



## THE INTERACTION BETWEEN MONETARY POLICY AND MACROPRUDENTIAL TOOLS: EMPIRICAL EVIDENCE OF THE SOUTHERN MEDITERRANEAN COUNTRIES

SAOUSSEN OUHIBI<sup>1</sup>, SAMI HAMMAMI<sup>2</sup>

### ABSTRACT

In this paper, we analyze the interactions between monetary policy and macroprudential tools in the southern Mediterranean over the period 2000-2017. This research examines the relationship between monetary policy and macroprudential tools using a structural vector Auto-regressive model (SVAR). Our empirical results show that macroprudential tools should be used only as a complement to monetary policy to achieve financial stability but cannot be a substitute to achieve price stability.

**Keywords:** monetary policy, macro prudential tools, interaction, SVAR

**JEL Codes:** E12, E42

### I. INTRODUCTION

In recent years, the southern Mediterranean countries encountered some growing economic problems, which were aggravated by the immediate negative impact of the global financial crisis and the large social manifestations in some Arab Spring which was accompanied by a long period of uncertainty and instability. In addition, the 2007 financial crisis led to a slowdown of the economic activity, the rise of the global financial volatility, the increase of systemic risk and the spread of the factors that identify the price and financial instability. Sami M (2012) stipulates that the international financial crisis has been restructuring not only in the conduct of monetary policy but also in the regulation of global finance and the mitigation of systemic risk in the southern Mediterranean countries. In other words, in the wake of the financial crisis, the price stability does not ensure financial stability. It is important to complete a monetary approach of the financial regulation with what is now generally called macro-prudential policy which aims at limiting the systemic risk and reduces the negative effects of the financial crisis. This crisis highlighted the need the coordination between monetary policy and macroprudential tools. The issue of combining the monetary policy and macroprudential policy tools has been a subject of debate between experts and economists both in the developed and in the emerging countries. As executives macroprudential policies were developed, policy makers have increasingly turned more towards the relationship between the monetary and macroprudential policy. The macroprudential approach may require a degree of coordination between the monetary policy and financial stability. This is especially important if the macroprudential supervising of the financial institutions and the role accountability of the monetary policy have affected the real economy though two different objectives.

For Bordes (2011) monetary and financial stability are complementary objectives. The former can even be considered a necessary condition to achieve the latter. This means that macroprudential tools will be useful to complement the monetary policy and not a substitution. In this situation, a wide range of instruments and measures have been proposed by the International Monetary Fund to be used as macroprudential tools. The Southern Mediterranean countries are ahead of many other countries in using macroprudential tools (capital adequacy ratio, loan deposit ratio ...). Lim and al (2011) suggested combining the use of macroprudential tools with monetary policy in order to fight against systemic risk. In general, macroeconomic policies should always be the main tool to be used when the source of systemic risk has an imbalance in the financial system. The main objective of this paper is to study the interaction between the tools of the macroprudential policy and the monetary policy. In particular, we are interested in the effect of monetary policy shock on the macroprudential instruments and on the macroeconomic variables; and in the effect of the macroprudential shock on the monetary

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<sup>1</sup> University of sfax, Tunisia

<sup>2</sup> University of sfax, Tunisia

policy and the macroeconomic variables. To this end, we estimate a structural vector autoregression model (SVAR) for the southern Mediterranean countries. For Claessens and al (2013), an effective economic management depends on understanding the nature of shocks affecting the economy and economic interactions. In particular, the interactions between the monetary policy, the macroprudential policy and the macroeconomic variables are important for policy makers. Therefore, the paper proceeds as follows. Section two, discusses the empirical literature of the interaction between monetary policy and macroprudential tools. In this section, first, it describes the complementary between monetary and macroprudential tools. Secondly, it identifies the empirical studies of the substitution between monetary and macroprudential tools. Third section presents the empirical analysis includes estimation methods the data and, results and interpretations, and the final section presents the conclusion and implications.

## **II. EMPIRICAL LITERATURE**

Several studies have investigated the effectiveness of macroprudential policy instruments and its interaction with monetary policy (Lim and al (2011), Beau and al (2012), Kuttner and Shim (2012), Brockmeijer Jan (2012), Camilo and al (2012), Bin Wang and Tao Sun (2013), Abdullah et al., (2013), and Roussel et al., (2021). This literature can be divided into sub-titles to show the substitution and the complementarity between monetary policy and macroprudential tools. Firstly, the complementarity between monetary policy and macroprudential tools, secondly, the substitution between monetary policy and macroprudential tools. The selection of the variables have been done with the help of these studies; Ali (2011), Ali (2015), Ali (2018), Ali and Bibi (2017), Ali and Ahmad (2014), Ahmad and Ali (2016), Audi and Ali (2016), Ali and Audi (2016), Ali and Audi (2018), Ali and Rehman (2015), Audi and Ali (2017), Ali and Naeem (2017), Audi and Ali (2017), Ali and Zulfiqar (2018), Ali et al., (2016), Arshad and Ali (2016), Ashraf and Ali (2018), Sajid and Ali (2018), Ali and Senturk (2019), Kassem et al, (2019), Ali and Bibi (2020), Sulehri and Ali (2020) and Audi et al., (2021), Ali et al., (2021), Senturk and Ali (2021).

### **III. THE COMPLEMENTARILY BETWEEN MONETARY POLICY AND MACROPRUDENTIAL TOOLS**

The effectiveness of the macroprudential policy suggests the possibility of using macroprudential tools to influence the economic activity. A number of studies also considered the complementarity between monetary policy and macroprudential tools. One of the first of these studies was Lim et al., (2011). Lim et al., (2011) explored the effectiveness of macroprudential policy to reduce the credit procyclicality and the leverage. They found that most of the frequently used instruments are effective in reducing the systemic risk and the procyclicality of the financial sector in the face of all types of shocks. Moreover, they concluded that the effectiveness of the macroprudential policy was reinforced through coordination with the monetary policy.

Angelini and al (2011a), studied the strategic interaction between the monetary and the macroprudential policy in Italy. Our empirical methodology is based on the dynamic stochastic general equilibrium model. These results confirm that the macroprudential policy by capital requirement can stabilize the economy, which affect the supply of loans, the financial or housing market shocks. However, the monetary policy by interest rate can minimize the inflation and output. This policy is not a substitute to macroprudential regulation because the monetary policy cannot address the systemic risk. The benefits of the introduction of macroprudential instruments tend to be significant when the financial market and housing shocks affect the supply of loans.

To assess the interaction between monetary and macroprudential policy, some studies focused specifically on the real estate market using the index of real estate prices and residential investment (macroprudential indicators). Beau and al (2012) investigated how the use of macroprudential tools could affect the conduct of the monetary policy for the euro area over the period 1985 -2010. Their results suggest that in most circumstances, macroprudential policy interacts with monetary policy to continue the stabilization of inflation. Kuttner and Shim (2012) analysis the effects of monetary and macroprudential policies on Housing Prices and Credit in 57 advanced and emerging market economies from 1980 to 2011. The applications of vector autoregressions (VAR) model suggest that macroprudential policies are effective to curb the housing credit prices and the interest rates policy tend to slow housing price appreciation and housing credit growth.

Some existing documents analyzed the effects of macro-prudential policy on various measures of vulnerability and financial stability. Brockmeijer Jan (2012) , used the dynamic panel regression to study the effectiveness of the macroprudential policy on financial vulnerabilities (credit growth, real estate prices ...) and its interaction with monetary policy in 36 countries (21 emerging market economies and 15 advanced economies) from 2000 to 2011 . He noted that the regulatory reserves and capital have significant effects on the credit growth and the LTV ratio and capital requirements have significant effects on the real estate prices. In addition, the results

obtained suggest that in the presence of financial sector distortions, it is optimal for monetary policy to consider financial shocks and stay the price stability. In this situation, you can say that monetary policy is complement of macroprudential policy.

Bin and Sun (2013) used panel fixed-effects models to analyse the interaction between monetary policy and macroprudential tools. The authors found that some macroprudential tools (capital ratio, liquidity ratio, and reserves for non-performing loans) are effective in reducing the systemic risk associated with the economic and financial environment in China. Their effectiveness depends on their interaction with the monetary policy. In addition, this research showed that monetary and macroprudential policies are most effective when they complement each other in China. Among the macroprudential instruments, there are the reserve requirements adopted by policy makers in Latin America to manage the procyclicality of the dynamics of bank lending and contain the systemic risks. Using a dynamic panel model VAR methodology, Camilo and al (2012) used panel data vector autoregression to examine the role of the reserve requirements and other macroprudential instruments and how they affect the real credit growth. Their results showed that these instruments have a moderate effect on the credit growth and play a complementary role in the monetary policy.

Maddaloni and Peydró (2013) analyzed the impact of the short-term interest rates and macroprudential policy on lending standards before the 2008 crisis in the Euro Area. The results suggest that the interest rate can affect the stability of the bank (and their impact depend both on the balance sheets of the bank and the banking prudential policy it adopts). The authors used panel data to seven macroeconomic variables (short-term interest rate, long-term interest rates, GDP growth, inflation, current account balance, loan to value, supervision standards for bank capital). The applications of GLS panel regressions suggest that interest rate and macroprudential tools are complement each other. Therefore, the decision of the monetary policy should pay more attention to the issues of financial stability, while banking supervision and prudential regulation should take into account the incentives to take risk possibly induced by low short-term interest rates.

More recently, Kim and Mehrotra (2017) investigated the effects of monetary and macroprudential policies in the Asia-Pacific region (Australia, Indonesia, Korea and Thailand) over 2000-2012 period, using structural panel vector autoregressions, we find that macroprudential policy is a complement of monetary policy at normal times and the two policies can help each other to achieve the targets of price and financial stability. Kosuke Aoki et al (2016) studied the interaction between monetary policy and macroprudential tools in emerging countries, their results support that monetary policy is a complement of macroprudential supervision. In addition, the monetary policy with macroprudential policy can reduce the financial distortions.

## **II.II. THE SUBSTITUTION BETWEEN MONETARY POLICY AND MACROPRUDENTIAL TOOLS**

There are many studies which fund that monetary policy responds to house prices and financial instability when macroprudential policy is not efficient, for example Aleksandra et al., (2015) studied the interaction between monetary policy and macroprudential tools from United States. Their results showed that monetary policy shocks have significant and persistent effects on financial conditions and can attenuate long-term financial instability and macroprudential policy tightening measures tend to be larger during recessions than expansions.

Stephen Lianfa (2005) studied the interaction between monetary policy and macroprudential tools in the United States, Germany and Japan, their results show that capital requirements can stabilize the price stability and economic activity and the interest rate policy neutralize the impact of the bank capital requirements. In another words, capital adequacy and interest rates are substitutes. The study uses the dynamic stochastic general equilibrium model includes fives variables (interest rate, inflation, M2, output gaps, capital requirements). In this context, Ashley Dunstan (2014) using the dynamic stochastic general equilibrium model to examine the relationship between monetary policy and macroprudential tools in New Zealand. Their results showed that when the macro-prudential instruments can become ineffective in achieving financial stability, the monetary policy could be particularly helpful for achieving financial stability.

More recently, in Sweden, Gabriela et al., (2015) investigated the effect of macro prudential policy on the economic activity and their interaction with monetary policy. In this research the macroprudential policy can also affect significantly the inflation shock, the credit shock and interest rate shock. In addition, the results obtained suggest that macroprudential tool (the countercyclical capital buffer) can counteract the rapid credit expansion and monetary policy can reduce the emergence of financial crises and counteracting financial imbalances. Quint and Rabanal (2014) studied the combination of the monetary and the macroprudential policies in the Euro Area over the 1995-2011 period. The authors used DSGE model includes macroeconomic variables (Inflation, house price, real private consumption, real residential investment, interest rate, household outstanding

debt). Their findings suggest that the introduction of a macroprudential rule helps to reduce the macroeconomic volatility and replace the lack of the monetary policy. The tools of macroprudential policy would always increase the welfare of investors, but their effects on the borrowers depend on the economic shock.

In inflation targeting economies in the Asia Pacific region, Kim and Mehrotra (2015) studied the interaction between monetary policy and macro prudential tools, the authors used SVAR model to five macroeconomic variables (the interest rate, measure of macroprudential tools, the consumer price index, credit to the private sector, real GDP). Their results, suggests that macro prudential tools had a significant effect on inflation and credit growth and the monetary policy can affect financial imbalances, in which increasing financial imbalances lead up to a financial crisis. Federico et al (2012) studied the relationship between the reserve requirements as a macroprudential tool and monetary in developing countries for the period 1970-2011. Our empirical methodology is based on the simultaneous equations. We find that reserve requirement is an instrument that substitutes for monetary policy.

**Table 1: Summary of empirical studies of the interaction between monetary and macroprudential policy**

<i>Author( s)</i>	<i>Countries</i>	<i>Methodologies</i>	<i>Interaction</i>
Angelini and al (2011a)	Italy	DSGE model	Complementary
Federico et al (2012)	Developing countries	Simultaneous Equations	Substitution
Beau and al (2012)	Euro Area	DSGE model	Complementary
Stephen Lianfa (2005)	United States, Germany and Japan	DSGE model	Substitution
Kuttner and Shim (2012)	Advanced and Emerging market economies	Vector Autoregression (VAR) model	Complementary
Brockmeijer Jan (2012)	Emerging and advanced economies	Dynamic Panel Regression	Complementary
Ashley Dunstan (2014)	New Zealand	DSGE model	Substitution
Angela M and José-Luis (2013)	Euro Area.	GLS panel regressions	Complementary
Quint and rabanal (2014)	Euro Area	DSGE	Substitution
Soyoung K and Aaron M (2015)	Asia-Pacific region	Structural Vector Autoregression	Substitution
Gabriela G and al (2015)	Sweden	DSGE	Complementary
Zdienicka and al (2015)	United States	DSGE	Substitution
Camilo and al (2012)	Latin America	Dynamic panel model VAR	Complementary
Soyoung K and Aaron M (2017)	Inflation targeting economies	SVAR	Complementary

### III. THE EMPIRICAL ANALYSIS

#### III.I. ESTIMATION METHODS

In this section, we will study the effects of a monetary policy shock (the interest rate shock) on the macroprudential instruments (the ratio of regulatory capital, the loan deposit ratio), on the real activity and on inflation. Similarly, we will analyze the effects of a macroprudential policy shock. The issue here is how the macroeconomic objectives, namely the stabilization of inflation and financial stability, can be achieved by the central bank. Today, for most central banks, the monetary policy has become a policy of setting interest rates. In fact, the main objective of this policy is to control inflation. Hence, the macroprudential policy should assist the monetary one. The study of the interaction between the monetary and the macroprudential policy tools in the southern Mediterranean countries will be conducted in this section with a Structural Vector Autoregression model (SVAR). Different methods are used to estimate and evaluate the interaction between the monetary policy and macroprudential instruments in the literature, for example the method of GMM (Generalized Method of Moments), the dynamic panel data, the Bayesian estimation of the stochastic dynamic general equilibrium (DSGE). The contribution of this study is to analyze the coordination between the monetary policy and the macroprudential instruments with the structural vector autoregression model. This model and the general equilibrium model are widely specialized, each with a role leading to a specific use. For Sims (1980), these two approaches have developed and offered original quantitative tools to renew the fluctuation analysis. The main objective of a SVAR model is to evaluate the impulse response of the endogenous variables to structural shocks by imposing restrictions to identify the orthogonal components (structural) of error terms. The SVAR approach was created by Blanchard (1989) and Blanchard and Quah (1989) who focused on the long-term identification restrictions to identify shocks in the economy. In this paper, the SVAR model is particularly suitable for the evaluation of the effects of the innovations of the monetary and macroprudential policy and the response of each variable to structural shocks and shows their macroeconomic transmissions. Indeed, we present the main features of the SVAR methodology.

The structural formula is:  $AX_t = B_1 X_{t-1} + B_2 X_{t-2} + \dots + B_p X_{t-p} + e_t$  (1)

Avec  $X_t$  a vector of  $n$  endogenous variables ( $X_{1t}, \dots, X_{nt}$ ), or  $A$  is a matrix ( $n \times n$ ), and  $e_t = (e_t^1, \dots, e_t^n)$  is a vector of residuals Structural of type iid  $N(0, \Omega)$ ,  $\Omega$  is a diagonal matrix of dimension ( $n \times n$ ).

The central objective is to determine the parameters of the SVAR to develop the impulse response functions of endogenous variables to structural shocks.

A first step is to estimate the reduced form of VAR. That is obtained by multiplying each member of de (1) through  $A^{-1}$ .

$$X_t = A^{-1}B_1 X_{t-1} + A^{-1}B_2 X_{t-2} + \dots + A^{-1}B_p X_{t-p} + A^{-1}e_t \quad (2)$$

$$= C_1 X_{t-1} + C_2 X_{t-2} + \dots + C_p X_{t-p} + A^{-1}e_t$$

Consider the following standard VAR model to estimate:

$$X_t = \phi_1 X_{t-1} + \phi_2 X_{t-2} + \dots + \phi_p X_{t-p} + \epsilon_t \quad (3),$$

the estimation of the VAR model led the estimated values of the parameters ( $\phi_1 \dots \phi_p, \epsilon_t$ ).

Comparing the form of structural VAR and the form of estimated standard VAR results in:

$$\phi_i = C_i = A^{-1}B \quad i=1, \dots, p \quad (4)$$

$$\epsilon_t = A^{-1}e_t \quad (5)$$

$X_t = C_i \epsilon_t$ , is the structural form with  $\text{Var}(\epsilon_t) = A^{-1} \text{Var}(e_t) (A^{-1})' = \Sigma$ .

we retain structural shocks vectors;  $e_t$  ( $e_{GDP}$ ,  $e_{IPC}$ ,  $e_{IR}$ ,  $e_{RC}$ ,  $e_{LTD}$ ), these shocks correspond on activity shock ( $e_{GDP}$ ), an inflation shock ( $e_{CPI}$ ), a monetary policy shock ( $e_{IR}$ ), and a macroprudential tools shock ( $e_{RC}$ ,  $e_{LTD}$ ). Cristiano and al (2007) argue that the constraints included in the VAR modeling are often linked to the macroeconomic theory. However, this macroeconomic theory suggests two categories of constraints (short term and long term). The short-term constraints are phenomena of slow adjustments in certain variables. The central idea is that instantaneous relationships between the SVAR model variables are contained in the variance covariance matrix of the innovations of the estimated SVAR model. On the other hand, the long-term constraints are related to the fundamental results in a general equilibrium.

The matrix multiplication related a Structural shock is:

$$\begin{pmatrix} \epsilon_t^{gdp} \\ \epsilon_t^{cpi} \\ \epsilon_t^{ir} \\ \epsilon_t^{rc} \\ \epsilon_t^{ltd} \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{pmatrix} \begin{pmatrix} e_{gdp} \\ e_{cpi} \\ e_{ir} \\ e_{rc} \\ e_{ltd} \end{pmatrix}$$

This dimension of matrix (6, 6) such as  $\epsilon_t = A e_t$ . This matrix  $A$  must check instantaneous constraints. In addition, the relationship between the estimated VAR innovations and structural innovations gives the following set of constraints  $\Sigma = AA'$  (6), to determine the matrix  $A$ , just use the method Choleski. The Cholesky decomposition of variance covariance matrix allows transforming the estimated VAR model. This transformation of the VAR model leads to a structural VAR model.

### III.II. THE DATA

To determine the interaction between the monetary policy and the macro prudential instruments, we performed an analysis on a sample of southern Mediterranean countries. By taking the interest rate as a proxy for the monetary policy, the regulatory capital ratio, the loan to deposit ratio are a macroprudential proxy. We have also included in the model, the GDP growth rates and inflation measured through the consumer price index. The data used are annual and cover the 2000-2017 period. They were taken from the database of the IFS (International Financial statistics), Financial Soundness Indicators and the World Bank. Indeed, there are many reasons for the choice of these variables. The first is the lack of data for some southern Mediterranean countries, for example Syria, Libya, Algeria, while the second is the fact that macroprudential instruments have not been used and finally the nature of shocks that have threatened the financial system. For this reason, we selected only six southern Mediterranean countries.

- *Market Money Interest Rate*: It is the short-term interest rate (proxy for monetary policy). Prudent monetary policy should try to bring rates to normal levels in market to consolidate favorable conditions for the resumption of lending to the private sector.
- *Regulatory Capital*: The regulatory capital or capital adequacy ratio is a macroprudential tools to control banks and assess systemic risk in the financial system. The makers of the macroprudential policy are supposed to minimize the excessive fluctuations of the overall credit growth taking into account the effects of decisions on economic activity policy (Haldane 2012). It is used to measure the amount of the bank's capital compared to the amount of its risk weighted credit.

- *Loan to deposit ratio*: is a tool for macroprudential policy which helps detect low liquidity problems and indicate a potential liquidity crisis in the banking system. It presents a relationship between the loans and deposits to assess the banking liquidity.
- *Inflation*: is measured by the consumer price index. In fact, the percentage of the index change over a period of time gives the amount of inflation during that specific period.
- *Gross Domestic Product*: Annual percentage growth rate of GDP is an instrument of economic activity. GDP provides a better measure of the economy health.

### III.III. RESULTS AND INTERPRETATIONS

#### III.III.I. UNIT ROOT TESTS

To test the stationarity of the variables used in the estimates, we used the stationarity tests, which are the Panel data tests of A. Levin and CFLin (1992); K.S.Im, M.H. Pesaran and Y.Shin (1997); G.S.Maddala S.Wu (1999) and K. Hadri (2000).

**Table 1: Unit root test**

Variables	The different unit root tests				Stationarity
	Levin, Lin & Chu	Im, Pesaran and Shin W-stat	ADF-Fisher Chi-square	PP-Fish Chi-square	
<b>IR</b>	-3.74833 (0.0001)	-2.1332 (0.0165)	24.1832(0.0192)	17.5495 ( 0.1301)	Stationary at Level
<b>GDP</b>	-3.16559( 0.0008)	-3.98546( 0.0000)	37.4740( 0.0002)	41.7084 (0.0000)	Stationary at level
<b>CPI</b>	-2.63813( 0.0042)	-1.83388(0.0333)	24.4935( 0.0174)	30.8599(0.0021)	Stationary at level
<b>D(LTD)</b>	-6.55470(0,0000)	39.4701(0.0001)	39.4701(0.0001)	47.8835(0.0000)	Stationary I(1)
<b>D(RC)</b>	-4.60829 ( 0.0000)	-3.01655 ( 0.0013)	29.1974 (0.0037)	23.6145 (0.0229)	Stationary I(1)

Note: D indicates variables in first difference, p-values in parentheses.

The results presented in table (2) show that (CAR and RPD) are not stationary at levels, but stationary in their first difference. The exception is IR, CPI and GDP which seem to be stationary at the level. As a result, this table show that a set of variables are integrated of order zero I (0) and the other assumes they are integrated of order One, I (1). We can conclude that there is evidence of a long terme-run relationship.

#### III.III.II. IMPULSE RESPONSE FUNCTION

In order to examine the interaction between monetary policy and macroprudential tools, we used the impulse response test. This test traces the effect of monetary and macroprudential shock on macroeconomic variables. Indeed, the study of the monetary and macroprudential interaction in the southern Mediterranean countries is realized in this paper using a structural vector autoregressive (SVAR) model. In fact, we modeled monetary, macroprudential as well of the economic activity shocks and inflation. Our SVAR model includes two macroeconomic variables that can be used to study the important issue of the interaction. On the basis of the economic theory and application of economic policies in the countries, Fode Sarr (2010) confirms that the monetary policy and the macroprudential tools interact at the level of economic activity (GDP) and the general price level (CPI). The Southern Mediterranean countries are interested in the introduction of targeted rules to reduce instability across the financial system. These are known as macroprudential regulations (in contrast with micro prudential regulations, which protect individual consumers or firms) (Roberto R. Rocha 2011). The choice of the Mediterranean countries is motivated by the fact that little attention has been paid to these countries. In addition, like in many other countries, the literature on the relationship between monetary and macroprudential tools in the southern Mediterranean countries is rather limited. However, none of the empirical studies have focused to investigating the interaction between monetary policy and macroprudential tools in this region. To some extent, it is possible to analyze these interactions in our context: these interactions are measured by the impact of the monetary shocks on the macroprudential tools and the impact of the macroprudential shock on the interest rates.

##### ➤ *The monetary policy shock*

Figure 1 presents the impact of the short-term interest rates on the macroeconomic variables. The interest rate shock results by deterioration during 10 periods. The interest rate shock leads to a rise of inflation in both periods, then to its decline. The interest rate is an instrument used by the central bank to control inflation. Any increase in the interest rates causes a decline of the demand for loans, and therefore a reduction of the demand and prices.

Following the increase of the money market interest rates, there is a decline of inflation, which this shock is explained by the deterioration of the market. From Figure 1, the increase of the interest rates affects the GDP for

the first three periods and causes the fall of the economic activity. The monetary policy has no permanent effects on the long term. These results are compatible with the standard effects of the monetary policy shocks. For William B and al (2012), higher interest rate can cause a slower economic growth due a slower capital cost by individuals and businesses who borrow from banks. Therefore, the level of non-performing loans could rise if the interest rates rise. An unexpected increase of the interest rate has a significant negative effect on the GDP. This result is consistent with the studies of Demchuk et al. (2012) and Alfred A. Haug et al (2013). Regarding the response of the loan deposit ratio, we observed a depreciation following the monetary policy shock. This result is consistent with that of study Vincent P (2014), which states that the deposit funding decreases when the interest rate increases because the opportunity cost of savings depositors in low-yielding assets increases. If the central bank changes the interest rate, this effect is passed on to the money market and affects the amount of deposits and banks' ability for granting loans, which affects the economic activity. For Jean Luc and Valerie Golitin (2005), the interest rate shock is one of the major inherent risks in the banking business. Excessive intake, uncontrolled risk or a bad anticipation of changes in the environment can be a threat not only for the financial stability of the credit institutions but also for the financial stability as a whole. A money market rate shock is reflected in the ratio of regulatory capital by negative effects on all periods. These effects are manifested by decreases in the third period. This result is consistent with the standard response of GDP after the shock of the interest rates. An interest rate shock over an interval of 10 periods on the regulatory capital ratio results in negative and positive effects. The negative effects are observed in the first two periods whereas the positive effects cover all the other periods.

➤ ***Regulatory capital shock***

The regulatory capital ratio presents a macroprudential tool that can weaken shocks when it is adequately generated. It makes it possible to measure the amount of the bank's capital in relation to the amount of its risk-weighted credit. The capital adequacy ratio is among the important concepts of the banking industry. It is used to promote the stability and efficiency of the financial system by reducing the probability of bank insolvency. When a bank becomes insolvent, this can lead to a loss of confidence in the financial system, which causes financial problems for other banks and may threaten the proper functioning of the financial markets. The shock of regulatory capital (figure2) is reflected on inflation by a reaction to the decline of the short term and an increase from the second period. This means that consumer prices index is sensitive to regulatory capital shock. The response of GDP and interest rate to regulatory capital shock is similar, they increase and then stabilize at its equilibrium level. About the response of loan to deposit, we observed a permanent depreciation. We also noted that the regulatory capital shock causes an increase of the money market interest rates, which results an increase of the inflation rate as measured by the consumer price index. The interest rate is an element influencing the investment decisions. The central bank regulates investment, and can reduce excess liquidity. Then, by reducing its key rate, a central bank encourages savings, through the favorable interest rate offered by central banks. Besides, the increase in the interest rate may tend to increase the value of a currency on the foreign exchange market. Indeed, an increase in the interest rates implies a better profitability of the loan. Therefore, the regulatory capital is a complement to the monetary policy since it contributes to the stabilization of the inflation and economic activity. Our results are consistent with other empirical studies such as that of Angelini et al (2012), which examined the issue of coordination in the context of the macroprudential regulator use of the regulatory capital as a tool to achieve financial stability. The authors found that the lack of cooperation between macroprudential and monetary authority can actually generate conflicting policies and therefore cooperation is necessary. The lack of cooperation between the two policies may cause excessive volatility in money market interest rates and capital requirements. The benefits of the introduction of regulatory capital become important in case of shock, which affects the supply of loans, and acts as an engine of economic dynamics. The availability of capital requirement as a tool of macroprudential policy provides a significant gain in terms of macroeconomic stabilization (Anglini P et al 2014). In fact, the IMF analysts (2013) concluded that the tools of macroprudential policy should focus on systemic vulnerabilities and not be burdened with macroeconomic objectives such as the economic growth and inflation. Similarly, the results suggest that there is a reinforcing role between the money market interest rate and the regulatory capital shock and vice versa. In other words, the interest rates tend to increase following a regulatory capital shock (figure 2) and the macroprudential tools show a small increase due to a money market interest rates shock (Figure1). In addition, our analysis shows a building role between the monetary policy and the macroprudential supervision tools. This result is consistent with the study of Tovar et al (2012) which shows that macroprudential instruments play a complementary role to the monetary policy.

➤ ***Loan to deposit ratio shock***

The loan / deposit ratio is a very important tool for realizing bank liquidity. It presents a relationship between loans and deposits to evaluate bank liquidity for each country. If this ratio is high, it means that banks may not have sufficient liquidity to cover unforeseen fund needs. The impact of a loan to deposit ratio shock on the

regulatory capital (figure 3) is limited to a significant depreciation until the third period. The analysis of the response functions shows that the economic activity reacts to loan to deposit ratio shock in the first two periods with a negative depreciation for the rest of the period. The adoption of macroprudential tools such as loan to deposit ratio and capital adequacy ratio may enable the regulators in the region to mitigate the impact of external shocks. In the Southern Mediterranean countries, the macro-prudential tools can complement the monetary and fiscal policies by ensuring the stability and strength of the financial system (Masson, 2013). The interest rate responds to the loan to deposit ratio shock through depreciation. For the IMF (2014), in case of liquidity shocks, banks are found with the risk of resorting to financing facilities from the central bank. As a result, there is no more capital inflow into the financial system. This shock reproduces similar effects on inflation and the regulatory capital. This result reveals that the monetary policy is very sensitive to the deposit loan ratio shock. Banks are in a financing deficit situation when loans exceed the deposit base, in which case they have access to financial markets. Therefore, a higher funding gap implies a heavy reliance on market funding which can be more volatile and costly than retail funding (Jan Willem 2013). Indeed, with a significant number of banks having a financing gap, negative shocks on market financing can affect the banking sector as a whole, which affects both the supply of credit and economic growth.

### ***GDP and inflation shock***

The response function analysis shows that the impact on economic activity is reflected in the consumer price index, which depreciates in the first three periods then regains its balance. The reaction of deposit loan ratio impact of economic activity is a weakly significant depreciation. The GDP shock is transmitted as a regulatory capital in a positive effect reflected by an increase until the third period (figure 4). An analysis of the impulse response function shows that the impact of inflation leads to a depreciation of the general price level, which is transmitted to economic activity by depreciation for the second period. Indeed, these effects are unconfirmity with theoretical predictions (figure 5). The interest rates respond to the inflation shock by depreciation. This can disrupt the transmission of the monetary policy, since the money market interest rate shocks interest are felt by the agents and dampened by high inflation (Mojon 2000). Similarly, the increase of the consumer prices index is transmitted to economic activity by depreciation for the second period. This shock reproduces similar effects on the deposit loan ratio as depreciation is observed for the second period. The shock of inflation on the regulatory capital ratio results in positive and negative effects. The positive effects are observed in the first seven periods whereas the negative are observed in the other periods. In a general manner, from the impulse response function, we can see that, unlike an interest rate shock, the shock of regulatory capital leads to a depreciation of the consumer price index, the short-term increase in gross domestic product and the money market interest rates. Different effects of macroprudential tool shock and the interest rate shock highlight the role of the macroprudential tools as a complement rather than a substitute for the monetary policy. For Svensson (2012), it is more efficient to assign monetary policy to the price stability and the tools of macroprudential monitoring to assess the financial system and achieve financial stability. While monetary policy focuses on financial stability, there is a risk of lack of transparency, accountability and credibility for inflation targeting. As a result, so the use of macroprudential instruments to support the objectives of monetary policy would be likely to reduce the effectiveness of the tools in achieving financial stability. It is important to note that macroprudential tools should not be considered as substitutes for the monetary and fiscal policy, not should they be used to offset the negative effects of macroeconomic policies. There is no consensus on the interaction between macroprudential and monetary policy instruments which must both act in a complementary or a substitutable manner. For example, Bean et al (2010) and Gertler and Karadi (2011), studied how the use of this tool may affect the conduct of the monetary policy. Their results suggest that macroprudential and monetary policy tools should be coordinated. Contrary to the studies of Rabanal Quint (2011), Beau et al (2012) and Filiz Ozkan Gulcin Unsal (2011) used the macroprudential instruments to maintain price stability in case there is a financial friction of the objective of financial stability.

## **IV. CONCLUSION AND IMPLICATIONS**

The objective of this article is to study the interaction between macroprudential tools and monetary policy. We take the experience of some Southern Mediterranean countries whose financial system is affected by changes in the economic environment and based on the banking sector, which requires the tightening of their prudential regulations. The financial system of the southern Mediterranean countries faces many challenges, such as problems caused by the economic crisis (Subprime, 2007) and Arab revolutions. Based on a structural vector autoregression model, we can say that macroprudential tool shock leads to an increase of GDP and inflation. Regarding the monetary policy shock, the results are consistent with the standard economic theory of (GDP according to which the consumer price index and loan to deposit ratio). The impulse response functions following the regulatory capital shock and the monetary policy shock are different. For this reason, we can say that macroprudential instruments are a complement and not a substitute for the monetary policy. According to



Christian Pascal (2015), since the reserve requirement shock and the interest rate shock have different effects on macroeconomic variables; both instruments are complements, not substitutes. To conclude, we can say that the financial system of the southern Mediterranean countries reveals a correlation between monetary policy and macroprudential tools (regulatory capital and loan to deposit ratio). This highlights the need for cooperation between macroprudential tools and monetary policy, which can lead to a reduction of systemic risk and therefore to financial stability. The main policy implications arising from our study can be presented as follows: first, evidence showed that the financial system of the southern Mediterranean countries reveals a complementary between monetary policy and macroprudential tools. Therefore, it is necessary to look for other macroprudential tools such as reserve requirement to assess systemic risk in the financial system. Secondly, in empirical terms, there is a lack of studies of the interaction between the monetary and the macroprudential policy in the African countries because the problems are often exacerbated by the absence of macro prudential data. Besides, it is important to examine the interaction between macroprudential and fiscal policy to maintain sovereign debt security and to avoid negative feedback between sovereign risk and the financial system. Future research should also focus on the interaction between macroprudential and fiscal policy in the southern Mediterranean countries. However, we believe that this research provides empirical results which are useful for the understanding of this type of national economy in the region as well as in determining the most effective the economic policies in order to increase economic development. It is apparent globally that the economic and public policies in the southern Mediterranean countries will necessarily be implemented jointly to create both growth and limit the budget deficit.

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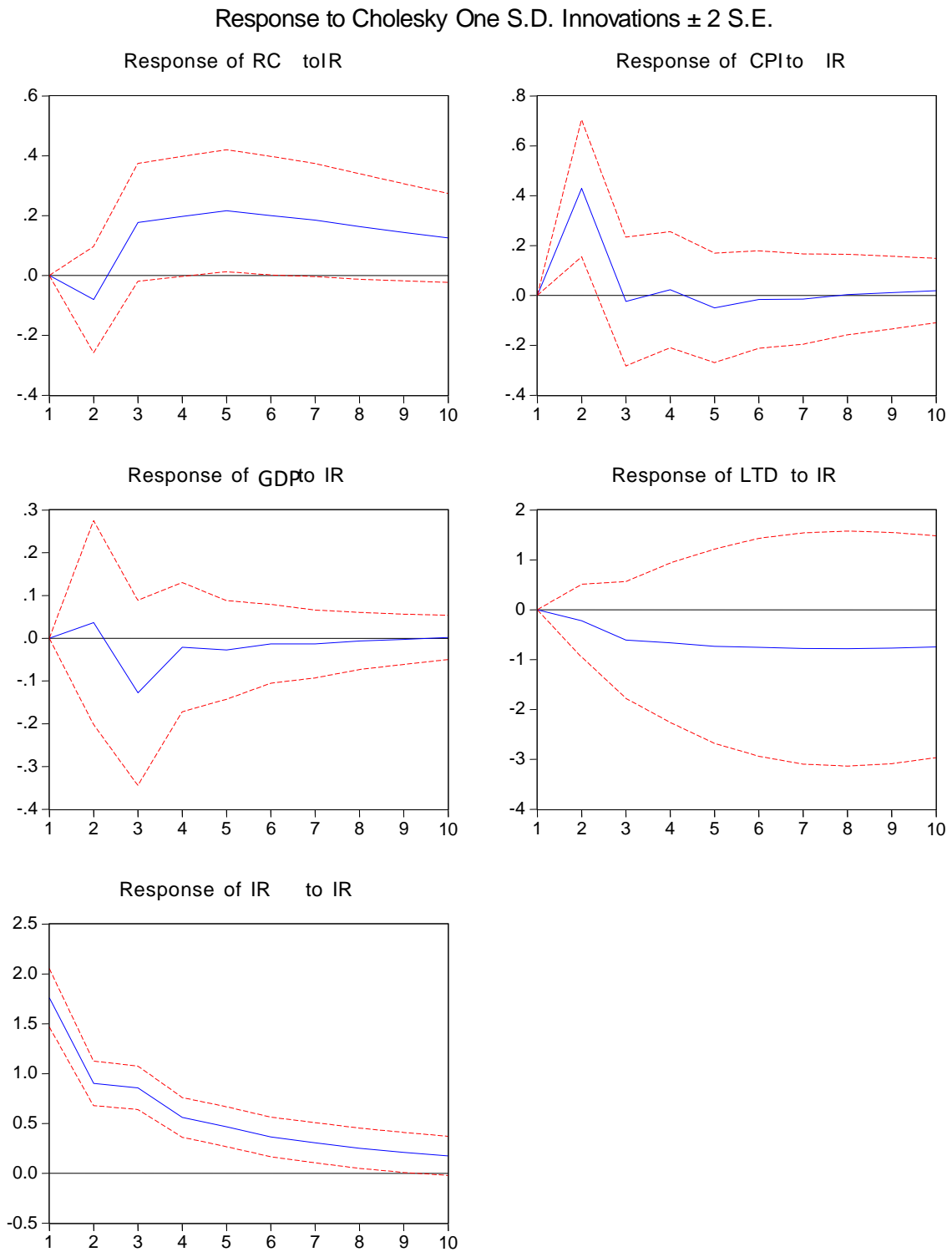
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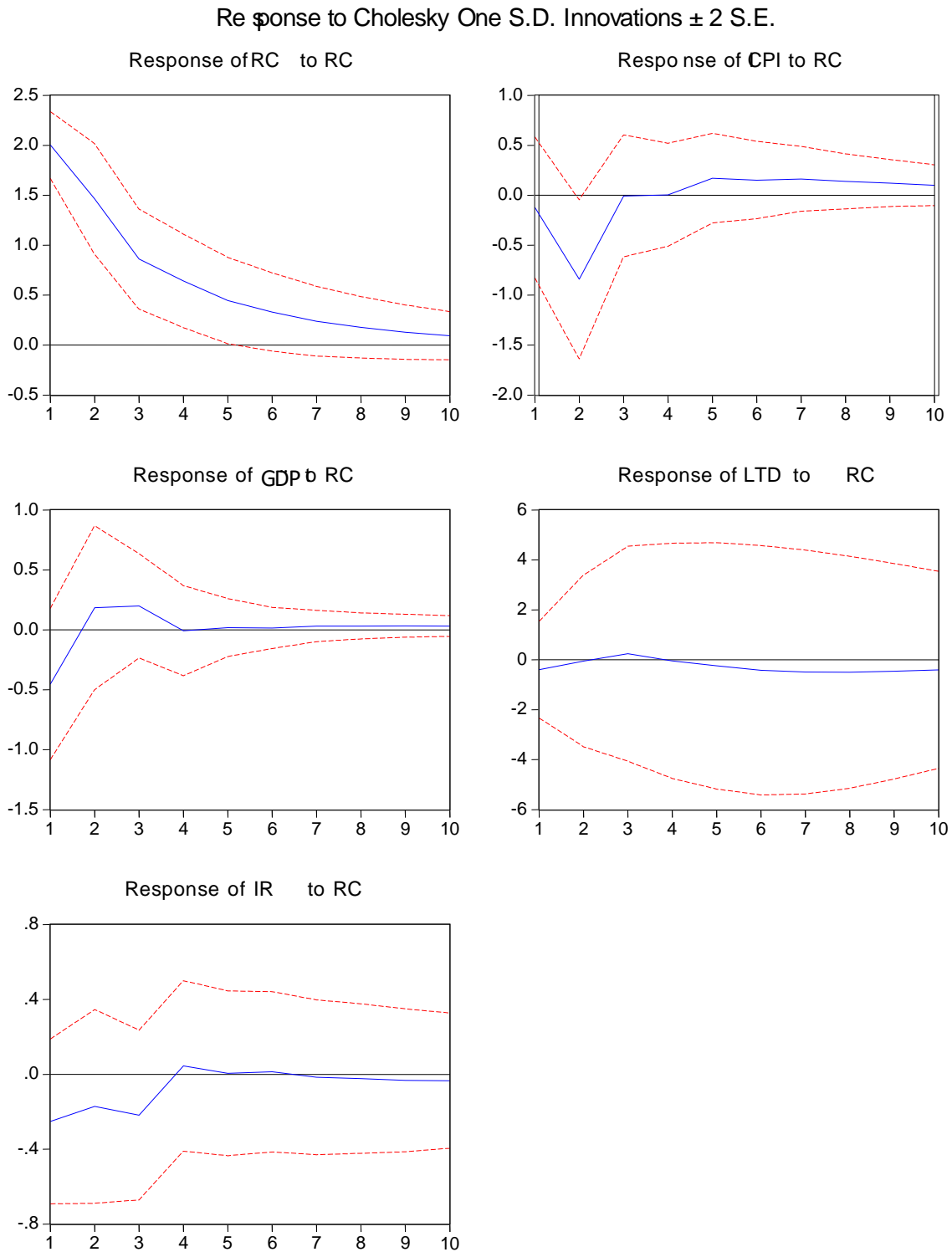
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APPENDIX

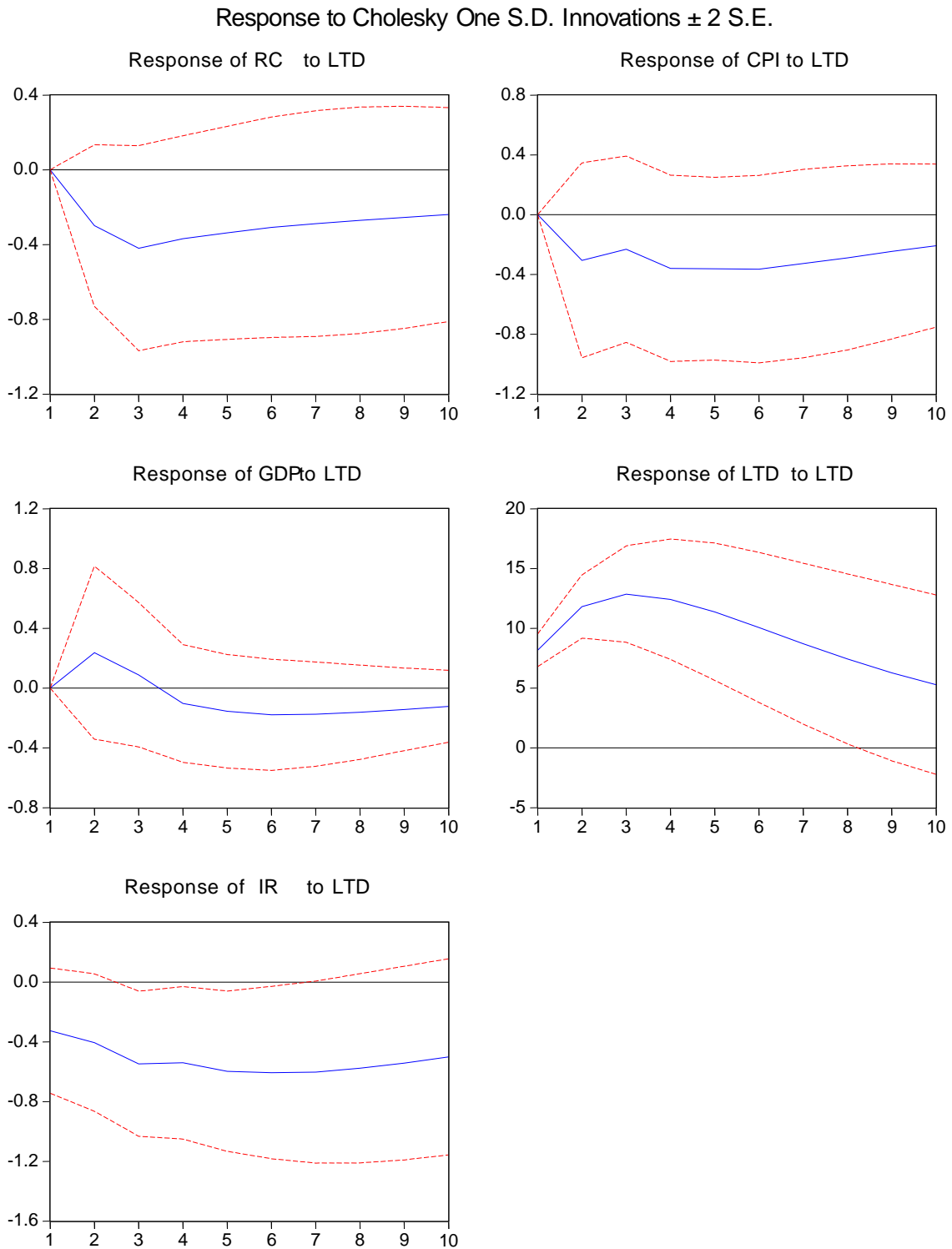
Figure 1: The impulse response function to an interest rate Market money shock



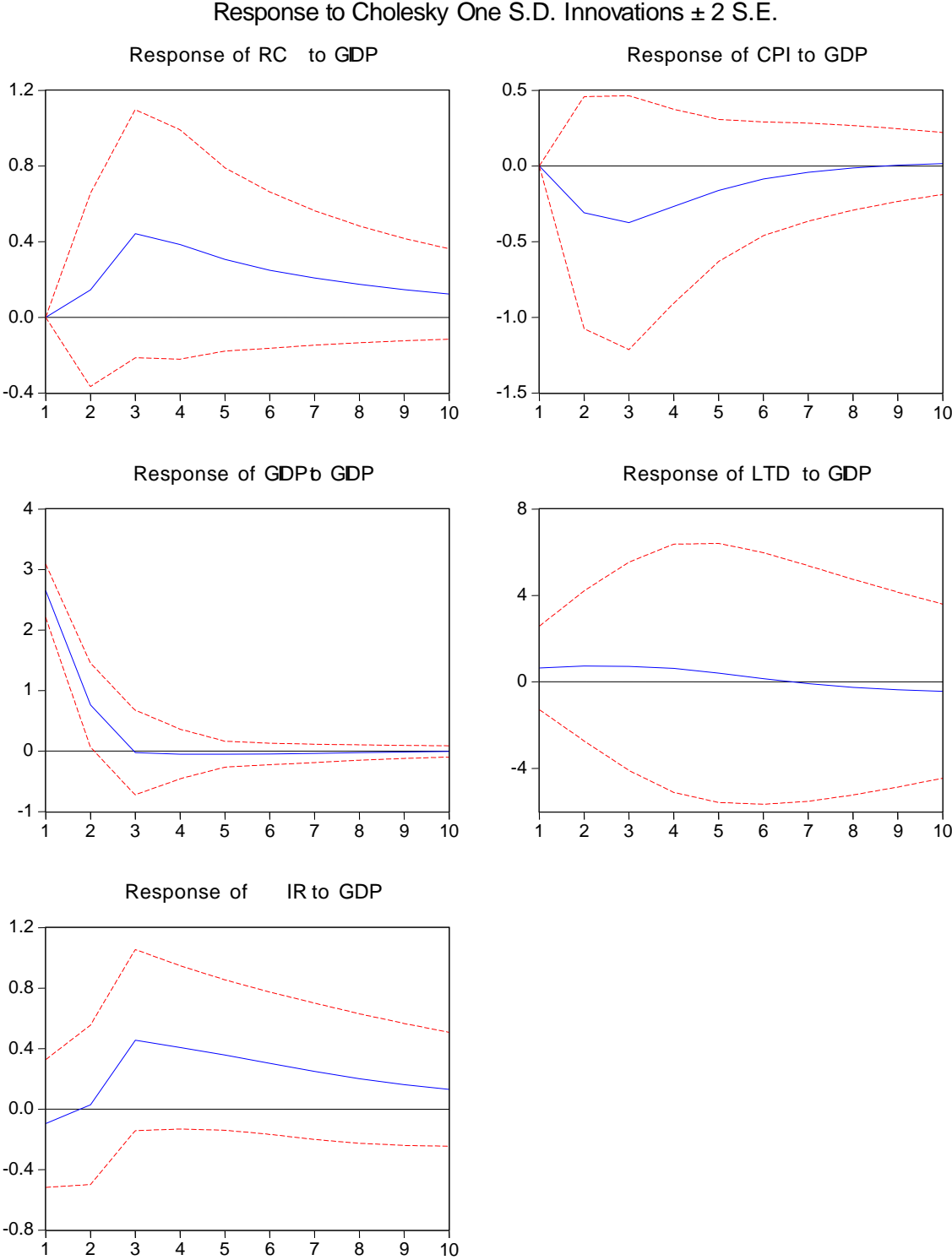
**Figure 2: The impulse response function to Regulatory Capital shock**



**Figure 3: The impulse response function to loan to deposit shock**



**Figure 4: The impulse response function to GDP shock**



**Figure 5: The impulse response function to inflation shock**

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

