through both regimes.

PRICE continues to show the price puzzle behaviour. For the same shock scenario, *PRICE* does not react contemporaneously, but reaches and stabilises at nearly 0.035pp in nearly eight periods. The effect is statistically significant in between three to twelve periods, even though the magnitude is relatively small. In return, there is a clear cut picture with regards to *Credit^{ALL}*. Results show that *Credit^{ALL}* reacts positively, but it is another variable that does not response contemporaneously to *BoA^{FA}* shock. This effect increases at nearly 0.180pp in nearly twelve periods. The accumulated impulse response are found to be statistically significant.

Finally, with regards to fast moving variables, *EX* is found not to react contemporaneously to a 1pp shock on *BoA^{FA}*. The effect increases after nearly three periods. It gets also statistically significant after nearly six periods. The accumulated impulse response stabilizes at nearly 0.02pp in nearly 15 periods. However, the persistence of this shock effect is considered to be relatively small based on the magnitude. On the other hand, yet again, *FSI* show that it increases to a positive shock on *BoA^{FA}*. Under a positive 1pp shock on *BoA^{FA}*. *FSI* does not react initially, but as the effect increases it stabilizes at nearly 0.01pp in nearly six periods. This relationship, however, is statistically insignificant. To that the persistence is relatively small.

ii. SIGN RESTRICTION APPROACH

The results of the Structural VAR based on the sign restriction approach is presented in Figure 3 – 6. In more details, Figure 3 plots the impulse response functions related to the benchmark model under the interest rate (i^{on}) channel and the lines show the response of variables to a standard deviation of the monetary policy interest rate shock. A glance at the results confirms that variables react relatively to the response of a monetary policy disturbance according to the predictions obtained from theory and far beyond the horizon upon which sign restrictions are imposed. Following the Taylor rule approach, an accommodating monetary policy shock dictated by an interest rate cut by the central bank, increases output and the price level, boosts bank lending in domestic currency, depreciates the real exchange rate, but to some surprising behaviour it is followed by some higher pressure on financial markets.

An inspection of the figure in more details shows that the inertia which follows a 1pp negative shock cut in the i^{ON} is associated by an initial decrease of nearly -0.263pp in one period. Then, the magnitude shrinks to nearly -0.076pp in two periods. Then it gets at nearly -0.056pp in the following period. The estimated impact is statistically significant until it diminishes to zero in just nearly six periods. The inertia evaluated by the accumulated impulse response is statistically significant. It materialises at nearly -0.393pp in three periods. By the end of the twelve periods the value added is relatively small to peak at nearly -0.468pp. This implies that the persistence of a shock effect with regards to i^{ON} is high at the beginning, but fades out soon.

At the same time, a 1pp shock cut in the i^{ON} has initially a relatively slightly positive effect on GDP^{29} as it increases by nearly 0.027pp initially, but the magnitude reaches at nearly 0.146pp in two periods and at nearly 0.113pp in three periods. This shock effect fades out to zero after nearly nine periods and it is statistically significant. The accumulated response is statistically significant. The impact materialises at nearly 0.285pp in just three periods and then peaks at nearly 0.515pp by the end of twelve periods. This shows that under a simple IS-LM curve, a positive monetary policy stimulus increase output overall due to the possibility both demand and supply side effects.

For the same shock impact inflationary pressure rises initially slightly probably due to the sticky price framework, but the magnitude augments later. $PRICE$ increases initially by nearly 0.025pp in response to a negative 1pp shock on i^{ON} . As in the case of GDP , the effect amplifies in two periods to peak at nearly 0.215pp. In the following period the magnitude reaches at nearly 0.105pp and the gradually shrinks to zero in twelve periods. By this time the effect becomes statistically insignificant. The accumulated response materialises at 0.323pp in just three periods. By the end of the twelve periods the effect reaches to nearly 0.549pp and is throughout statistically significant. $PRICE$ shows similar patterns to GDP behaviour, but the demand side effects pre-dominate the supply side.

Further to these findings, bank lending channel is found to react positively to a stimulus monetary policy through interest rate cut. As in the case of the previous two variables, a 1pp shock cut in the i^{ON} boosts $CREDIT^{ALL}$ by nearly 0.029pp initially. Then, in the following period the effect is estimated to get at nearly 0.141pp and becomes even stronger in the third period by peaking at nearly 0.153pp. Thereafter, the response starts to shrinks out slowly until it gets to zero in twelve periods. During the course of this lasting period the impact is found to be statistically significant. With regards to the accumulated response the effect is estimated to materialise at nearly 0.323pp by the end of third period. The magnitude is found to more than doubt in twelve periods to reach at nearly 0.665pp. This result is similar to Shijaku and Kalluci, (2013). The pass-through effects of a stimulus interest rate cut compared to GDP and $PRICES$, which are among the main variables to the focus of the decision making, is relatively higher with regards to $CREDIT^{ALL}$, even though further research would require investigating whether this is caused due to demand or supply side effects.

Other results under the sign restriction approach support the view that policy shocks affect also behaviour of the fast moving such as the foreign exchange rate market indicators. A positive stimulus monetary policy leads to an initial strong effect in the foreign exchange rate market. This effect shrinks later mostly to the positive effect of such shock to a higher confidence through better performances of economic activity and bank lending channel. EX increases initially by nearly 0.212pp in response of a similar 1pp negative shock on i^{ON} . The estimated impact gets at nearly 0.179pp in the second period. Then, this effect shrinks at nearly 0.149pp in the following. The impulse response is found to be statistically significant until it diminishes to

²⁹ An alternative model specification, using the annual real growth rate of quarterly output instead of GDP , ensembles these findings, but showing that it increases initially by nearly 0.095pp, peaks at nearly 0.151pp in two periods and shrinks gradually to zero thereafter. Still the impulse response is statistically significant.

zero in nearly nine periods. The accumulated pass-through effect materialises throughout time to peak at nearly 0.831pp by the end of this twelve period time span. It is evident that interest rate channel matters in transmitting the monetary shocks to foreign exchange rate market, and in fact, plays a greater role with regards to the other variables.

Finally, the picture on financial market condition is yet again a very much of a clear cut even under the sign restriction approach. Surprisingly, even though under the expected sign, it also increases to a stimulus monetary policy shock through an interest rate cut³⁰. The results imply that *FSI* increases initially by nearly 0.191pp. The effect shrinks to nearly 0.143pp in two periods and in the following period it gets at nearly 0.098pp. This impulse response is statistically significant until it fades graduate to zero in nearly nine periods. The accumulated pass-through effect materialises to nearly 0.431pp in the first three periods and peaks to nearly 0.637pp by the end of twelve periods. These results yet support the view that policy changes have an immediate impact on the fast moving variables. To that, results point to the need for the policy-makers to take into account the impact that their actions might have on financial market conditions linked to exchange rate movements.

Figure 4 displays results of the impulse response related to the alternative benchmark model that considers the importance of a different accommodating monetary channel. That is the responses of variables to a standard deviation of the monetary policy balance sheet policy shock. The responses to this easing monetary policy shock paint a relatively similar picture to those under the model specification with interest rate channel, albeit with some clear information on the magnitude pass-through effects with regards to these two policy shocks scenario. All the impulse responses are statistically significant until they shrink to zero. They have the expected prior behaviour that is an easing monetary condition through an expansionary central bank balance sheet policy (BOA^{FA}) leads to an increase of output, prices and bank lending, followed by a depreciation of the price of domestic currency and higher pressure on financial market condition.

Yet again, a 1pp positive shock on BOA^{FA} is followed by an increase on BOA^{FA} by nearly 0.216pp in the first period. Then, the magnitude drops immediately at nearly 0.079pp, followed by a gradually shrink until it get to zero in more than twelve periods. At peak the accumulated response reaches at nearly 0.643pp in twelve periods. These results show that the inertia of balance sheet policy to the shock behaviour is relatively similar to that of i^{ON} , initially high and drops gradually throughout time until it gets to zero, but the persistence is found to be longer and to a greater extend.

Despites support for a demand side effect, *GDP* responses initially slightly to a positive 1pp shock on BOA^{FA} . This effect peaks at nearly 0.184pp in two periods. Then it shrinks at nearly 0.127pp in the following periods and so on until it diminishes to zero by twelve periods. However, at the peak, the accumulated impulse response materialises at nearly 0.679pp, that is nearly 0.164pp higher than the estimated impact on response to a 1pp policy rate (i^{ON}) shock. *PRICE* increases by nearly 0.021pp in the first period. The effect reaches at nearly 0.167pp in the

³⁰ The analysis considered also a scenario with sign restrictions such as ($GDP > 0$; $PRICE > 0$; $CREDIT^{ALL} > 0$; $i^{ON} < 0$; $EX > 0$; $FSI < 0$), but found no accepted draws that satisfied these restrictions.

following period and shrinks immediately at nearly 0.076pp. The magnitude of the response diminishes through time to get at zero in twelve periods. At the peak the accumulated response accounts for nearly 0.264pp in three periods and at nearly 0.494pp by the end of the twelve periods. This effect is nearly -0.055pp smaller to the previous results found under the shock effect of i^{ON} . With regards to bank lending channel, the immediate response is positive, but still low. $CREDIT^{ALL}$ increases initially by nearly 0.032pp to the 1pp positive shock on BOA^{FA} . Indeed, the response peaks at nearly 0.187pp in just two periods, but start to decline thereafter. The pace of the decrease is slow, moving from nearly 0.108pp to nearly 0.008pp in twelve periods. The accumulated impact is figured to peak at nearly 0.643pp by the end of the twelve periods. This suggests that quantitative monetary policy easing directed either to higher government finance exposure or to higher bank liquidity portfolio ultimately leads to better economic performance, a demand side effect on price level and greater bank lending under the supply side effects.

At the same time, regarding the fast moving variables, the results demonstrate EX response immediately to a 1pp positive shock on BOA^{FA} . The initial effect is estimated to be at nearly 0.199pp. This is, however, slightly smaller than the impact found to the response of the same shock to i^{ON} . The magnitude drops at nearly 0.169pp in the next period, to be followed by a response of nearly 0.139pp in three periods and so on until it fades out to zero at the end of twelve periods. To that, the accumulated response is estimated to peak at nearly 0.865pp suggesting that the pass-through effect of a balance sheet policy is nearly more than two third completed. The findings suggest that EX is initially more effected by portfolio behaviour link to the interest rate changes, but the persistence appear to be stronger under a model specification with BOA^{FA} .

Furthermore, FSI response behaviour seems similarly regardless of the alternative policy shocks. Indeed, yet again the immediate response of FSI to a positive shock on BOA^{FA} is positively associated. It is high at the beginning, but dropping gradually throughout time³¹. FSI increases initially by nearly 0.194pp in response to a 1pp positive shock on BOA^{FA} . Then, the magnitude drops at nearly 0.148pp. This effect dimidiates at nearly 0.106pp in the following period. The pace of decline continues gradually until it fades out to zero only after twelve periods, at which the accumulated response peaks at nearly 0.734pp. This is stronger than the effect of a shock to interest rate changes. To that, indeed results on the persistence of FSI are similar to the dynamics of the EX supporting the view that they are link together.

B. ROBUSTNESS CHECK: ALTERNATIVE ESTIMATES

The benchmark VAR specification is re-assessed allowing for robustness checks through alternative modelling choices. These checks consider the responses of macroeconomic variables to a standard deviation of the monetary policy shock under a SVAR with sign restriction approach. On the one hand, the estimation is replicated by using an alternative sign restrictions approach, by changing either the number of horizons or the number of variables over which sign restrictions are imposed. On the other hand, it consists of four variations to the benchmark

³¹ The alternative scenario with sign restrictions such as ($GDP > 0$; $PRICE > 0$; $CREDIT^{ALL} > 0$; $i^{ON} < 0$; $EX > 0$; $FSI < 0$) showed there was no accepted draws that satisfied these restrictions.

VAR, that includes: (i) alternative bank lending variables to account for the effect of monetary policy with respect to total bank lending ($CREDIT^{TOT}$)³²; (ii) a model using the one week repurchase agreement of seven-day maturity (i^{REPO}) instead of the overnight rate³³; (iii) an alternative specification considering monetary base (M_0)³⁴ as the quantitative policy instrument instead of BOA^{FA} ; (iv) and another one where a money market variable³⁵ is used instead of credit market variables.

Figure 5 shows the results of an alternative counterfactual estimation that includes $CREDIT^{TOT}$ under the effect of i^{ON} channel, which implies that it increases initially by 0.077pp to a 1pp positive shock on i^{ON} . The response peaks at nearly 0.174pp in two periods. It drops at nearly 0.154pp in the following period. It continues so until it fades out to zero in twelve periods. Throughout this time, the response behaviour is statistically significant. The accumulated response accounts for 0.834pp increase in $CREDIT^{TOT}$ by the end of twelve periods, which is nearly 0.104pp higher than the one found in the case of $CREDIT^{ALL}$. These results imply that easing monetary costs provides short run positive stimulus not only to the lending in domestic currency but also to the counterpart in foreign currency.

At the same time, Figure 6 presents the findings to a positive 1pp shock scenario on BOA^{FA} . To that, $CREDIT^{TOT}$ reacts positive, increasing by nearly 0.086pp and materialising in the following period 0.189pp. The magnitude of the response continues to be positive, but the marginal response drops until it materialises at zero in twelve periods. At the peak, the accumulated response reaches at nearly 0.755pp. That is slight smaller than the materialised effect found to the i^{ON} shocks scenario. This is, yet again, another confirmation that bank lending is more affected by cost related factors. Furthermore, the response of other variable seems not to be sensitive across sample choices, even though it has to be notice that either under i^{ON} or the BOA^{FA} shock scenario the final accumulated response is higher probably owing to the fact that $CREDIT^{TOT}$ includes also added impact of the counterpart of lending in foreign currency.

Finally, with regards to bank lending channel, Figure 7 (a and b) shows the pass-through effect of monetary policy changes with respect to de-euroisation bank lending components, that is the estimation of the effect upon the behaviour of the ratio of bank lending to the private sector in domestic currency to the total bank lending to the private sector ($CREDIT^*$). Results in Figure 5a implies that $CREDIT^*$ increases by nearly 0.165pp initially in response of a positive 1pp shock on i^{ON} . The impact holds unchanged for at least period, but latter on it starts dropping until it fades out to zero in nearly just nine periods by which the accumulated response account for nearly 0.803pp. Figure 5b shows that to the 1pp positive shock on BOA^{FA} , the immediate response of $CREDIT^*$ is still high and accounts for nearly 0.160pp in the first period. The magnitude gets at nearly 0.165pp in two periods, but starts to shrink slowly to zero in nine periods, after which the accumulated response materialises at nearly 0.605pp. It is notable that these results provide

³²The $CREDIT^{TOT}$ represents total bank lending in domestic and foreign currency to the private sector. First, it is deflated by CPI. Second, seasonally adjusted and log-transformed. Finally, it enters the model as the cyclical component estimated by the HP filter.

³³This is transformed in real terms by subtracting the inflation rate.

³⁴ M_0 represents the volume of Net foreign asset plus domestic assets minus other net assets. First, M_0 is deflated by CPI. Second, it is seasonally adjusted and log-transformed. Finally, it enters the model as the cyclical component estimated by the HP filter.

³⁵Money market variable is represented by the monetary aggregates e.g. the intermediate money (M_2) and the money supply (M_3).

clear and supportive evidence that easing monetary policy changes stimulus more bank lending in domestic currency, but to a greater extent under the cost reduction related policies.

Yet, despite the support for bank lending view in the benchmark model, the money market view of the short run pass-through effects of monetary policy changes is clearly relevant as well. Correspondingly, findings in Figure 8 and 9 display the impulse response functions of a standard deviation of the monetary policy shock for model specification using the real money stock channel instead, that is intermediate money (M_2) and money supply (M_3)³⁶. The impulse responses to the monetary policy changes paint a relatively similar picture to those under the model specification with bank lending channel, albeit yet again with some robustness check and clear picture on the pass-through effects on monetary policy inertia and other macroeconomic variables. That is all the impulse response functions have the expected prior and founded behaviour. A stimulus monetary policy increase output and price level, depreciate exchange rate and increases pressure to financial market, but most importantly increase real balance stock of money. The latter are found to be more sensitive compared to bank lending channel.

Figure 8a (9a) displays that the immediate response of M_2 (M_3) to a negative 1pp shock type to i^{ON} is positive and high, and it starts to decline throughout time. Initially, M_2 (M_3) increases by nearly 0.175pp (0.216pp) and the pace of the diminishing marginal response is slow until it fades out to zero in twelve periods. At peak the accumulated response of M_2 (M_3) materialises at nearly 0.492pp (0.556pp) in the first quarter and less than doubles to nearly 0.810pp (0.928pp) by the end of the fourth quarter. The impulse response is found to be statistically significant. Figure 8b (9b) shows that to the positive 1pp shock on BOA^{FA} , the immediate response peaks at nearly 0.202pp (0.225pp). Similarly, it starts to decline slowly until it diminish to zero in twelve period. The accumulated response of M_2 (M_3) peaks to nearly 0.735pp (0.880pp) by the end of twelve periods. This is nearly 0.075pp (0.048pp) smaller than the accumulate response found under the shock effect of i^{ON} .

Furthermore, some additional features are worth noting. Analysis under different monetary channels, that is either the i^{REPO} or M_0 , provide supportive robustness evidences on model specification and provide clear cut picture on the short term pass-through effects of monetary policy changes, even though in both cases the magnitudes are smaller. Extending the horizon of sign restriction to 2 periods does not change the final outcome, but increase the number of accepted draws. Increasing the number of variables under sign restriction lowers the number of accepted draws. The greatest impact of the monetary policy change is on money market and foreign exchange rate channels. The former is more affect related to monetary policy change with regards to interest rate. The latter responses to a greater extent to the monetary policy changes with regards to balance sheet policies, even though at the beginning it shows that portfolio patterns are more persistent. These effects are followed by the impact on the financial market condition and bank lending. The former responses more to balance sheet policies. The latter is affect more by cost related policies and together with the other two slowing moving

³⁶ M_2 represents the volume of M_1 (Demand Deposits in domestic currency plus Currency Out of the Bank) plus Time Deposits). M_3 is the volume of M_2 plus Deposits in foreign Currency (Demand Deposits plus Time Deposits). First, M_2 and M_3 are deflated by CPI. Second, they are seasonally adjusted and log-transformed. Finally, they enter the model as the cyclical component estimated by the HP filter.

variables, output and prices, are found to be initially effected slightly. At peak the responses materialises in the first two periods and overall all of them pick up pick up demand side effects.

In addition, the greatest impact, through means of policy rate, is found to be on price, bank lending and real balance of money stock and the greatest impact, through the liquidity effect, is found on output, exchange rate and financial market conditions. Accommodating monetary policy contributes to the total bank lending and de-euroisation of lending channel. Output exhibits more persistence that price level, even though the persistence was even greater at the other fasting moving variables. To all that said, most importantly the analysis are qualitatively consistent with the consensus view on the transmission mechanism that monetary policy has real short term effects. All models specification show relatively similar dynamics supporting robustness check of the model estimation and monetary policy pass-through effects take place at horizons above 6 – 12 lags. Above all, as in Migliardo (2010), the sign restrictions approach reduces bias, given that the confidence bands for impulse response are tight to the median value. This approach provides clear cut results compared to the Puzzle behaviours found under the Cholesky decomposition.

IV. CONCLUDING REMARKS

This paper analyses the transmission mechanism of monetary policy for the small open economy, Albania. Special attention is paid to the relative importance of accommodative monetary policy, such as interest rate or/and balance sheet policy changes channels. The idea is to analyse the macroeconomic pass-through effects of conventional monetary policy and possible balance sheet type instruments that can be employed by the monetary authority in the case of Albania. This provides supportive evidence to achieve the policy objective and to boost the economic growth recovery through market confidence and bank credit channel. The paper make uses of structural vector autoregressive model with Cholesky scheme identification and sign restrictions approach. The latter approach has the advantages of overcoming the former approach. First, it makes full use of the contemporaneous effects as the variance – covariance matrix is full. Second, it eliminates any possible puzzles as it drops results that does not satisfy the theory. This analysis makes use of the impulse response function and highlights the dynamics effect between a structural monetary policy shock and the main economic variables, namely output, prices, money or banking lending indicator, policy rate or balance sheet instruments, exchange rate and a financial market condition index

Empirical findings under the Cholesky identification approach are relatively mixed. Impulse response function are either statistically insignificant or show a Puzzle behaviour. In return, under the sign restriction approach, findings are robust to different model specification channels. Monetary policy changes, either through policy rate cuts or balance sheet expansion, have real short run effect and the pass-through of monetary transmission mechanism materialise within 12 periods. Positive monetary stimulus boosts output, bank lending and real money stocks. To that, real price of domestic currency deprecates, which all together with the accommodating monetary policy puts more pressure to the financial market condition. This point to the need for policy-makers to take into account the impact that their actions might have on financial market conditions possibly to the unhedged bank lending and non-performing

loan in foreign currency. To that, it is also to be considered the possibility that easing monetary condition does contribute to the de-euroisation bank lending portfolio. In addition, based on the magnitude, the pass-through effects of the monetary policy changes in the case of Albania are found to be strong with respect to these variables and under this sample approach. Finally, these results provide some vital information with regards to the outcomes of alternative monetary policy instrument that might be employed by the central bank Governing Council. On the one hand, results show that the greatest impact, through means of interest rate instrument, is found to be on inflation pressure channel, bank lending channel and real money stock channel. On the other hand, the greatest impact through the balance sheet liquidity effects is on output, exchange rate channel and financial market conditions. Output exhibits more persistence than price level, even though the persistence was even greater at the other fast moving variables. Similar money market is more affected than the bank lending channel. Exchange rate and financial market show similar behaviour patterns.

Some other caution is, however, required to this analysis that needs to be borne in mind for future research. First, the analysis does not explicitly assess the effectiveness of different types of macro-prudential or/and balance sheet policies. This could expand further the information base used in decision making. It can improve research quantitatively and qualitatively as well as suitability of instruments to achieve the policy objectives. Second, the sample period covers normal times as well as period under financial market stress. To this, future research could consider the effectiveness of balance sheet monetary policies especially during the crisis period, even though there might be a risk to data sufficiency. An alternative solution could be to use the same model specification. The estimated the model by splitting the sample between pre-crisis and after the crisis, on the argument to analyse through the impulse response function whether the monetary transmission mechanism in the case of Albania has changed in the aftermath of the financial and economic crises.

Further, the model could include simultaneously both bank lending and money stock variable so that to evaluate the full effect of a possible supply or demand shock effects on price level. To that, an alternative approach could consider the inclusion of both policy instruments, policy rate and balance sheet instruments, to check upon on robustness checks whether the estimated response still holds. Finally, the benchmark model could also be assessed on the robustness arguments to the inclusion of additional variables that might have a bearing on the analysis. Among future research might consider a version including the outstanding debt of the government. Alternative possible solution might be to consider the pass-through effects of monetary policy changes on core inflation or inflation expectations, asset prices and longer term interest rate.

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APPENDIX I

Table 1. Unit Root Test^a, period 2002 M01 – 2014 M12.

Variable	Level			First difference		
	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
<i>Augmented Dickey Fuller (ADF) test</i>						
GDP	[0.0000]	[0.0004]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
PRICE	[0.0000]	[0.0001]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
CREDIT ^{ALL}	[0.0001]	[0.0008]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
CREDIT ^{TOT}	[0.0054]	[0.0284]	[0.0003]	[0.0049]	[0.0259]	[0.0003]
M ₂	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
M ₃	[0.0026]	[0.0156]	[0.0001]	[0.0000]	[0.0000]	[0.0000]
i ^{ON}	[0.1703]	[0.3749]	[0.0678]	[0.0004]	[0.0028]	[0.0000]
i ^{REPO}	[0.8891]	[0.3983]	[0.2496]	[0.0024]	[0.0090]	[0.0002]
BOA ^{FA}	[0.0010]	[0.0060]	[0.0000]	[0.0003]	[0.0017]	[0.0000]
M ₀	[0.0173]	[0.0755]	[0.0011]	[0.0000]	[0.0000]	[0.0000]
EX	[0.0005]	[0.0032]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
FSI	[0.0000]	[0.0001]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
i ^{ECB}	[0.0061]	[0.0250]	[0.0003]	[0.0000]	[0.0000]	[0.0000]
<i>Phillips – Peron (PP) test</i>						
GDP	[0.0000]	[0.0001]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
PRICE	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
CREDIT ^{ALL}	[0.0455]	[0.1601]	[0.0037]	[0.0000]	[0.0000]	[0.0000]
CREDIT ^{TOT}	[0.0895]	[0.2709]	[0.0086]	[0.0000]	[0.0000]	[0.0000]
M ₂	[0.0002]	[0.0017]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
M ₃	[0.0001]	[0.0008]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
i ^{ON}	[0.0677]	[0.1976]	[0.0086]	[0.0000]	[0.0000]	[0.0000]
i ^{REPO}	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
BOA ^{FA}	[0.0231]	[0.1018]	[0.0016]	[0.0000]	[0.0000]	[0.0000]
M ₀	[0.0100]	[0.0472]	[0.0006]	[0.0000]	[0.0000]	[0.0000]
EX	[0.0107]	[0.0502]	[0.0006]	[0.0000]	[0.0000]	[0.0000]
FSI	[0.0985]	[0.3960]	[0.0188]	[0.0000]	[0.0002]	[0.0000]
i ^{ECB}	[0.0320]	[0.1267]	[0.0024]	[0.0000]	[0.0001]	[0.0000]

^a automatic lag selection based on Schwarz Info Criterion (SIC)

Source: Author's calculations

Table 2: Sign restrictions scheme of a model specification with bank lending in domestic and under different MP instruments^(a).

	Policy rate instruments		Balance sheet instruments	
	i^{on}	i^{REPO}	BoA ^{FA}	M ₀
(b)	5791	2341	5175	4292
(c)	3	3	3	3
GDP	(+)	(+)	(+)	(+)
PRICE	(+)	(+)	(+)	(+)
CREDIT ^{ALL}	(+)	(+)	(+)	(+)
i^{on}	(-)			
i^{REPO}		(-)		
BOA ^{FA}			(+)	
M ₀				(+)
EX	(+)	(+)	(+)	(+)
FSI	(?)	(?)	(?)	(?)

(a) – Based on 100000 draws (rotations) tried during model estimation.

(b) – Number of accepted draws that satisfy the restrictions imposed.

(c) – Number of horizons over which sign restrictions are imposed.

(?) – No sign restriction is imposed.

Source: Author's calculations

Table 3: Sign restrictions scheme of a model specification with total bank lending channel and under different MP instruments^(a).

	Policy rate instruments		Balance sheet instruments	
	i^{on}	i^{REPO}	BoA ^{FA}	M ₀
(b)	7439	5417	5739	5088
(c)	3	3	3	3
GDP	(+)	(+)	(+)	(+)
PRICE	(+)	(+)	(+)	(+)
CREDIT ^{TOT}	(+)	(+)	(+)	(+)
i^{on}	(-)			
i^{REPO}		(-)		
BOA ^{FA}			(+)	
M ₀				(+)
EX	(+)	(+)	(+)	(+)
FSI	(?)	(?)	(?)	(?)

(a) – Based on 100000 draws (rotations) tried during model estimation.

(b) – Number of accepted draws that satisfy the restrictions imposed.

(c) – Number of horizons over which sign restrictions are imposed.

(?) – No sign restriction is imposed.

Source: Author's calculations

Table 4: Sign restrictions scheme of a model specification with intermediate money (M2) and under different MP instruments^(a).

	Policy rate instruments		Balance sheet instruments	
	i^{on}	i^{REPO}	BoA ^{FA}	M ₀
(b)	6762	4491	6390	5285
(c)	3	3	3	3
GDP	(+)	(+)	(+)	(+)
PRICE	(+)	(+)	(+)	(+)
M ₂	(+)	(+)	(+)	(+)
i^{on}	(-)			
i^{REPO}		(-)		
BOA ^{FA}			(+)	
M ₀				(+)
EX	(+)	(+)	(+)	(+)
FSI	(?)	(?)	(?)	(?)

(a) – Based on 100000 draws (rotations) tried during model estimation.

(b) – Number of accepted draws that satisfy the restrictions imposed.

(c) – Number of horizons over which sign restrictions are imposed.

(?) – No sign restriction is imposed.

Source: Author's calculations

Table 5: Sign restrictions scheme of a model specification with money supply (M3) and under different MP instruments^(a).

	Policy rate instruments		Balance sheet instruments	
	i^{on}	i^{REPO}	BoA ^{FA}	M ₀
(b)	6995	5485	5429	5657
(c)	3	3	3	3
GDP	(+)	(+)	(+)	(+)
PRICE	(+)	(+)	(+)	(+)
M ₂	(+)	(+)	(+)	(+)
i^{on}	(-)			
i^{REPO}		(-)		
BOA ^{FA}			(+)	
M ₀				(+)
EX	(+)	(+)	(+)	(+)
FSI	(?)	(?)	(?)	(?)

(a) – Based on 100000 draws (rotations) tried during model estimation.

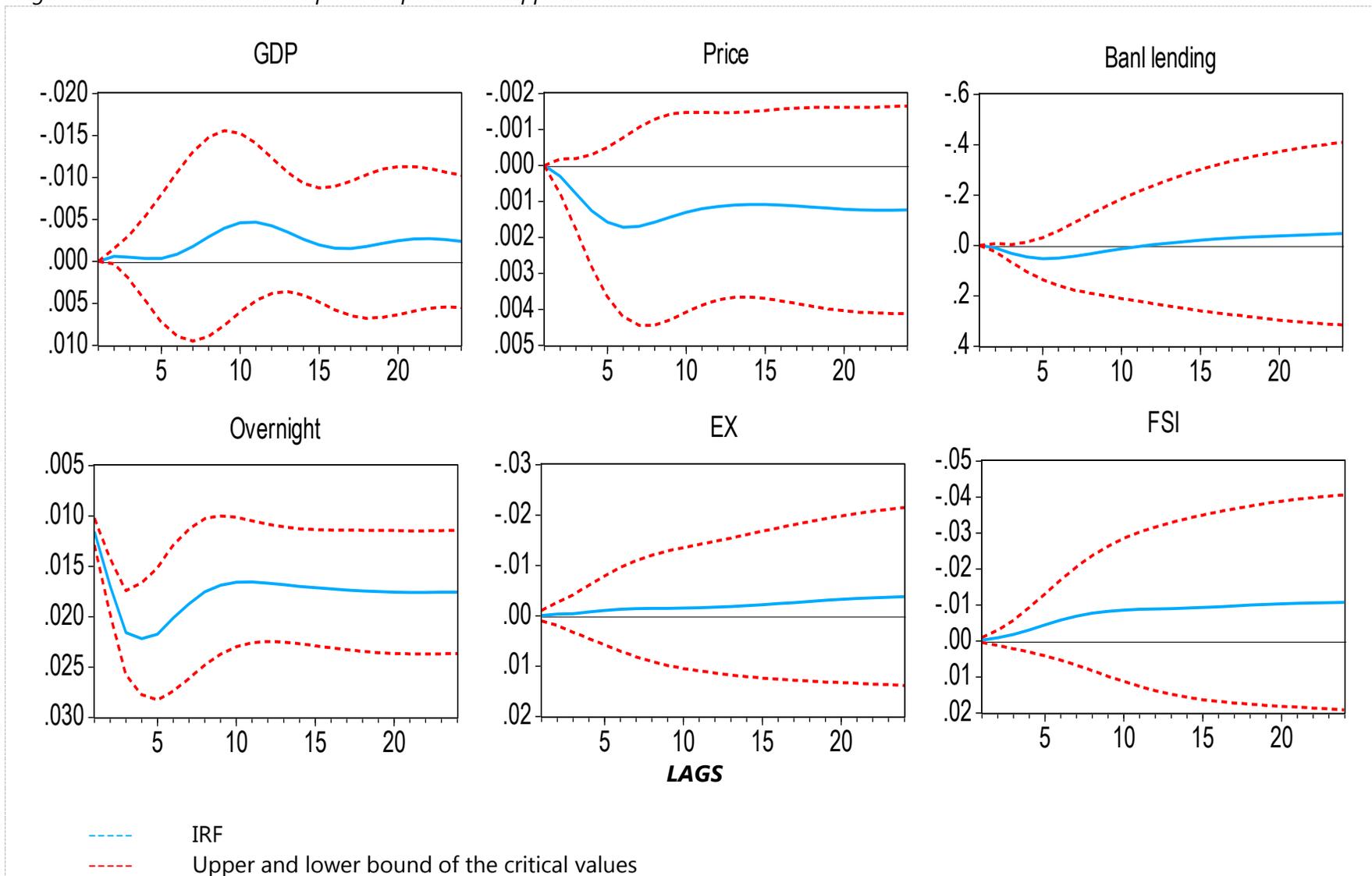
(b) – Number of accepted draws that satisfy the restrictions imposed.

(c) – Number of horizons over which sign restrictions are imposed.

(?) – No sign restriction is imposed.

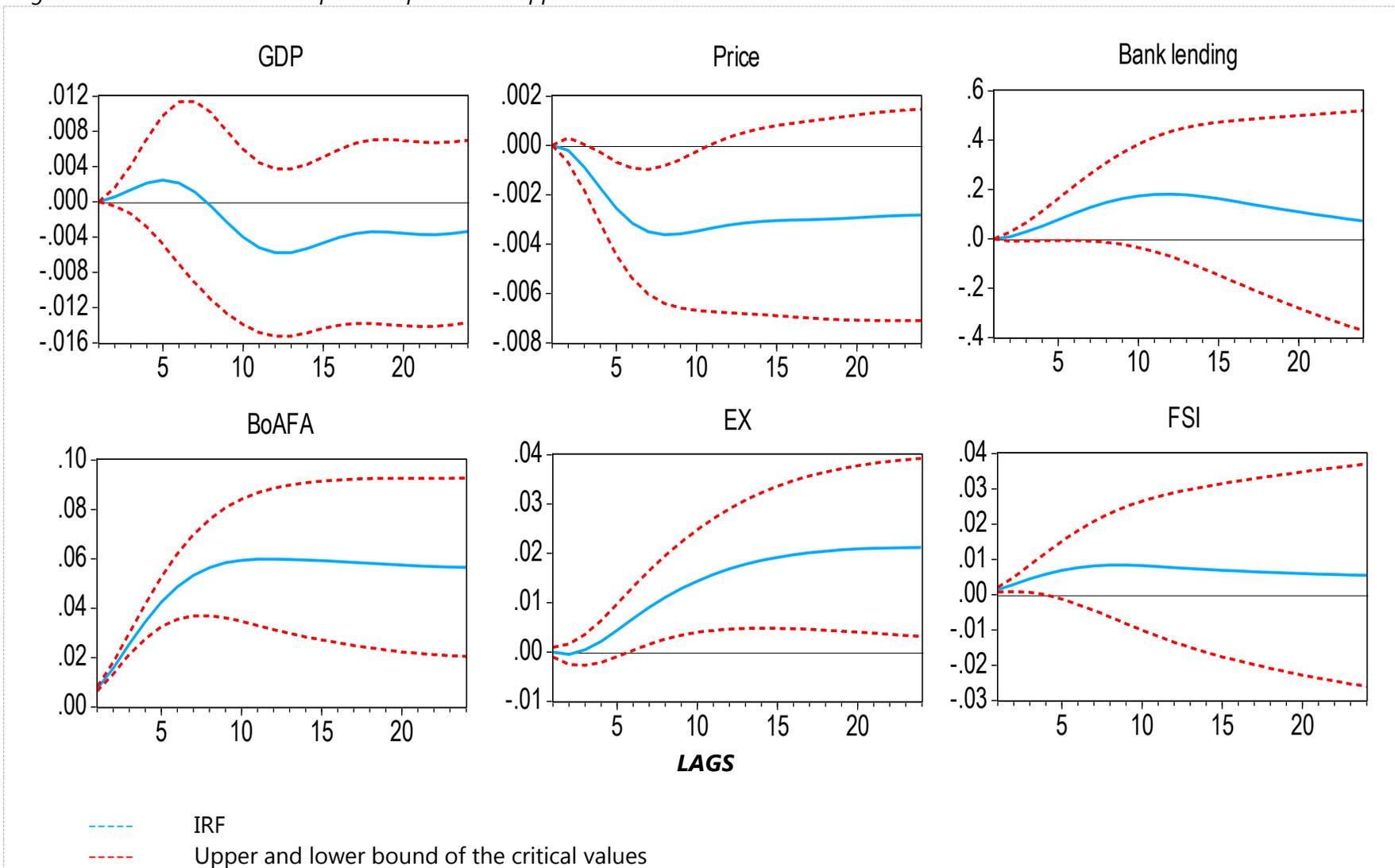
Source: Author's calculations

Figure 1. Non-accumulated impulse response to a 1pp shocks on i^{ON} .



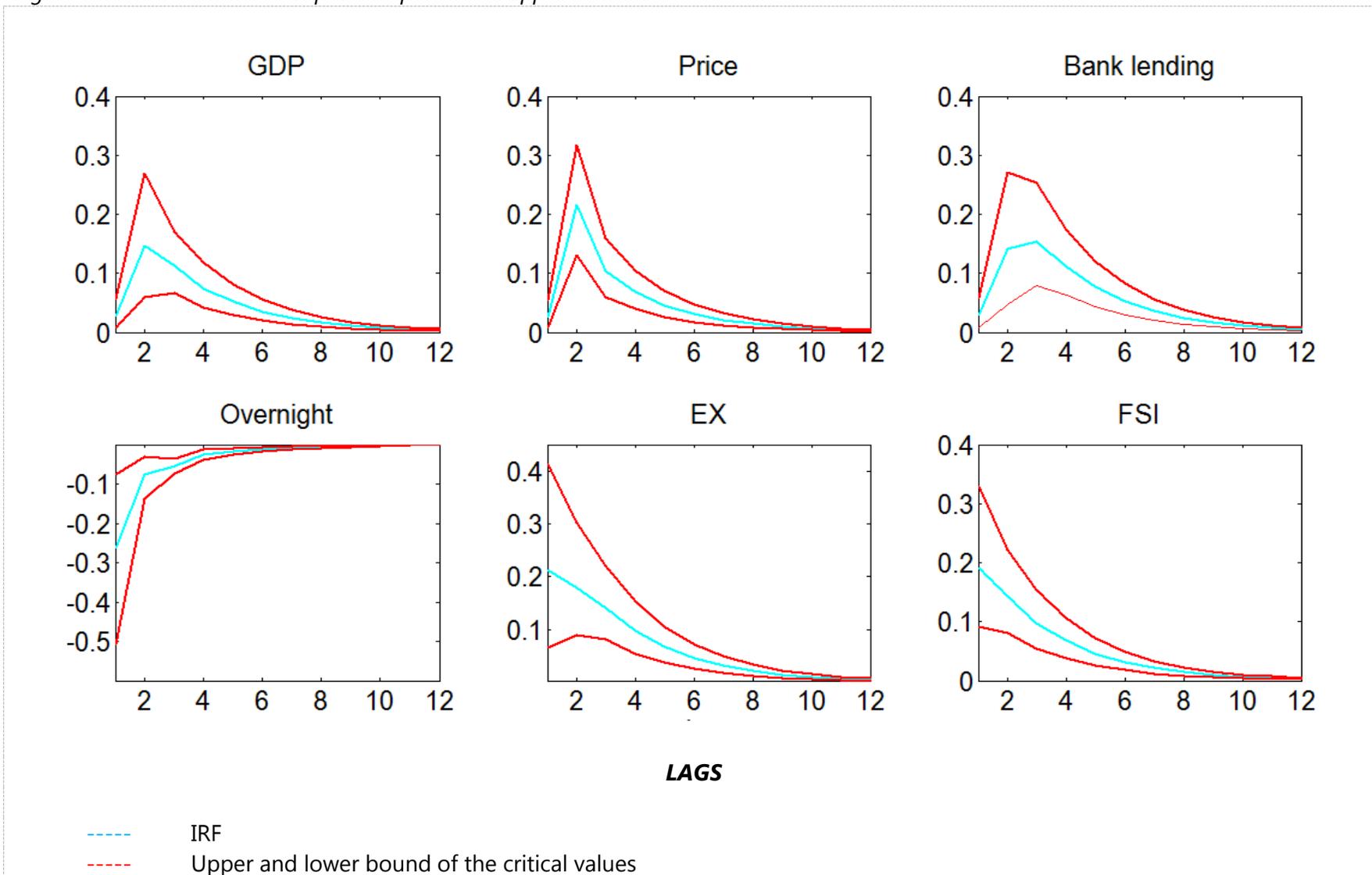
Source: Author's Calculations

Figure 2. Non-accumulated impulse response to a 1pp shocks on i^{ON} .



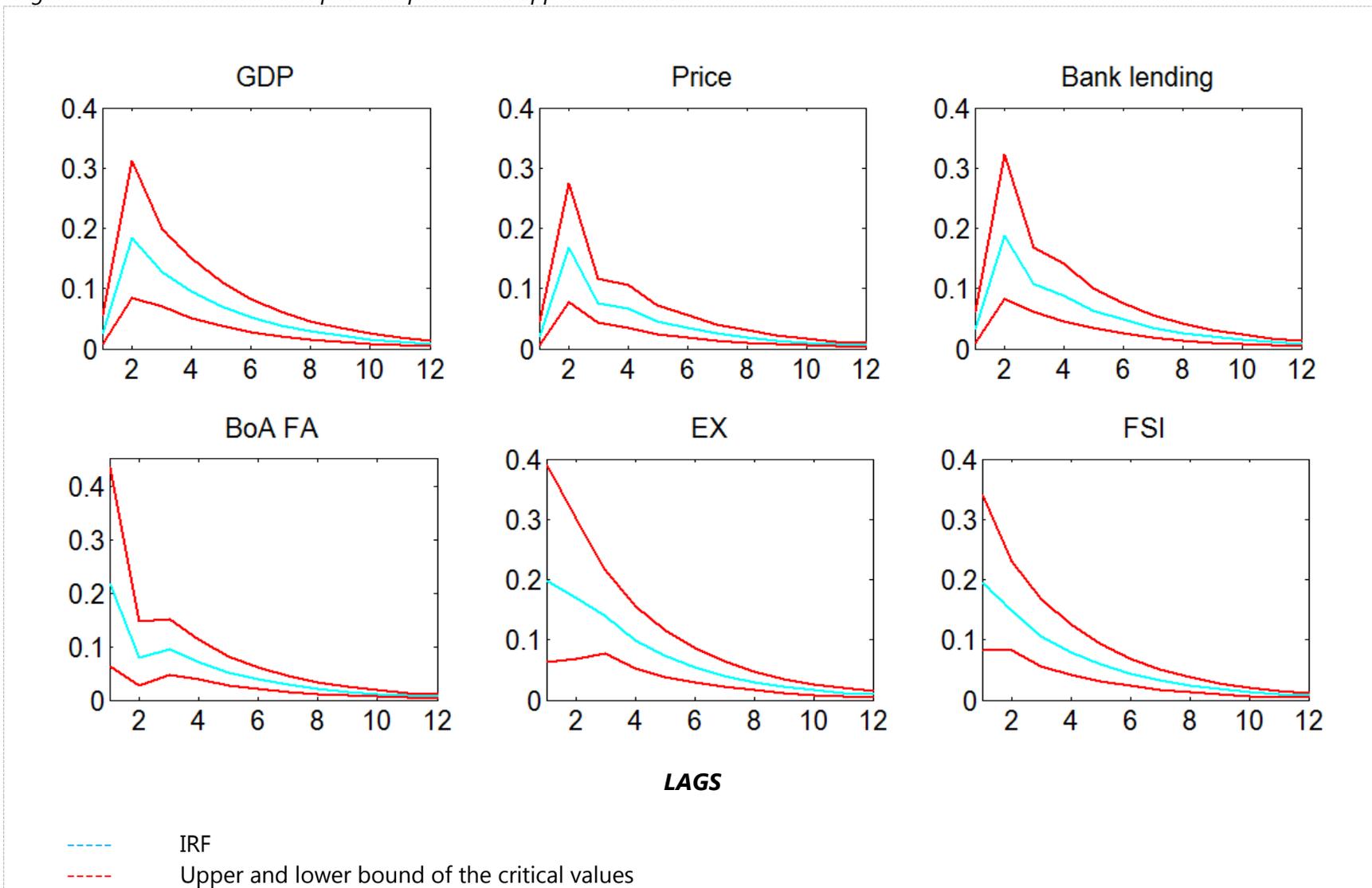
Source: Author's Calculations

Figure 3. Non-accumulated impulse response to a 1pp shocks on i^{ON} .



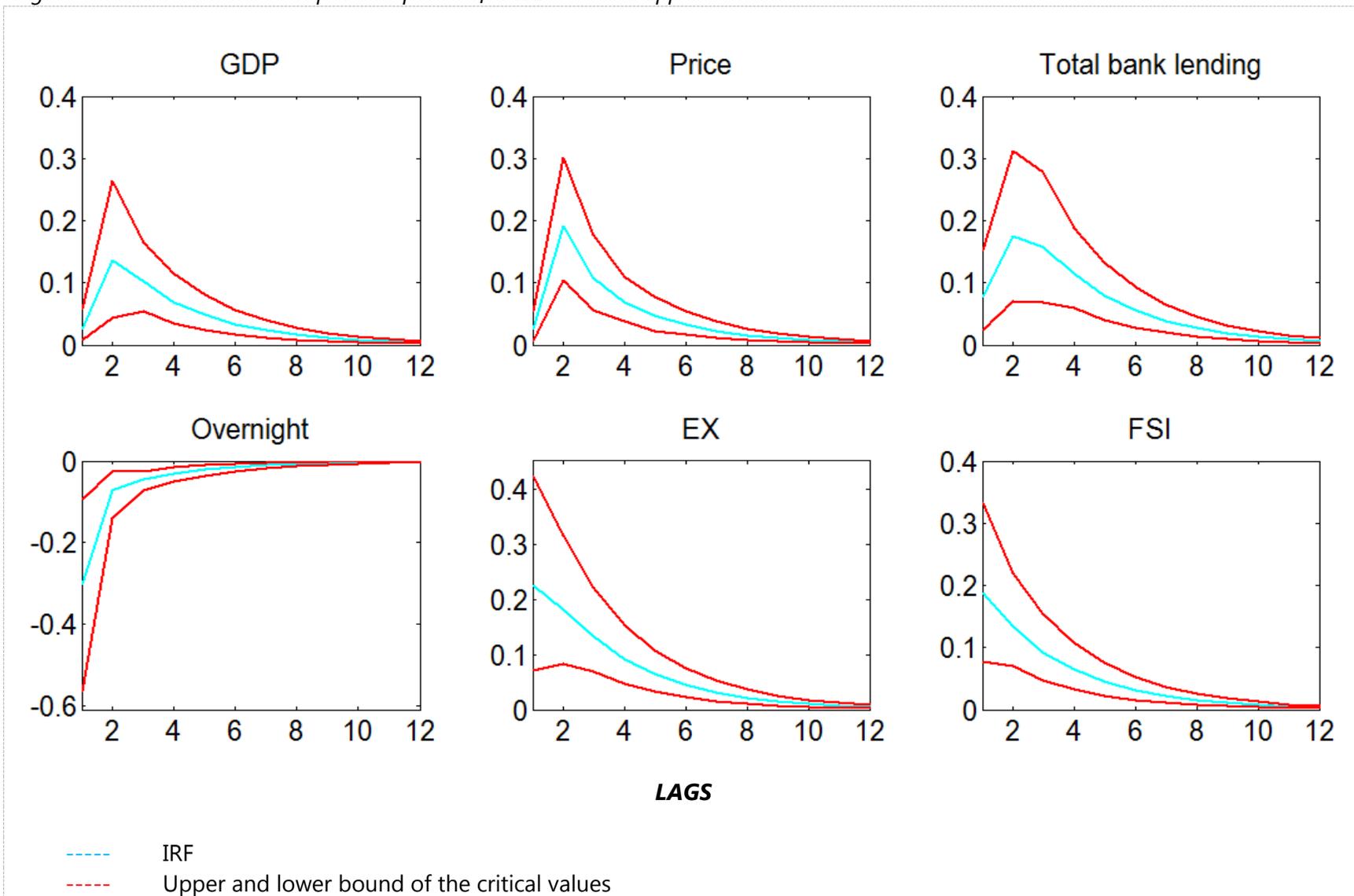
Source: Author's Calculations

Figure 4. Non-accumulated Impulse response to a 1pp shocks on BOA^{FA} .



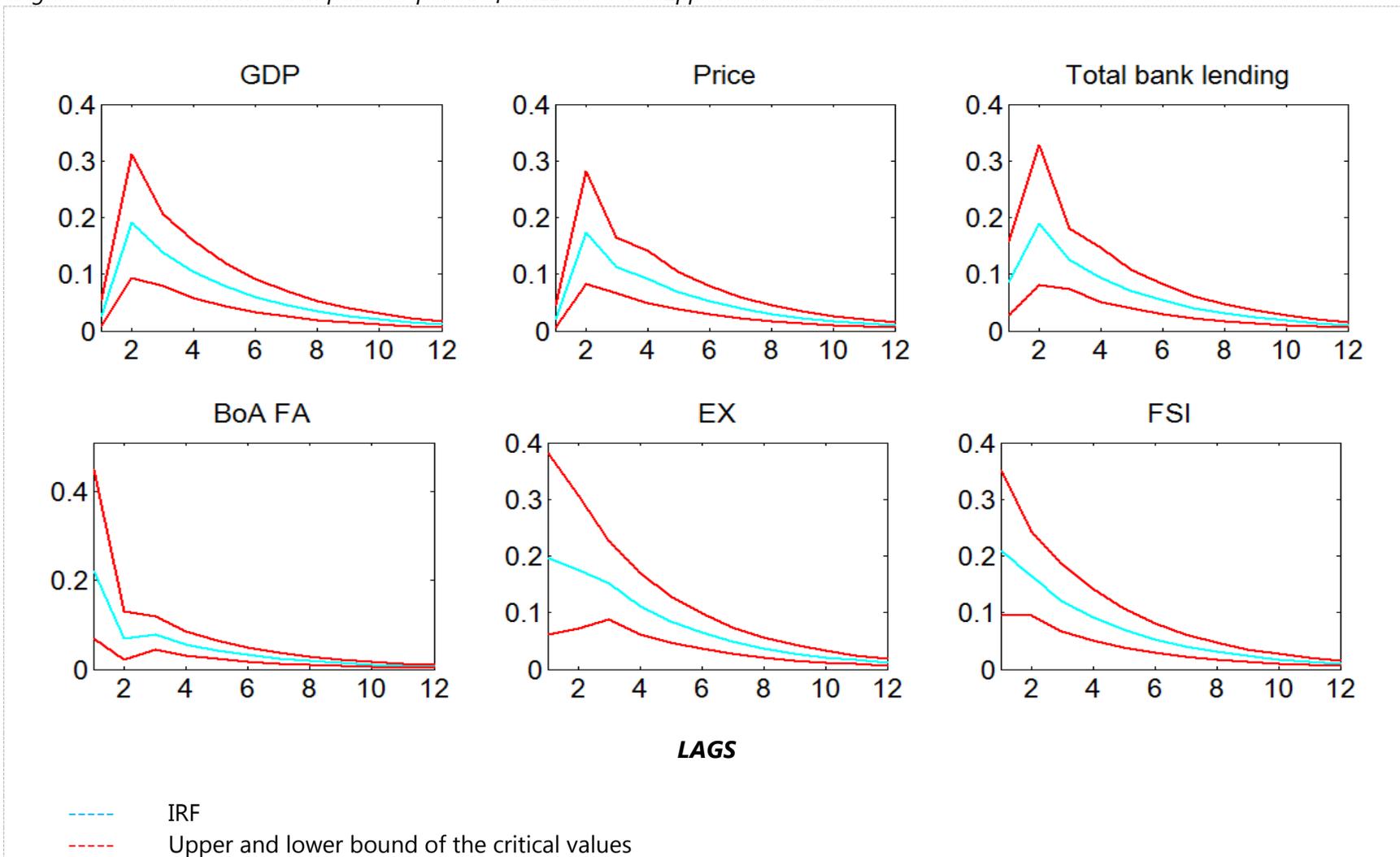
Source: Author's Calculations

Figure 5. Non-accumulated Impulse response of $CREDIT^{TOT}$ to a 1pp shocks on i^{ON} .



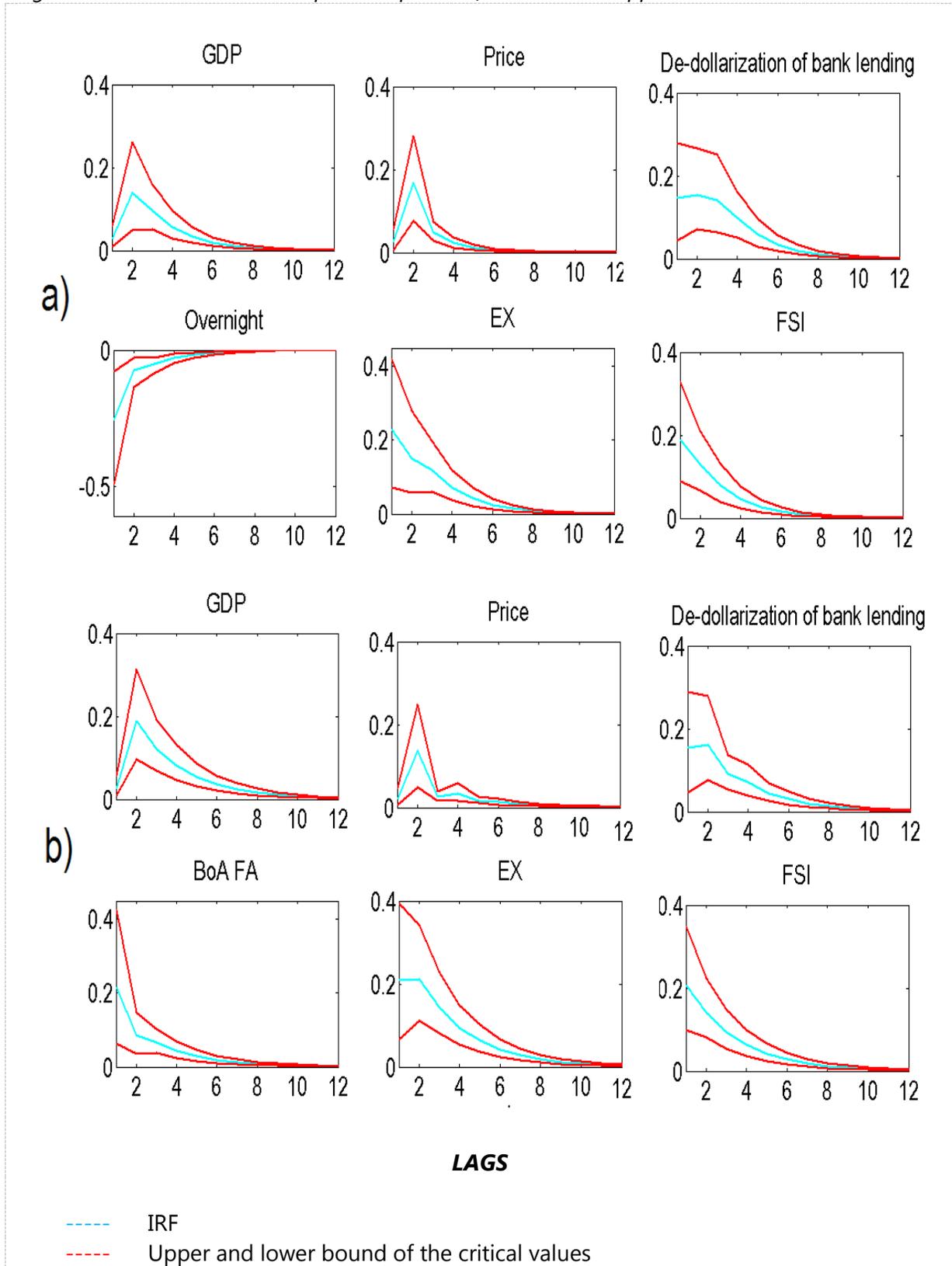
Source: Author's Calculations

Figure 6. Non-accumulated Impulse response of $CREDIT^{TOT}$ to a 1pp shocks on BOA^{FA} .



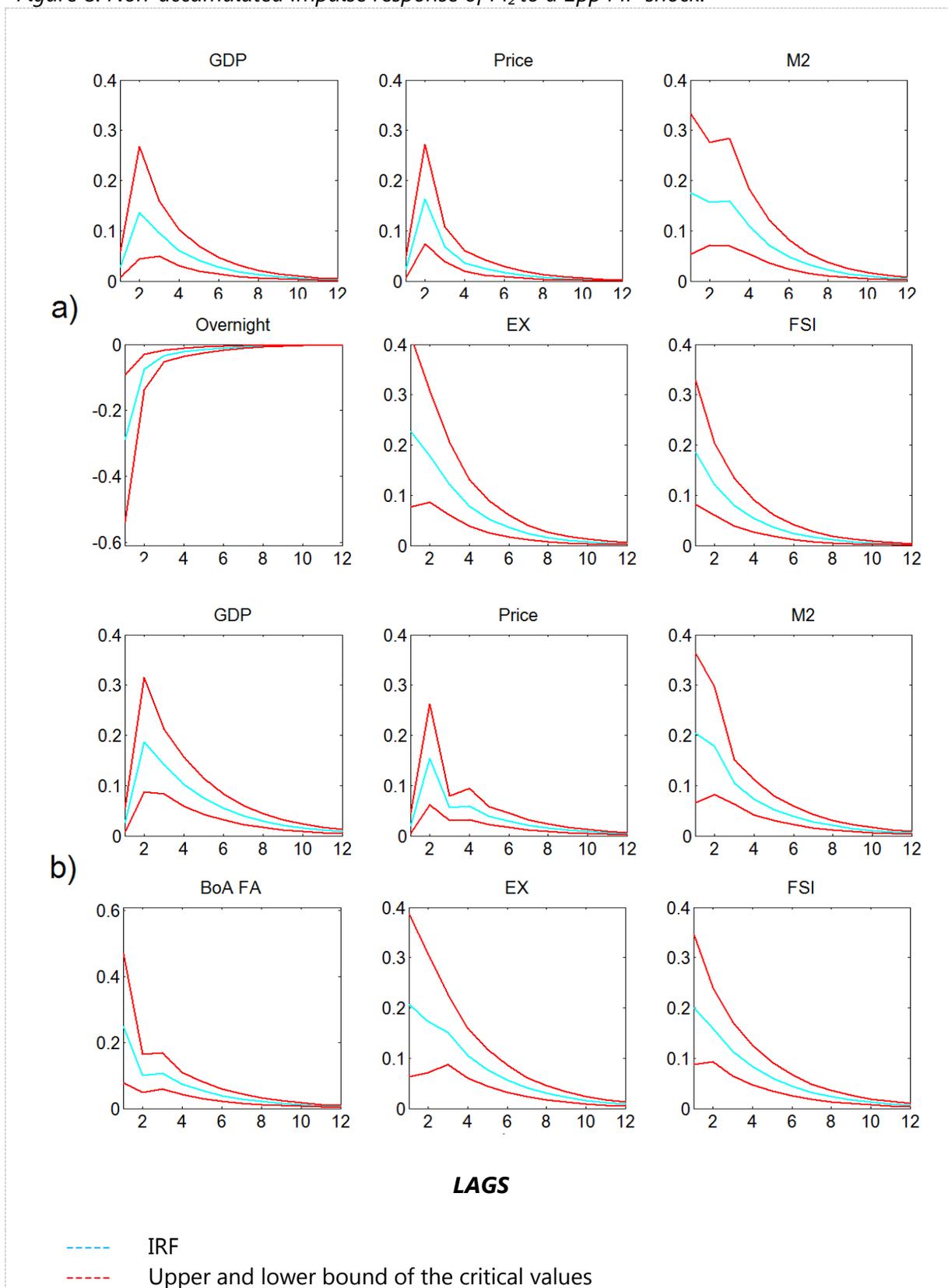
Source: Author's Calculations

Figure 7. Non-accumulated Impulse response of CREDIT* to a 1pp MP shock.



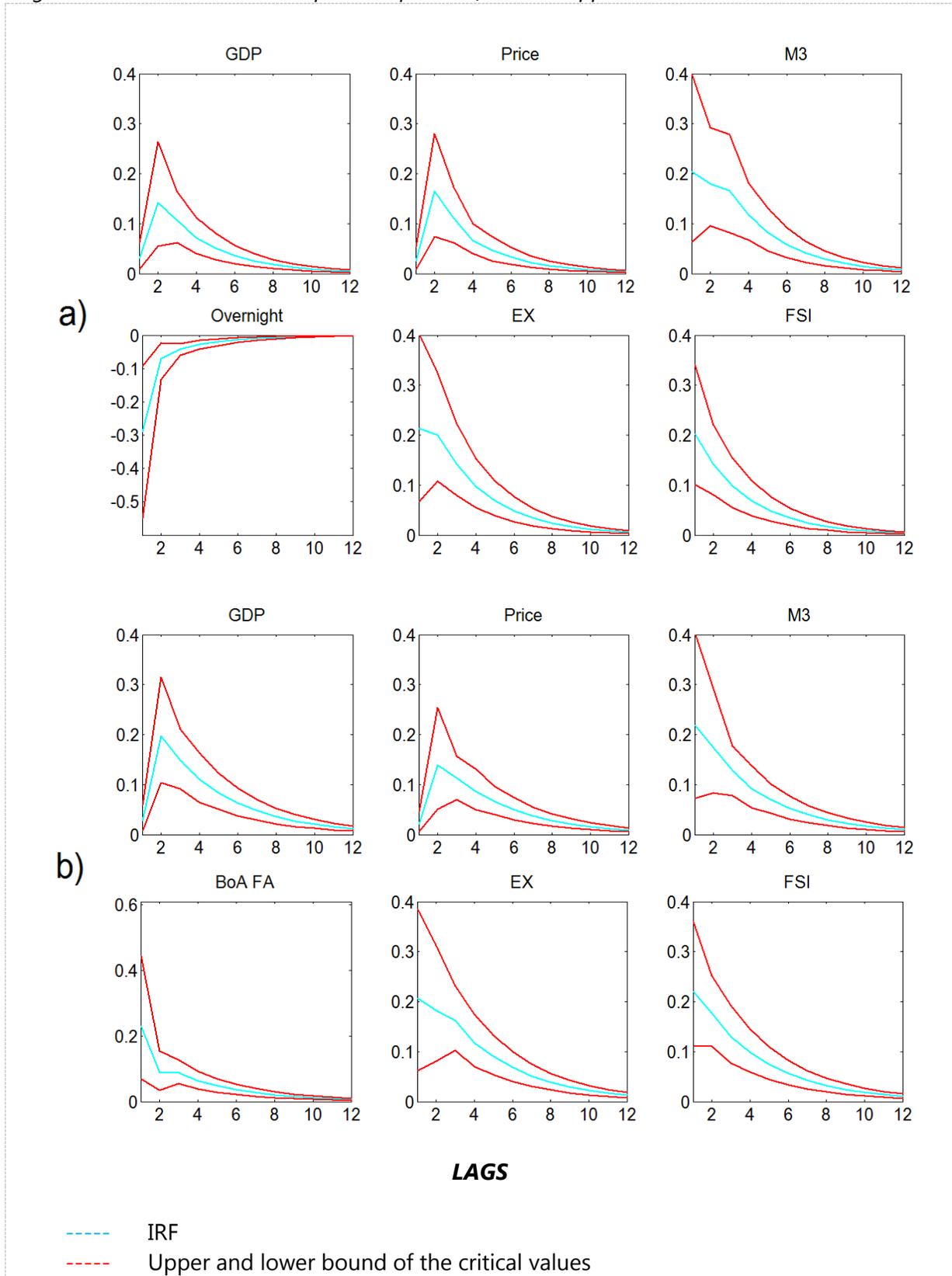
Source: Author's Calculations

Figure 8. Non-accumulated Impulse response of M_2 to a 1pp MP shock.



Source: Author's Calculations

Figure 9. Non-accumulated Impulse response of M3 to a 1pp MP shock.



Source: Author's Calculations