Budget deficit, money growth and inflation: Empirical evidence from Vietnam

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Abstract

This study empirically examines the nexus among budget deficit, money supply and inflation by using a monthly data set from January 1995 to December 2012 and a SVAR model with five endogenous variables, inflation, money growth, budget deficit growth, real GDP growth and interest rate. Since real GDP and budget deficit are unavailable on the monthly basis, we interpolate those series using Chow and Lin's (1971) annualized approach from their annual series. Overall, we found that money growth has positive effects on inflation while budget deficit growth has no impact on money growth and therefore inflation. In addition, budget deficit is autonomous from shocks to other variables. The estimation results also reveal that the State Bank of Vietnam implemented tightening monetary policy in response to positive shocks to inflation by reducing money growth but the response was relatively slow because it took three months for the monetary authority to fully react to such shocks. Finally, interest rate was not an effective instrument for fighting inflation but it was significantly and positively influenced by inflation.

Key words: Inflation, Money Growth, Budget Deficit, Structural Vector Auto-regressive Model.

JEL classification: E31, E58, E61.

1. Introduction

Price stability is the primary goal of monetary policy for almost all central banks in the world today. Thus, identifying causes of inflation is usually a crucial issue and draws a lot of interest of policymakers as well as monetary authorities. By definition, inflation is defined as a rapid and continuing rise in price level, and is always originated from a high growth rate of money supply. Theoretically, budget deficit could be a source of inflation, and its impact on inflation depends on how long it lasts, and how it is financed. On the one hand, if the government only suffers from a temporary budget deficit, it could only lead to a temporary increase in the price level, but not inflation no matter how it is funded. On the other hand, if budget deficits are permanent and are financed by money creation, then inflation occurs (Mishkin, 2004). However, if budget deficits are addressed by issuing government bonds that are bought by non-bank entities and they hold those bonds until their maturity, then budget deficits do not cause money supply to increase and therefore do not lead to inflationary pressure. Furthermore, issuing bonds implies that the demand for loanable funds increases, thereby causing market interest rates to grow. This effect then contributes to reducing inflation. Yet, if non-bank holders of bonds do not hold them until their maturity and banks (including the central bank) repurchase those government bonds, money supply rises and there will be inflationary pressure.

Statistical data from the Ministry of Finance of Vietnam shows that Vietnam has persistently faced budget deficits since the beginning of the 1990s. Particularly, the ratio of budget deficits to GDP was quite high in 1990, which was about 7 percent, but was decreasing until the early 2000s. Since the start of the 2000s, the budget to GDP ratio has been going up, and its average in this period, which is roughly 5 percent, is relatively higher than that in the 1990s, which stayed at about 3 percent. One of the underlying reasons why budget deficits have increased in recent years is that the Vietnamese government wanted to boost the economy by raising expenditures. It is notable that such an increase in the budget deficits to GDP ratio in recent years has been in line with a significant growth in inflation. In particular, inflation since 2004 has always been above 7 percent per annum, which is higher than the average for the eight preceding years. Remarkably, inflation in 2008 hit its record, approximately 23 percent per year, which has been the highest level since the last decade. In addition, the year 2011 also struck the monetary authorities by an unpredictable level of inflation, 18.58 percent per annum. Furthermore, carefully looking at the dynamics of money supply, it can be seen that money supply has continuously increased since the early 1990s. On average, the growth rate of money supply has been approximately 32 percent since 1990.

One may question the linkage among these three variables, budget deficits, money supply, and inflation. Thus, unanswered questions about such relation are posed. What are the impacts of budget deficit on money supply? How do inflation and money supply interact with each other? What is the effect of budget deficit on inflation?

There have been a considerable number of studies on the link between budget deficits and inflation since the 1980s in developed countries and especially since the early 1900s in developing countries and emerging economies, when many of them implemented expansionary fiscal policy to speed up their economic growth (Barnhart,

W.S., and Darrat, F.A., 1988; Bradley, D.M., 1984; Burdekin, C.K.R., and Wohar, E.M., 1990; Haan, J.D., and Zelhorst, D., 1990; Kia, A., 2006; Jeitziner, B., 1999). These studies, however, produced mixed results across countries and across periods of time, and have mainly concentrated on South American countries, Middle Eastern countries, Asian countries, and African countries. It is striking that very few studies on the impact of budget deficits on inflation have been conducted for Vietnam despite the fact that Vietnam has permanently experienced a high level of budget deficits as well as high inflation compared with other neighboring countries in the region. There have been several qualitative research papers (Le, L., 2008; Tran, G., 2008), which simply observed the movements of budget deficits, money supply and inflation, and then drew a conclusion that budget deficit has been a source of inflation in Vietnam. The limitation of these studies is that they simply used graphical simulation and statistical descriptions to infer the relationship between budget deficits and inflation, and did not undertake empirical tests to confirm the conclusion. One quantitative study (Nguyen, H. and Nguyen, T., 2011), which included budget deficits in their models as an explanatory variable to identify the causes of inflation, shows that the effect of budget deficits on inflation Vietnam is statistically insignificant. However, that study mainly focused on the production side to discover the origins of inflation and the impulse response analysis might not be robust because the study used a vector error correction model (VECM), in which impulse response functions have a problem with the standard error.

This study, therefore, will try to address this gap with a careful analysis of the causal relationship among budget deficit, money supply and inflation for the period January 1995 to December 2012 by applying a structural vector auto-regressive (SVAR) model. Thus, this study will contribute to the literature in the following aspects. First, the study carefully investigates the impacts of government budget deficits on money supply, and thus creates a solid foundation for tracing the impacts of fiscal deficits on inflation in Vietnam. Second, the SVAR model is estimated with a relatively large number of observations thanks to the interpolation method developed by Chow and Lin (1971). Third, the study captures the inflationary event in 2011 in the context of a high level of budget deficits in previous years, which has not showed up in other studies so far.

The remaining parts of this paper are structured as follows. The literature review summarizes empirical studies on the determinants of inflation and on the nexus among budget deficit, money supply and inflation. The next section examines key issues of monetary and fiscal policies in Vietnam over the past years. The following part is dedicated to selecting variables and describing the data set used to estimate the model. Sections 5 and 6 present the model specification and the identification strategy to estimate the model. Subsequently, the study analyzes the estimation results of impulse response functions and variance decomposition. Finally, robustness checks are conducted by varying identification restrictions and the paper ends with concluding remarks.

2. Literature Review

Inflation has been studied extensively in the literature from theoretical discussions to empirical research. There have been two major issues that those studies concentrate on. One group has tried to analyze the impact of inflation on the economy and social

welfare whereas the other has mainly discussed the determinants of inflation. This section will pay attention to reviewing the literature on the origin of inflation and especially on the linkage among budget deficit, money supply and inflation.

A discussion of the origins of inflation would be incomplete without a review of the Keynesian school and the monetarist school. According to Mishkin (2004), the monetarist analysis argues that the money supply is viewed as a sole source of shifts in aggregate demand, leading to a continuous increase in the price level. Thus, monetarist analysis shows that high inflation must be driven by high money supply growth. Similarly, Keynesian analysis indicates that continuingly increasing money supply will have the same effect on the aggregate demand, implying that high inflation is originated from high money growth rate. Furthermore, the Keynesian analysis convincingly points out that the supply-side shocks by themselves cannot produce inflation. The impact of fiscal policy on inflation is also investigated in the Keynesian school. Accordingly, the fiscal deficits cannot itself cause inflation without monetary accommodation. Yet, permanent budget deficits could generate inflation if they are supported by an expansionary monetary policy. Thus, empirical studies on the linkage among budget deficits, money supply and inflation will be reviewed subsequently.

An empirical study by Allen and Smith (1983) tried to examine whether there was a relation between the US Treasury borrowings and monetary growth before the 1980s. The study used a quarterly data set and produced evidence of a positive and significant impact of total Treasury borrowing on the growth of the monetary base for the 1954Q1-1961QI and 196lQIII-1974QIV periods. Another study by Bradley (1984) for the U.S also found that persistent federal deficits led to money supply growth through an increase in reserves growth.

In an empirical study for Albania, Bulgaria, and Romania, Milo (2012) found a positive relationship between monetary financing of government deficits and money base growth; public finance imbalances are the main cause of money creation and inflation in these countries. Budget deficits are now financed through not only the purchase of government bonds or direct loans to state by the central banks, but also the purchase of government bonds or direct loans to state by the second level banks. The impact of budget deficits funding by the second level banks depends on whether the public debt securities enlarge banks' portfolio or substitute other assets in this portfolio, including loans to the economy.

Jeitziner (1999) examined the relationship between fiscal deficits and growth rate of the monetary base and the money supply M1 in Switzerland by using quarterly data from 1973Q2 to 1994Q1. The author found that the money supply M1 did not move together with budget deficits in the period. However, regressing the monetary base on budget deficits in the period from 1973Q2 to 1979Q4 showed that budget deficits led to a faster growth rate of the monetary base. In a study that investigated the relationship between government budget deficits and money growth in developing countries, Haan and Zelhorst (1990) found a mixed result. In the majority of countries in the sample, there was no clear relationship between budget deficits and money growth. Yet, government budget deficits tend to affect money growth in high-inflation years. Barnhart and Darrat (1988) investigated the causal linkage between budget deficits and money growth in seven major countries in the Organization for Economic Co-operation

and Development (OECD) using multivariate Granger-causality tests combined with Akaike's AIC criterion and Zellner's iterative seemingly unrelated regressions. Their result showed that the monetary policy and fiscal policy were conducted independently in OECD countries where budget deficits had little or no impact on money growth. Similarly, Ashra, Chattopadhyay, and Chaudhuri (2004) conducted an empirical study for India and concluded that there was no systematic relationship between budget deficits and money growth.

Burdekin and Wohar (1990) examined the relationship between budget deficits and money growth in eight countries including Canada, France, Italy, Japan, Switzerland, United Kingdom, United States and West Germany in the period 1960Q1-1985Q4 and concluded that countries whose central banks are independent from the governments exhibit a poor linkage between fiscal deficits and the evolution of money supply. In contrast, budget deficits tend to be related with money growth in countries with low degree-of-independence central banks. They argue that less independent central banks were sometimes under pressure to finance government budget deficits whereas independent central banks were more toward price stability goal and less toward accommodation of government budget deficits. This finding is fairly interesting since it suggests that the independence of central banks determines the effect of budget deficits on money growth.

Regarding the link between money supply and inflation, Akinboade, Siebrits and Niedermeier (2004) studied the case of South Africa and found that broad money supply has a positive correlation with inflation. Another study by El-Shagi and Giensen (2013) found that in the US, there has been a significance impact of money growth on prices. They investigated the consequences of the Federal Reserves' response to the financial crisis. Their result indicated that inflation rate in the U.S has increased by above 5 percent for more than a decade due to the expansionary monetary policy implemented by the Fed. Similarly, Nina, Wojciech, Georges and Geomina (2006) found that inflation in Romania in the period 1992-2000 was caused by high money growth rate.

Lin and Chu (2013) employed the dynamic panel quantile regression (DPQR) model under the autoregressive distributional lag (ARDL) specification, and investigated the causality between budget deficits and inflation in 91 countries between 1960 and 2006. The empirical results show that the fiscal deficit had a strong impact on inflation in high-inflation periods, and had a weak impact in low-inflation episodes. Kia (2006) examined the determinants of inflation in Iran and found that the fiscal policy was quite effective to combat inflation, implying that that higher budget deficits cause inflation and vice versa; reducing budget deficits will contribute to fighting inflation. Another study by Ahmad and Sajad (2011) also for Iran found that there was not only the causation from budget deficits to inflation but also a direction from the price level to budget deficits. Likewise, Chimobi and Igwe (2010) shows a bi-directional relationship between inflation and budget deficits in Nigeria. Ekanayake (2012) applied an auto-regressive distributed lag (ARDL) model, using annual data from 1959 to 2008 to examine the relationship between budget deficits and inflation in Sri Lanka. This study did not use the ratio of budget deficits to GDP as in others; instead, the ratio of budget deficits to narrow money supply was used. The result suggests that, in the long run, a one percentage point increase in the ratio of the fiscal deficits to narrow money was associated with about an 11 percentage point increase in inflation. Nevertheless, this

effect became less significant without the public sector wage expenditure. Generally, the impact of fiscal deficits on inflation in Sri Lanka was not only through the monetary channel but also through the expenditure on public sector wage.

Catao and Terrones (2005) used a model that treats inflation as non-linearly related to fiscal deficits through the inflation tax base and estimates this relationship as intrinsically dynamic, using panel techniques that explicitly distinguish between short-run and long-run effects of fiscal deficits. They acquired data from 107 countries over the period 1960–2001 provided empirical results that show a strong positive relation between fiscal deficits and inflation among high-inflation and developing countries, but not among low-inflation advanced economies.

Le (2008) and Tran (2008) are two major qualitative studies that analyzed the correlation between budget deficits and inflation in Vietnam. By using statistical descriptions, they indicate that fiscal deficits were a source of inflation in Vietnam. They argue that the fiscal policy in Vietnam was continuously expansionary, leading to, on average, a 5 percent ratio of budget deficits to GDP. They add evidence that the Vietnamese government has issued a large amount of long-term government bonds to raise money to invest in large-scale projects. This expansionary fiscal policy led to a rise in money growth because the majority of undue government bonds were repurchased by the State Bank of Vietnam or commercial banks.

In contrast, Nguyen and Nguyen (2010) performed an empirical study to examine the determinants of inflation in Vietnam from 2000 to 2010 using an interpolated monthly data set. They conducted the cointegration test to analyze the long-run impact of budget deficits on inflation. In addition, they employed the vector error correction model to analyze the short-run dynamics and movements to the long-run equilibrium. Their results show that there is no effect of budget deficits on inflation in the short run, and the impact is also unclear in the long run.

To sum up, the literature review on the relationship among budget deficits, money supply and inflation reveals the following key points. First, the effect of fiscal deficits on money growth is mixed across countries and across periods of time. Budget deficits are likely to be supported through money creation if the degree of independence of central banks is low whereas they are unlikely to cause money supply to rise if the monetary policy is independent. Second, recent studies show that the link between money growth and inflation is quite clear, confirming that inflation is always a monetary phenomenon. Third, budget deficits are highly correlated with inflation in high-inflation developing countries, and the link between them becomes weaker in advanced countries. Fourth, qualitative studies in Vietnam indicate that the fiscal deficit is a source of inflation in Vietnam while the quantitative study shows that there is no impact of budget deficits on inflation in the short run, and that the effect is unclear in the long run.

Thus, this study will try to address the contradiction between findings on the linkage between budget deficits and inflation in Vietnam by investigating the nexus among budget deficits, money supply and inflation.

3. Fiscal and monetary policy in Vietnam

This section will briefly examine the structure of fiscal policy and monetary policy by analyzing the Budget Act and the Law on the State Bank of Vietnam enacted by the National Assembly of Vietnam. The purpose of this section is to comprehend how fiscal and monetary policy in Vietnam works so as to formulate a sound identification strategy for the estimation exercise.

According to the Law on the State Bank of Vietnam introduced in 1997, the monetary policy was responsible for controlling inflation and stimulating economic growth. The fact is that the monetary policy of the State Bank of Vietnam had prioritized economic growth for many years. For example, from 2005 to 2008, the State Bank of Vietnam pursued a policy, which prioritized GDP growth provided that the inflation rate is lower than the economic growth rate. It can also be inferred from the Law that the State Bank of Vietnam was highly dependent on the government in terms of setting goals and choosing instruments, implying that the likelihood of financing budget deficit through money creation was quite high. In 2010, the National Assembly of Vietnam introduced the amended version of the Law on the State Bank of Vietnam, in which the monetary policy is responsible for the goal of price stability only. In addition, the amended law stipulates that choosing the instruments to achieve goals is at the discretion of the Governor of the State Bank and the Prime Minister, meaning that the State Bank of Vietnam has obtained a certain level of independence in terms of using the instruments.

There are several essential things in the framework of the fiscal policy. First, both of the 1996 and 2002 versions of the Budget Act state that the primary objective of the government expenditures has been the development of the country as a whole, especially the economic development. Second, the government budget deficit is financed by borrowing domestically (issuing domestic bonds) and borrowing from foreign institutions or foreign governments (issuing international bonds). Furthermore, the borrowing is not allowed to be spent on consumption but is spent for the development purpose only. Last, determining the maximum level of budget deficit and deciding how budget deficits are funded are at the discretion of the National Assembly of Vietnam, implying that there exists the legislative lag in the process of financing budget deficit.

4. Choice of variables and data descriptions

In order to choose appropriate variables, one may use the long run government budget constraint:

$$\frac{B_{t-1}}{P_t} = E_t \sum_{j=0}^{\infty} \frac{1}{(1+i_{t+j})^j} \left(T_{t+j} - G_{t+j} + \frac{M_{t+j} - M_{t-1+j}}{P_{t+j}} \right) \qquad (1.1)$$

where

B_{t-1} is the nominal value of the government bonds issued in period (t-1) with the maturity in period t.

P is the price level.

i is the short-term interest rate.
T refers to tax revenues.
G refers to government expenditures.
M refers to money supply.

Relation (1.1) can be rewritten as

$$\frac{B_{t-1}}{P_t} + G_t - T_t = \frac{M_t - M_{t-1}}{P_t} + E_t \sum_{j=1}^{\infty} \frac{1}{(1+i_{t+j})^j} \left(\frac{M_{t+j} - M_{t-1+j}}{P_{t+j}} - (G_{t+j} - T_{t+j}) \right)$$

or

$$D_t = \frac{M_t - M_{t-1}}{P_t} + E_t \sum_{j=1}^{\infty} \frac{1}{(1+i_{t+j})^j} \left(\frac{M_{t+j} - M_{t-1+j}}{P_{t+j}} - D_{t+j} \right) \quad (1.2)$$

where D_t is budget deficit in period t and is defined as $\frac{B_{t-1}}{P_t} + G_t - T_t$. Note that G_{t+j} (j=1,…,∞) here is defined as the total government expenditures including payment for bonds which are issued in the previous periods and have maturity in period (t+j). Hence, $(G_{t+j} - T_{t+j})$ is regarded as budget deficit in period (t+j). This definition of budget deficit is consistent with the data provided by the Vietnam Ministry of Finance.

Equation (1.2) shows the nexus among budget deficit, money supply, price level and interest rates. Thus, those variables will be selected to estimate the SVAR model. Moreover, real gross domestic product (GDP) would be added to the model to capture the income effects on inflation. Another reason for the inclusion of real GDP in the model is that real GDP is an important goal for which monetary and fiscal policies are designed.

An effort was made to acquire a monthly data set of the five endogenous variables from January 1995 to December 2012 including 216 observations, but budget deficit and real GDP are unavailable on the monthly basis. Therefore, in order to obtain a full monthly data set, Chow and Lin's (1971) annualized approach is employed to interpolate budget deficit and real GDP from their annual series to monthly series. Once having monthly data of budget deficit and real GDP, all variables (except interest rate) are expressed in the form of annualized growth rate. Accordingly, the SVAR model will be estimated using five endogenous variables, inflation, growth rate of money supply (M1), growth rate of budget deficit, real GDP growth rate, and nominal interest rate.

The data set used to estimate the SVAR model is acquired from two various sources[1]. Data of consumer price index, real GDP, interest rate and money supply is obtained from the International Financial Statistics (IFS), and data of budget deficit is generated from the Ministry of Finance of Vietnam. The definitions of variables used in the model and their data sources are summarized in Table 1, Appendix.

<Insert Table 1 around here>

[1] The time series were already seasonally adjusted.

5. Model specification

The SVAR model is represented in the following form:

$$BY_t = B_0 + B_1 Y_{t-1} + B_2 Y_{t-2} + \cdots + B_p Y_{t-p} + u_t \quad (1.3)$$

where Y_t={infl, g_y, d_pc, m1_pc, i}' is a 5x1 vector of five endogenous variables; B is a 5x5 matrix of contemporaneous impacts; B_0 is a 5x1 vector of intercept terms; B_1, …, B_p are 5x5 matrices of coefficients; and u_t is a 5x1 vector of structural innovations, which are uncorrelated and $E(u_t u_t')=I$.

6. Identification strategy

The so-called SVAR model, (1.3), could not be estimated without imposing further restrictions. First, (1.3) can be rewritten as

$$B^{-1}BY_t = B^{-1}B_0 + B^{-1}B_1 Y_{t-1} + B^{-1}B_2 Y_{t-2} + \cdots + B^{-1}B_p Y_{t-p} + B^{-1}u_t$$

This is equivalent to

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + e_t$$

where $A_i=B^{-1}B_i$ (i=0,…,p); e_t is reduced-form residuals and is defined as $B^{-1}u_t \equiv Cu_t$ ($C=B^{-1}$); and $E(e_t e_t')=CC'=\Sigma$. By imposing restrictions on the matrix C, the model is identified.

First of all, because prices are more sluggish than other endogenous variables, inflation is assumed to have contemporaneous impacts on the remaining variables. In addition, real GDP growth is assumed to be contemporaneously influenced by inflation but has contemporaneous effects on the remaining variables. As discussed earlier, there are two possible channels to finance budget deficit. If budget deficit is financed by issuing government bonds, then demand for loanable fund will increase, leading to a rise in interest rates. The working of this mechanism basically depends on market forces. If budget deficit is funded by printing money, it is reasonable to assume that there is the so-called legislative lag to do so. Hence, budget deficit is assumed to have no contemporaneous impacts on interest rate and money supply. Finally, nominal interest rate is assumed to be contemporaneously affected by other endogenous variables except budget deficit. Specifically, an increase in inflation will cause nominal interest rate to go up because of the Fisher effect. The growth in real GDP (real income) leads to an increase in the money demand, which in turn leads to a rise in interest rates. Finally, changes in money supply will clearly affect interest rate by changing the equilibrium interest rate in the money market. These restrictions can be represented in terms of reduced-form residuals and structural innovations as follow.

$$\begin{bmatrix} e_{inf} \\ e_{g\_y} \\ e_{d\_pc} \\ e_{m1\_pc} \\ e_i \end{bmatrix} = \begin{bmatrix} c_{11} & 0 & 0 & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 & 0 \\ c_{31} & c_{32} & c_{33} & 0 & 0 \\ c_{41} & c_{42} & 0 & c_{44} & 0 \\ c_{51} & c_{52} & 0 & c_{54} & c_{55} \end{bmatrix} \begin{bmatrix} u_{inf} \\ u_{g\_y} \\ u_{d\_pc} \\ u_{m1\_pc} \\ u_i \end{bmatrix}$$

7. Estimation results[2] and discussions

7.1. Results of the unit root tests and the optimal lag

This study basically employs the Augmented Dickey-Fuller (ADF) test to examine whether the time series have a unit root. The null hypothesis is that the series has a unit root. In this study, 5 percent is chosen to be the significance level. Thus, if the p-value reported by the ADF test is lower than 0.05, the series is said to have no unit root; otherwise, it has a unit root. Accordingly, the ADF test[3] shows that all of the series have no unit root at 5 percent significance level since all the p-values reported are lower than 0.05. This implies that the VAR model using these time series is stable.

Table 2: The summary of the ADF tests for a unit root

Variables	ADF test statistic	*Mackinnon critical values for rejection of hypothesis of a unit root* 1%	5%	10%	P-value	Decision
infl	*-8.810491*	-3.460884	*-2.874868*	-2.573951	0.0000	*I(0)*
g_y	*-9.853245*	-3.462253	*2.875468*	-2.574271	0.0000	*I(0)*
d_pc	*-14.00999*	-3.460884	*-2.874868*	-2.573951	0.0000	*I(0)*
m1_pc	*-4.631741*	-3.463067	*-2.875825*	-2.574462	0.0002	*I(0)*
i	*-2.945004*	-3.461327	*-2.875062*	-2.574054	0.0420	*I(0)*

There are several criteria for choosing the optimal number of lags such as LR, FPE, AIC, BIC, and HQ. However, in this study, we mainly use the BIC together with the result of the test for autocorrelation among the residuals and the roots of characteristic polynomial to determine the optimal number of lags. The result shows that the BIC and HQ select one lag as the optimal lag while AIC, FPE and LR choose longer lags (see Table 3, Appendix). In order to double check the optimal lag and stability of the model, we test for autocorrelation among the residuals, and examine the roots of characteristic polynomial. The autocorrelation LM test shows that there is no autocorrelation among residuals in the model estimated with 4 lags (see Table 4, Appendix). In addition, all the roots of characteristic polynomial are smaller than 1, meaning that the model satisfies the stability condition (see Table 5, Appendix). Therefore, the optimal number of lags is 4. In the following sections, the impulse responses of endogenous variables will be discussed using the identification restrictions.

<Insert Table 3 around here>

[2] All the figures showing impulse responses of endogenous variables are given in Appendix.

[3] We also used the Phillips-Perron and KPSS tests to check the stationarity of those time series. These two tests also give the same results as the ADF test does.

<Insert Table 4 around here>

<Insert Table 5 around here>

7.2. Impulse responses of inflation

Figure 1 shows responses of inflation to a positive shock to the growth rate of money supply. Accordingly, an increase in the growth rate of money supply accelerates inflation. Specifically, inflation is accelerated for 3 months due to the rise in the growth rate of money supply. More importantly, the effect of money growth on inflation becomes strongest in the second month since the occurrence of the shock, implying that the transmission mechanism of the credit channel into inflation works quite quickly. The effects of money growth on inflation disappear since the third month. These findings might lead to several policy implications. For instance, if the State Bank of Vietnam targets to reduce inflation rate most significantly in current period, then it should lower money growth 2 months before. In addition, in high inflation periods, it might be necessary to decrease money growth consecutively several times because each money growth shock only takes effect for 3 months.

<Insert Figure 1 around here>

Figure 2 indicates that a positive shock to growth rate of budget deficit has no effect on inflation. Thus, provided that fiscal policy works effectively[4], the fragile relationship between budget deficit and inflation suggests that fiscal policy might be prioritized to stimulate economic growth in the short run without concern about inflation pressure because monetary policy could stimulate aggregate demand and therefore output, but could also intensify inflation pressure as discussed earlier.

<Insert Figure 2 around here>

A positive shock to real GDP (real income) growth is expected to increase aggregate demand and hence inflation by boosting consumption. Figure 3 shows that a positive shock to real GDP growth causes inflation to go up for three months and the shock fuels inflation most significantly in the third month. A positive shock to interest rate is usually expected to hinder inflation because higher interest rate reduces investment and consumption and therefore reduces aggregate demand. However, the estimation result shows that positive shocks to interest rate have no impact on inflation (Figure 4). This finding suggests that interest rate is not an effective instrument for the State Bank of Vietnam to fight inflation.

<Insert Figure 3 around here>

<Insert Figure 4 around here>

The impulse response functions of inflation show that inflation increases considerably due to its own shock (Figure 5). Specifically, an 11 percent increase in inflation rate in the current month will contribute approximately 8 percent to inflation

[4] It is essential to evaluate the effectiveness of fiscal policy in order to come up with the recommendation. Nevertheless, this is beyond the scope of this study. For simplicity, this study supposes that fiscal policy works well.

rate in the next month. The effects of the shock wear off since then and vanish since the sixth month. The responses of inflation to its own shock indicate an essential characteristic of inflation in Vietnam: Inflation is retentively memorized and highly expected. This typical characteristic of inflation requires a detailed plan of the State Bank of Vietnam to fight inflation, meaning that it should commit to attaining and sustaining a proper target level of inflation rate. By doing so, the State Bank of Vietnam could be able to gain credibility from the economy in coping with inflation. This in turn facilitates the implementation of monetary policy to combat inflation.

<Insert Figure 5 around here>

7.3. Impulse responses of money growth

In high inflation periods, a rise in inflation rate is usually expected to have a negative impact on money growth because central banks lower money growth to combat inflation. Figure 6 reveals that money growth decreases in response to a positive shock to inflation. Specifically, an 11 percent increase in inflation rate will lead to an 8.8 percent decrease in the growth rate of money supply in the third month. Money growth falls until the sixth month and stops decreasing since the following month. The growth rate of money supply declines most significantly in the third month since the occurrence of the shock, implying that the State Bank of Vietnam fully recognizes and strongly responds to inflation shocks in the third month. This also implies that monetary policy is relatively slow in responding to inflation shocks because it takes three months for monetary authorities to fully respond to such shocks.

<Insert Figure 6 around here>

In addition to price stability, economic growth is another important goal that the State Bank of Vietnam pursues. The impulse response function of money growth reveals that the monetary authority quickly responds to a positive shock to real GDP growth by increasing money growth to further stimulate economic growth (see Figure 7, Appendix). However, the monetary authority only increases money growth one time in the first month and does not take further action. The reason for this might be to avoid an unexpected inflation shock in the future.

<Insert Figure 7 around here>

Figure 8 indicates that a positive shock to budget deficit growth has no effect on money growth, implying that budget deficit has been unlikely to be financed by money creation. This finding is consistent with the analysis of impulse responses of inflation to budget deficit growth because a fragile relationship between money growth and budget deficit growth is expected to result in a poor relationship between budget deficit growth and inflation[5].

<Insert Figure 8 around here>

[5] Note that we found a firm relation between money growth and inflation earlier.

A positive shock to interest rate reduces money growth for three months (see Figure 9, Appendix). The fact is that interest rates in Vietnam in the last years increased mainly because of high inflation rate. Consequently, a decrease in money growth in response to an increase in interest rate refers to an effort of the State Bank of Vietnam to cope with inflation. Figure 10 shows impulse responses of money growth to its own shock. Accordingly, a 52.2 percent increase in the growth rate of money supply is followed by a 38.4 percent rise in the next month. This could be reasonably inferred that the State Bank of Vietnam usually adjusts money growth for two consecutive months to achieve its goals.

<Insert Figure 9 around here>

< Insert Figure 10 around here>

7.4. Impulse responses of budget deficit

Borrowers would gain and lenders would lose if inflation occurred because an unexpected increase in inflation lowers the real value of money. Thus, a positive shock to inflation is expected to increase budget deficits[6] because the government is the borrower when issuing bonds. Similarly, a positive shock to money growth is also expected to accelerate budget deficit due to the reduction of interest rate, the cost of borrowing. Figure 11 shows impulse responses of budget deficit growth to positive shocks to inflation, money growth and interest rate. Accordingly, shocks to inflation, money growth and interest rate have no impact on budget deficit growth. There is a fact that the Vietnamese government has targeted high economic growth as a primary goal for many years. Hence, the fiscal policy must have served as a key instrument of the government to boost the economy. This could be a reason explaining why budget deficit growth is unlikely to be affected by market forces such as inflation, money growth and interest rate.

< Insert Figure 11 around here>

Impulse response functions of budget deficit growth shows that a positive shock to real GDP growth has no significant effect on budget deficit growth (Figure 12). On the one hand, the government increases expenditures to boost economic growth by stimulating aggregate demand. On the other hand, higher economic growth would contribute more tax revenues to the government budget. This explains why budget deficit growth does not respond to a positive shock to economic growth.

< Insert Figure 12 around here>

7.5. Impulse responses of real GDP growth

Theoretically, nominal variables have no impact on real GDP growth in the long run; it is technology progress that determines real output growth in the long run. For example, money growth does not affect real output growth but its effect is translated into inflation in the long term, which is the so-called neutrality of money. As can be

[6] The shock is actually expected to increase government borrowing by issuing bonds. But the fact is the government usually borrows to finance budget deficit.

seen from Figure 13, positive shocks to inflation, budget deficit growth and money growth have no significant effect on real GDP growth. In contrast, a positive shock to interest rate reduces real GDP growth in the second month since the occurrence of the shock (Figure 14). This is because an increase in interest rate has negative impacts on investment and consumption and therefore aggregate demand.

< Insert Figure 13 around here>

< Insert Figure 14 around here>

7.6. Impulse responses of interest rate

Figure 15 represents the impulse response of interest rate to a positive inflation shock. As expected, an increase in inflation causes interest rate to rise according to Fisher effect. More importantly, the effect of the shock to inflation on interest rate is quite persistent because it lasts for 19 months. This finding adequately explains movements of interest rates in Vietnam in the past years. It also carries a policy implication: so as to stabilize interest rates, inflation must be kept under control.

< Insert Figure 15 around here>

In theory, a rise in real income will boost money demand, which in turn leads to an increase in interest rate. As shown in Figure 16, a positive shock to real GDP growth basically has positive impacts on interest rate from the eighth month to the thirteenth month. This result implies that interest rate reacts to a shock to real income slowly and persistently. In contrast to shocks to inflation and real GDP growth, shocks to money growth and budget deficit growth have no impact on interest rate (Figure 17). The last important thing about the impulse responses of interest rate is shocks to interest rate in the past are retentively memorized, which is explicitly revealed in Figure 18, which shows that interest rate goes up for 17 months due to its own shock.

< Insert Figure 16 around here>

< Insert Figure 17 around here>

< Insert Figure 18 around here>

7.7. Variance decomposition

In this section, we discuss variance decomposition of the five endogenous variables to examine how their variations depend on other variables' shocks and their own innovations. Table 6 shows that variations of inflation in the first month are only due to its own shock. This is actually because we assume that inflation is contemporaneously affected by its own shock only. Since the second month, the role of inflation in explaining its own variations is decreasing while the importance of money growth and real GDP growth is increasing. Specifically, in the second month, approximately 81.4 percent of variations of inflation are due to its own shocks while money growth and real GDP growth growth account for about 4.8 percent and 13.3 percent, respectively. The contributions of the five variables to the variations of inflation become gradually unchanged since the eighth month. Specifically, real GDP growth, budget deficit growth, money growth and interest rate account for 22.9 percent,

2.8 percent, 7.5 percent and 0.8 percent, respectively. These figures indicate that the importance of budget deficit and interest rate in explaining innovations of inflation is fairly trivial. This result is consistent with the impulse response analysis of inflation, in which shocks to budget deficit growth and interest rate are unlikely to impact inflation while inflation is mostly affected by shocks to real GDP growth and its own shocks.

< Insert Table 6 around here>

Table 7 presents the variance decomposition of money growth. As can be seen from the table, the variations of money growth in the first month are mainly explained by its own innovations, which is approximately 63.5 percent. The contribution of its own shocks to its variations is decreasing over time, which is around 51.4 percent in the sixth month and approximately 51 percent since the eighth month. Real GDP growth and inflation also play an important role in explaining the variations of money growth. Specifically, real GDP growth and inflation explain roughly 32.5 percent and 7.8 percent of variations of money growth over time. This result implies that real GDP growth has played a more important role than inflation did in designing and implementing monetary policy. This also clarifies why Vietnam has experienced high inflation periods. The contribution of interest rate to innovations of money growth is also significant, which stands at roughly 6.5 percent. The role of budget deficit growth in explaining variations of money growth is fairly limited. Specifically, budget deficit growth only contributes 2.5 percent to variations of money growth, implying that the State Bank of Vietnam has achieved a certain level of independence.

< Insert Table 7 around here>

Next, we discuss the variance decomposition of budget deficit. Table 8 shows that the sole source of variations of budget deficit growth is its own shocks (approximately 93.4 percent over time) while other variables perform an insignificant role. As discussed earlier in the analysis of impulse response of budget deficit growth, Vietnam has been in the transition stage of development and needs to establish and develop its infrastructure. Hence, fiscal policy decisions are likely to be affected by that factor rather than money growth, inflation or interest rates.

< Insert Table 8 around here>

The variance decomposition of real GDP growth is presented in Table 9, which shows that variations of real GDP growth are mainly attributed to its own shocks. Specifically, its own shocks account for approximately 86.3 percent of its variations over time, and the rest is explained by the other variables. Shocks to interest rate are the second significant factor that explains the variations of real GDP growth while inflation, money growth and budget deficit play a trivial role in determining fluctuations of real GDP growth.

< Insert Table 9 around here>

Fluctuations of interest rate are mostly attributed to its own shocks and inflation. In detail, 93.3 percent of variations of interest rate are due to its own shock in the first month, and the figure stands at roughly 56.3 percent over time. It is notable that the role

of inflation in explaining the variations of interest rate is quite significant. Despite the small contribution of 2.8 percent in the first month, shocks to inflation account for approximately 34.1 percent of variations of interest rate over time. Real GDP growth is the third important factor that explains the fluctuations of interest rate while budget deficit growth and money growth play an extremely trivial role (see Table 10, Appendix).

< Insert Table 10 around here>

8. Robustness of the results

In order ensure the robustness of the estimation of impulse response functions, various identification restrictions will be used. *First*, the assumption of price rigidity is maintained but we make a change to the assumption of the interaction between budget deficit growth and money growth. Specifically, budget deficit growth now is assumed to have contemporaneous impact on money growth[7], meaning that there is no legislative lag. This restriction is represented in terms of structural innovations and reduced-form residuals below.

$$\begin{bmatrix} e_{inf} \\ e_{g\_y} \\ e_{d\_pc} \\ e_{m1\_pc} \\ e_i \end{bmatrix} = \begin{bmatrix} c_{11} & 0 & 0 & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 & 0 \\ c_{31} & c_{32} & c_{33} & 0 & 0 \\ c_{41} & c_{42} & c_{43} & c_{44} & 0 \\ c_{51} & c_{52} & 0 & c_{54} & c_{55} \end{bmatrix} \begin{bmatrix} u_{inf} \\ u_{g\_y} \\ u_{d\_pc} \\ u_{m1\_pc} \\ u_i \end{bmatrix}$$

The estimation results generated by using this identification restriction are roughly similar[8] to the results obtained by using identification strategy earlier. There are two minor things that are slightly different from the earlier results. The first difference is that money growth is contemporaneously affected by a positive shock to budget deficit and is affected one time only. This is actually because of the restriction imposed. In addition, the magnitude of the effect is extremely small. The contemporaneous impact of money growth on interest rate is the second difference. However, the effect occurs one time only and is fairly small. Thus, these deviations are insignificant and the estimation results obtained earlier are robust.

< Insert Figure 19 around here>

Second, in addition to the change to the identification strategy above, budget deficit growth now is assumed to have contemporaneous impact on interest rate, meaning that whenever the government budget slips into deficit, the government is able to issue bonds promptly, and that the bond markets work perfectly. By imposing such assumptions, the model becomes a recursive VAR version with structural innovations and reduced-form residuals expressed as follow.

[7] We assumed earlier that money growth is not contemporaneously affected by budget deficit growth.
[8] See Figure 19, Appendix.

$$\begin{bmatrix} e_{inf} \\ e_{g\_y} \\ e_{d\_pc} \\ e_{m1\_pc} \\ e_i \end{bmatrix} = \begin{bmatrix} c_{11} & 0 & 0 & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 & 0 \\ c_{31} & c_{32} & c_{33} & 0 & 0 \\ c_{41} & c_{42} & c_{43} & c_{44} & 0 \\ c_{51} & c_{52} & c_{53} & c_{54} & c_{55} \end{bmatrix} \begin{bmatrix} u_{inf} \\ u_{g\_y} \\ u_{d\_pc} \\ u_{m1\_pc} \\ u_i \end{bmatrix}$$

The estimation results produced from this identification restriction are almost the same[9] as those yielded by using the initial identification strategy. One minor difference is that interest rate is negatively affected by budget deficit growth. Nonetheless, the size of the effect is fairly limited. This therefore affirms the robustness of the initial results.

< Insert Figure 20 around here>

9. Concluding remarks

In this study, the interaction among key macroeconomic variables such as inflation, real GDP, budget deficit, money supply and interest rate was investigated by employing a SVAR model. In order to assure the reliability of the estimation results, the robustness checks were conducted by varying the identification restrictions.

The estimation results reveal several key findings. *First*, similar to empirical results from Akinboade, Siebrits and Niedermeier (2004), El-Shagi and Giensen (2013), Nina, Wojciech, and Georges and Geomina (2006), money growth has positive impacts on inflation in Vietnam. Specifically, inflation will go up for 3 months in response to a positive shock to money growth. Furthermore, the strongest effect of a positive shock to money growth on inflation is in the second month since the occurrence of the shock. However, money growth has no effect on real GDP growth, budget deficit growth and interest rate. *Second*, despite the fact that Catao and Terrones (2005), and Lin and Chu (2013) found a strong positive relation between fiscal deficits and inflation among high-inflation and developing countries, empirical results of this study reveal that shocks to budget deficit growth have no effect on real GDP growth, interest rate, money growth and therefore inflation. This finding, however, shares a conclusion with Barnhart and Darrat (1988), and Ashra, Chattopadhyay, and Chaudhuri (2004) in which budget deficits have no significant effect on money growth in OECD countries and India, respectively. And more importantly, this finding supports Nguyen and Nguyen (2010) in which there is no significant effect of budget deficits on inflation in Vietnam. *Third*, positive shocks to inflation negatively affect money growth, accelerate interest rate but have no effect on budget deficit growth and real GDP growth. It takes three months for the State Bank of Vietnam to fully realize and react to a positive shock to inflation. Generally, the State Bank of Vietnam implements tightening monetary policy by lower money growth for three months to curb inflation. *Fourth*, real income has strong impacts on inflation, interest rate and money growth but produces no effect on budget deficit growth. *Fifth*, budget deficit growth is independent from shocks to interest rate. Additionally, interest rate is not an effective monetary instrument for the State Bank of Vietnam to combat inflation because shocks to interest rate have no effect on inflation. *Finally*, inflation and interest rate in Vietnam are persistent because they are highly expected and retentively memorized. This characteristic of inflation suggests that an

[9] See Figure 20, Appendix.

effective inflation-fighting policy must be transparent, and that the State Bank of Vietnam must commit to pursue it so as to gain credibility from firms and households.

Appendix

Table 1: Definitions of variables and their data sources

Variable	Abbreviation	Source
Inflation	infl	IFS
Growth rate of money supply	m1_pc	IFS
Real GDP growth rate	g_y	IFS
Interest rate	i	IFS
Budget deficit growth rate	d_pc	Vietnam Ministry of Finance

Table 3: Lag length criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3674.735	NA	1.24e+13	44.33415	44.42789	44.37220
1	-3371.920	583.7389	4.35e+11	40.98699	**41.54940***	**41.21527***
2	-3336.509	66.12837	3.84e+11	40.86156	41.89264	41.28008
14	-2977.564	35.74576	**2.53e+11***	40.15138	46.80653	42.85275
15	-2952.602	27.06727	2.72e+11	40.15184	47.27566	43.04345
16	-2934.546	18.49179	3.23e+11	40.23549	47.82799	43.31734
23	-2692.860	29.20256	4.83e+11	39.43205	50.30526	43.84556
24	-2595.106	**52.99922***	2.75e+11	**38.55549***	49.89738	43.15924

* indicates lag order selected by the criterion

Table 4: Autocorrelation LM test for the residuals

Lags	LM-Stat	Prob
1	19.38113	0.7785
2	26.12130	0.4011
3	27.51862	0.3305
4	30.35139	0.2114
5	31.85822	0.1622
6	23.37531	0.5557
7	25.94200	0.4107
8	20.08646	0.7423
9	15.79316	0.9208
10	26.25006	0.3944

Table 5: VAR stability condition check

Root	Modulus
0.874339 + 0.038282i	0.875177
0.874339 - 0.038282i	0.875177
0.570457 + 0.328926i	0.658493
0.570457 - 0.328926i	0.658493
-0.100981 + 0.601818i	0.610231
-0.100981 - 0.601818i	0.610231
0.365574 - 0.428679i	0.563392
0.365574 + 0.428679i	0.563392
0.226511 - 0.499383i	0.548352
0.226511 + 0.499383i	0.548352
-0.447102 - 0.280238i	0.527668
-0.447102 + 0.280238i	0.527668
-0.520171	0.520171
-0.228886 + 0.464146i	0.517513
-0.228886 - 0.464146i	0.517513
-0.259988 + 0.381271i	0.461477
-0.259988 - 0.381271i	0.461477
-0.273540	0.273540
0.195969	0.195969
-0.078349	0.078349

No root lies outside the unit circle.
VAR satisfies the stability condition.

Table 6: Variance decomposition of inflation

Period	S.E.	infl	g_y	d_pc	m1_pc	i
1	7.983067	100.0000	0.000000	0.000000	0.000000	0.000000
2	9.448364	81.43363	13.25705	0.552091	4.756847	0.000381
3	10.52562	69.94358	21.58895	0.647529	6.988202	0.831731
4	10.86288	68.58470	21.85711	2.038281	6.715863	0.804045
5	11.15379	66.44035	22.66055	2.668077	7.468347	0.762674
6	11.20899	66.20658	22.79082	2.652272	7.586390	0.763928
12	11.28020	65.88047	22.99067	2.816820	7.507070	0.804963
24	11.31271	65.66645	22.89578	2.810395	7.467542	1.159833
∞	11.32394	65.62537	22.88089	2.804861	7.454807	1.234066

Table 7: Variance decomposition of money growth

Period	S.E.	infl	g_y	d_pc	m1_pc	i
1	7.983067	0.231047	36.24681	0.000000	63.52215	0.000000
2	9.448364	1.467990	33.50352	1.064530	59.74094	4.223017
3	10.52562	4.042300	32.58803	2.363169	54.44058	6.565924
4	10.86288	5.959268	32.41751	2.400281	52.64005	6.582894
5	11.15379	7.186983	32.41426	2.327526	51.71661	6.354618
6	11.20899	7.566706	32.48260	2.304821	51.37744	6.268440
12	11.28020	7.800901	32.55993	2.477390	50.89086	6.270914
24	11.31271	7.877326	32.47376	2.472385	50.72556	6.450967
∞	11.32394	7.916750	32.45602	2.469791	50.67311	6.484331

Table 8: Variance decomposition of budget deficit growth

Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5
1	7.983067	0.109898	0.563421	99.32668	0.000000	0.000000
2	9.448364	0.611510	0.557236	97.94457	0.747117	0.139565
3	10.52562	0.680963	1.556704	96.50778	0.739029	0.515524
4	10.86288	1.469002	1.716659	95.22861	0.772088	0.813642
5	11.15379	1.549852	1.834605	94.59284	1.160768	0.861937
6	11.20899	1.589851	1.837741	94.54988	1.161625	0.860907
12	11.28020	1.695351	1.910278	94.11138	1.189898	1.093090
24	11.31271	1.929341	1.956488	93.50291	1.185956	1.425303
∞	11.32394	1.985895	1.975511	93.38341	1.185954	1.469232

Table 9: Variance decomposition of real GDP growth

Period	S.E.	infl	g_y	d_pc	m1_pc	i
1	7.983067	0.012284	99.98772	0.000000	0.000000	0.000000
2	9.448364	0.185661	89.81266	2.370219	1.689297	5.942164
3	10.52562	1.148030	87.84841	3.558481	1.829770	5.615312
4	10.86288	1.431160	87.62988	3.559135	1.815547	5.564278
5	11.15379	1.725796	86.75115	3.489536	2.582207	5.451310
6	11.20899	1.828549	86.49400	3.504683	2.738539	5.434228
12	11.28020	1.839439	86.35621	3.605881	2.745304	5.453160
24	11.31271	1.861237	86.29861	3.603926	2.743568	5.492655
∞	11.32394	1.870465	86.28369	3.603166	2.743218	5.499465

Table 10: Variance decomposition of interest rate

Period	S.E.	infl	g_y	d_pc	m1_pc	i
1	7.983067	2.805215	2.705889	0.000000	1.204622	93.28427
2	9.448364	6.944632	2.295815	0.189866	0.543506	90.02618
3	10.52562	10.45572	1.446698	0.435652	0.445189	87.21674
4	10.86288	14.55088	1.211201	0.591388	0.376948	83.26958
5	11.15379	18.21468	1.892727	0.776999	0.298337	78.81726
6	11.20899	21.40313	2.758485	0.788292	0.250208	74.79989
12	11.28020	30.58333	6.461863	0.545841	0.430465	61.97851
24	11.31271	33.86595	8.505680	0.423929	0.572035	56.63241
∞	11.32394	34.13403	8.713358	0.417746	0.588461	56.14640

Figure 1: Impulse response of inflation to a positive money growth shock

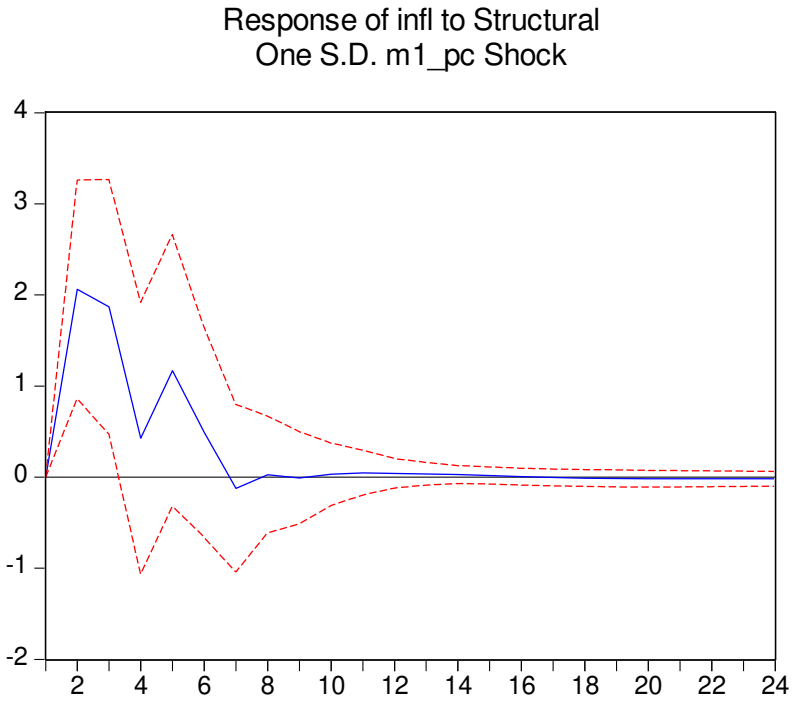


Figure 2: Impulse response of inflation to a positive shock to budget deficit growth

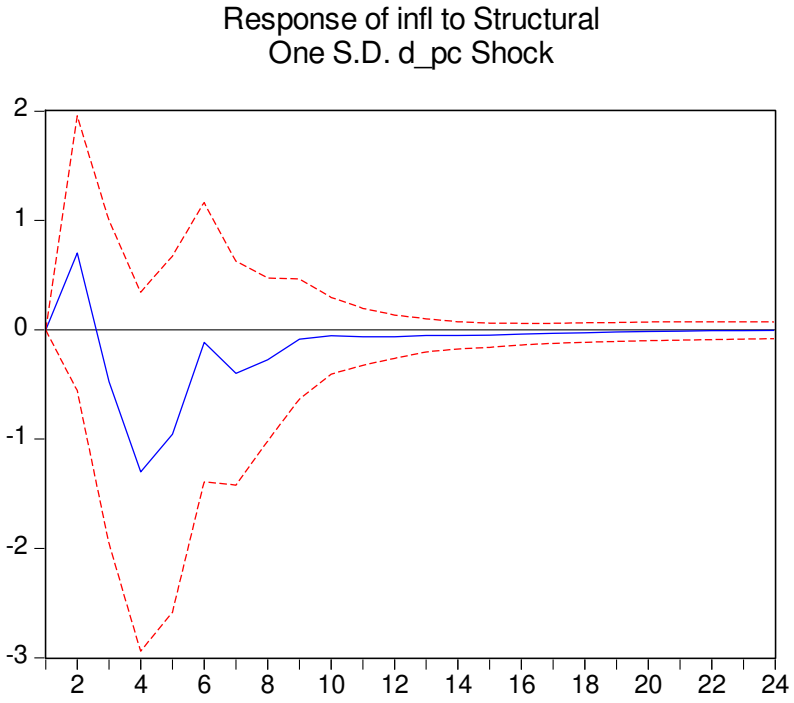


Figure 3: Impulse response of inflation to a positive real income shock

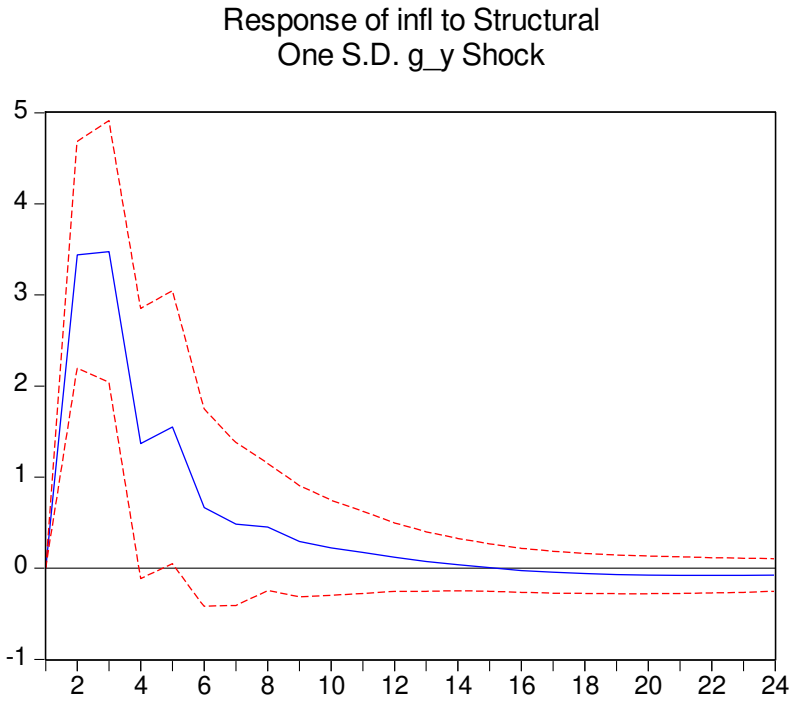


Figure 4: Impulse response of inflation to a positive interest rate shock

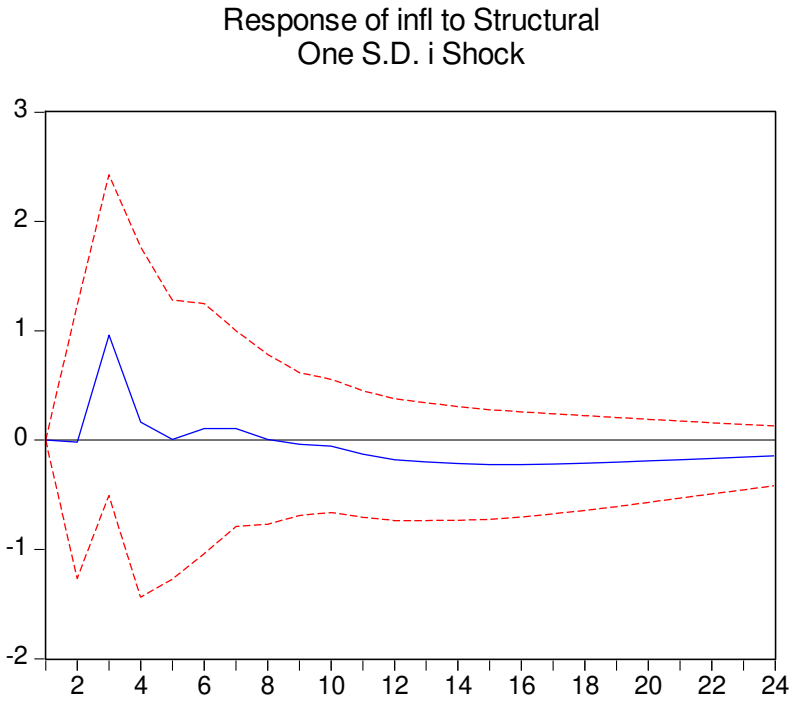


Figure 5: Impulse response of inflation to its own shock

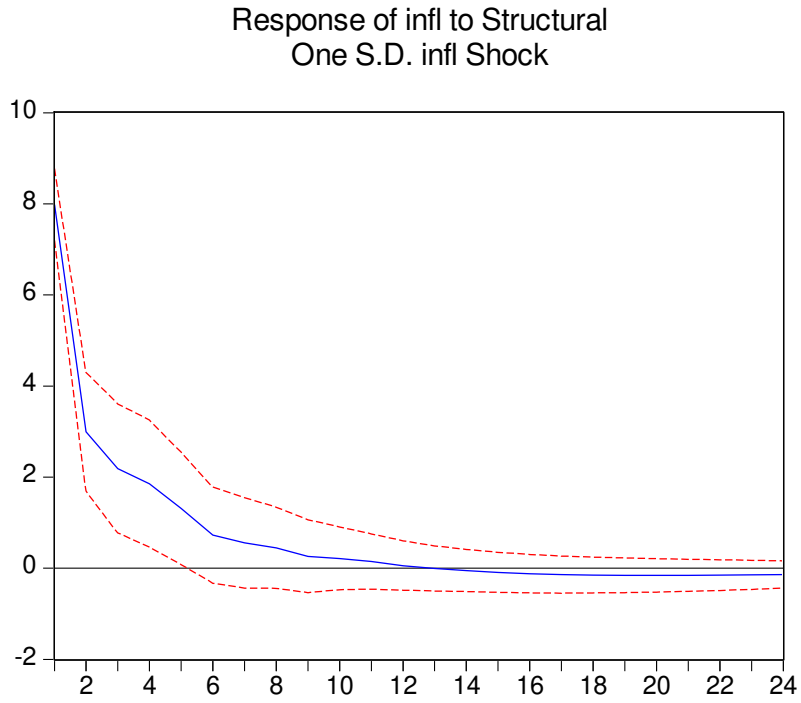


Figure 6: Impulse response of money growth to a positive inflation shock

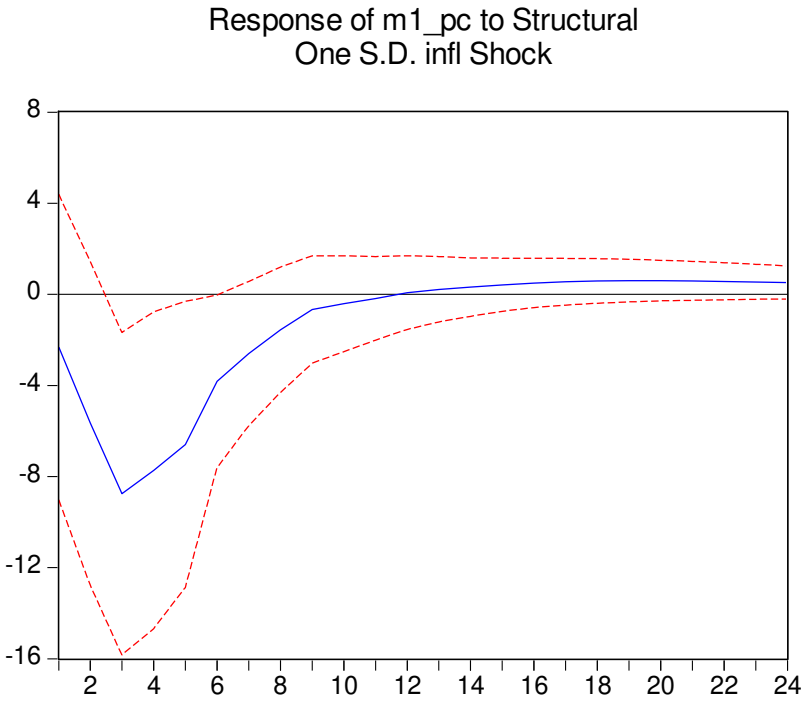


Figure 7: Impulse response of money growth to a positive real income shock

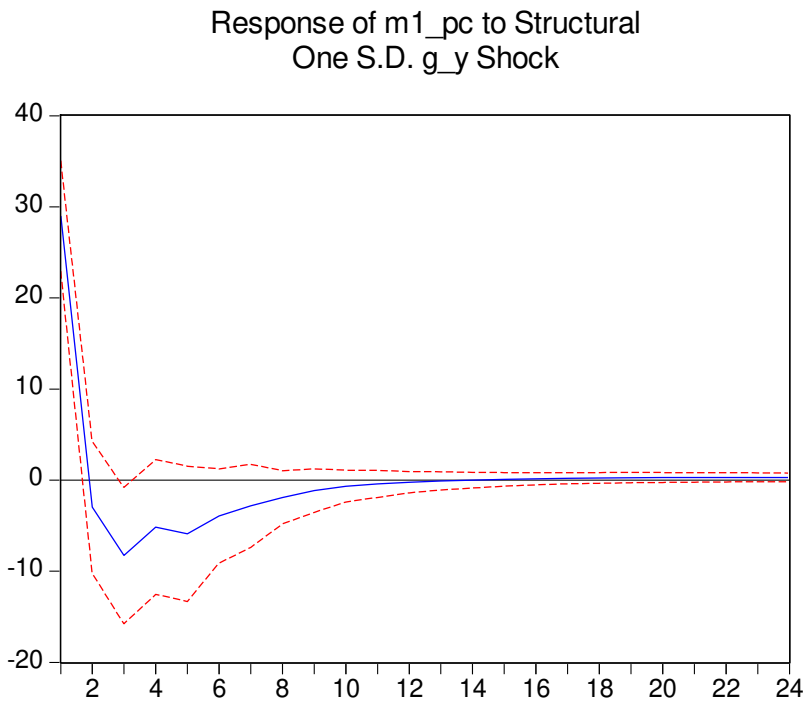


Figure 8: Impulse response of money growth to a positive shock to budget deficit growth

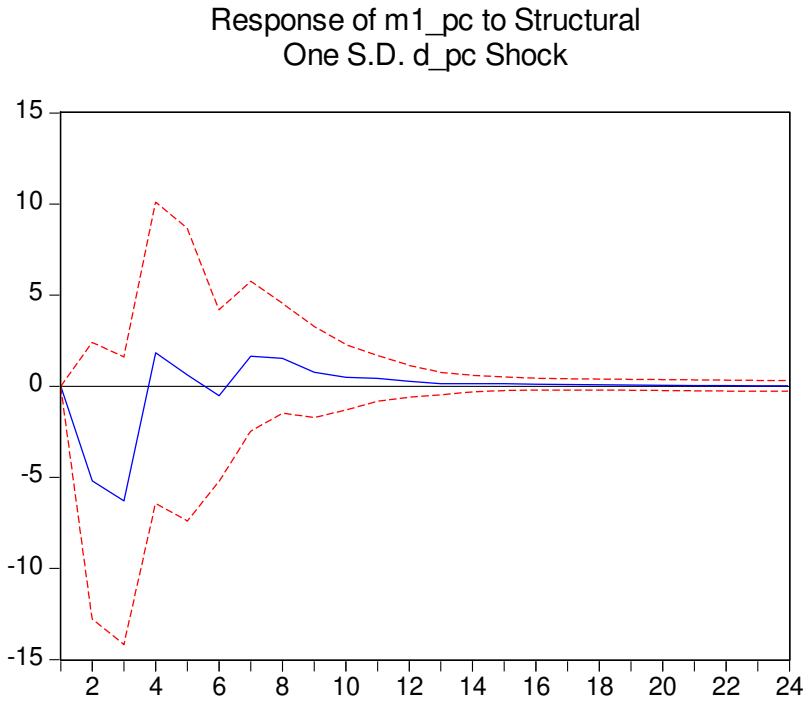


Figure 9: Impulse response of money growth to a positive interest rate shock

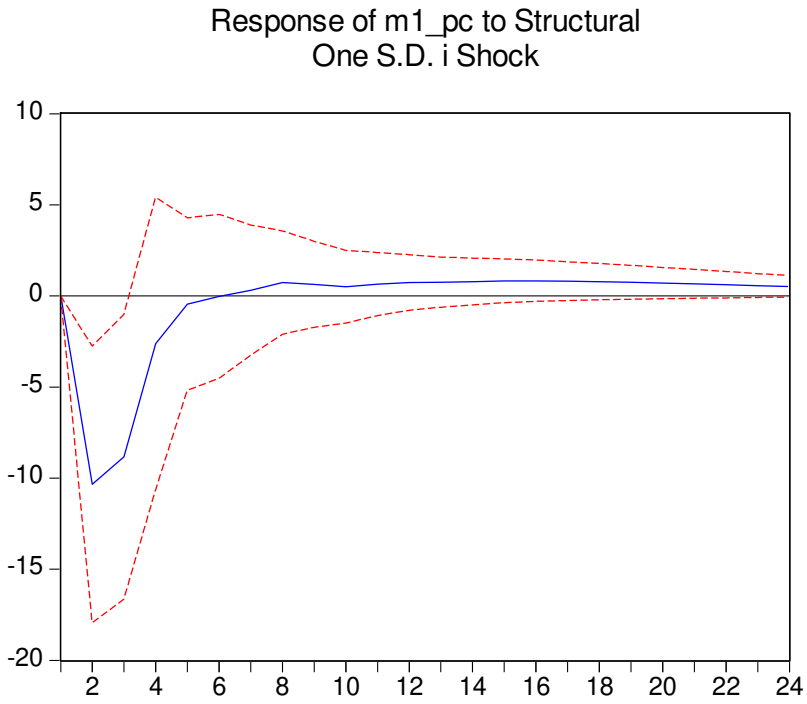


Figure 10: Impulse response of money growth to its own shock

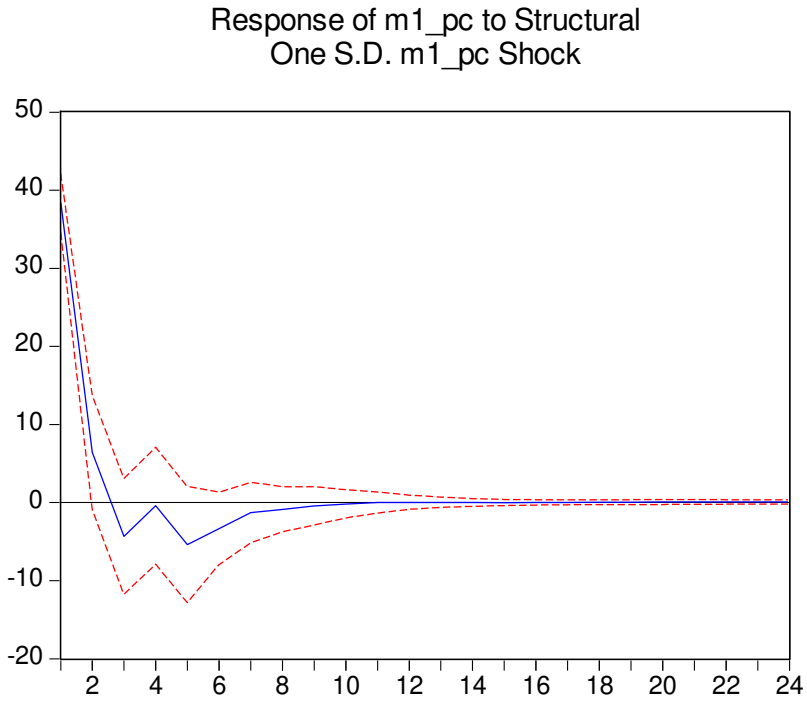


Figure 11: Impulse response of budget deficit growth to positive shocks to inflation, money growth and interest rate

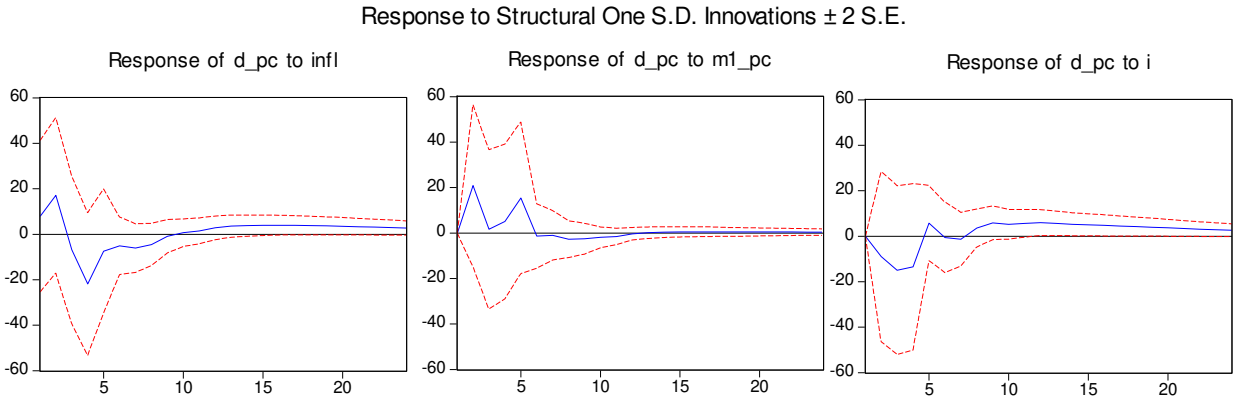


Figure 12: Impulse response of budget deficit growth to a positive shock to real GDP growth

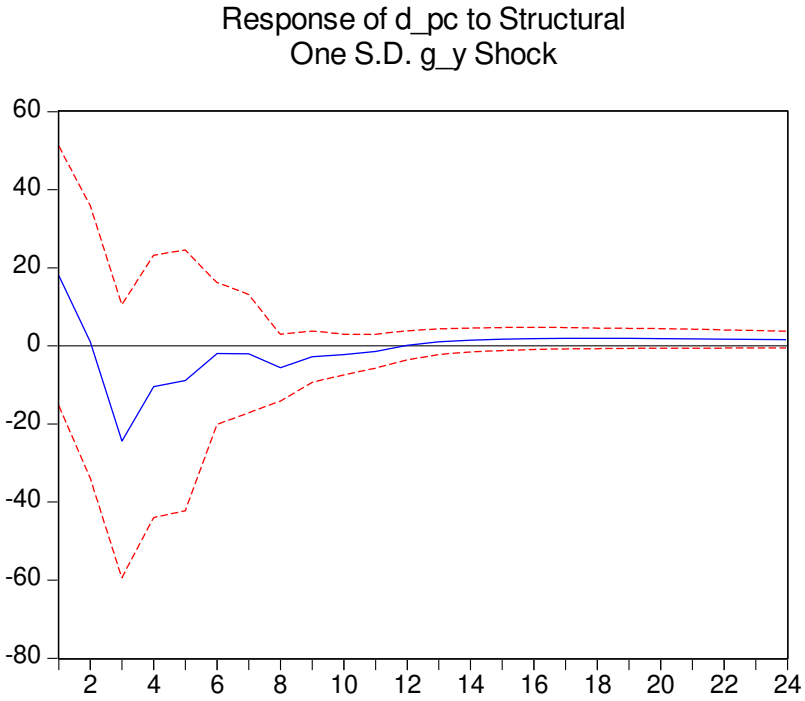


Figure 13: Impulse response of real GDP growth to positive shocks to inflation, budget deficit growth and money growth

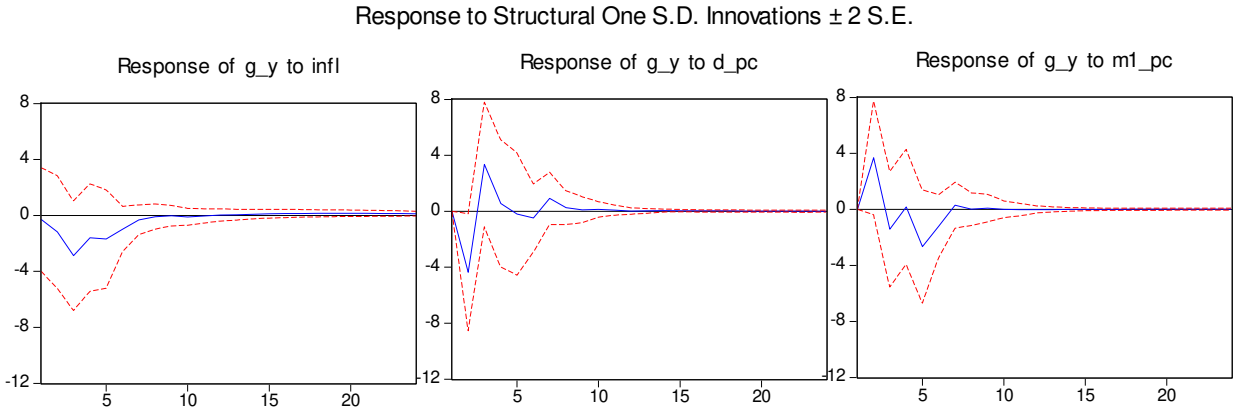


Figure 14: Impulse response of real GDP growth to a positive interest rate shock

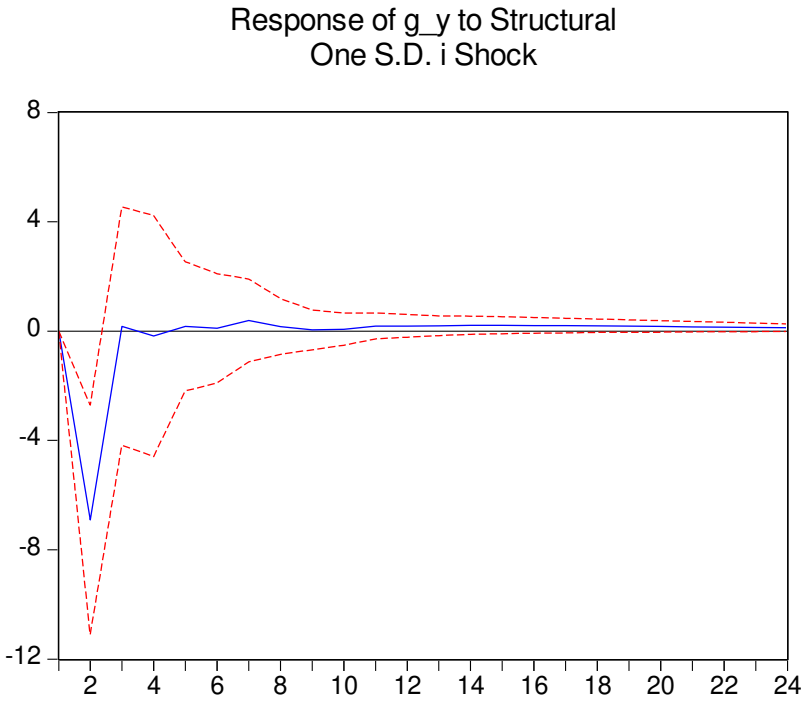


Figure 15: Impulse response of interest rate to a positive inflation shock

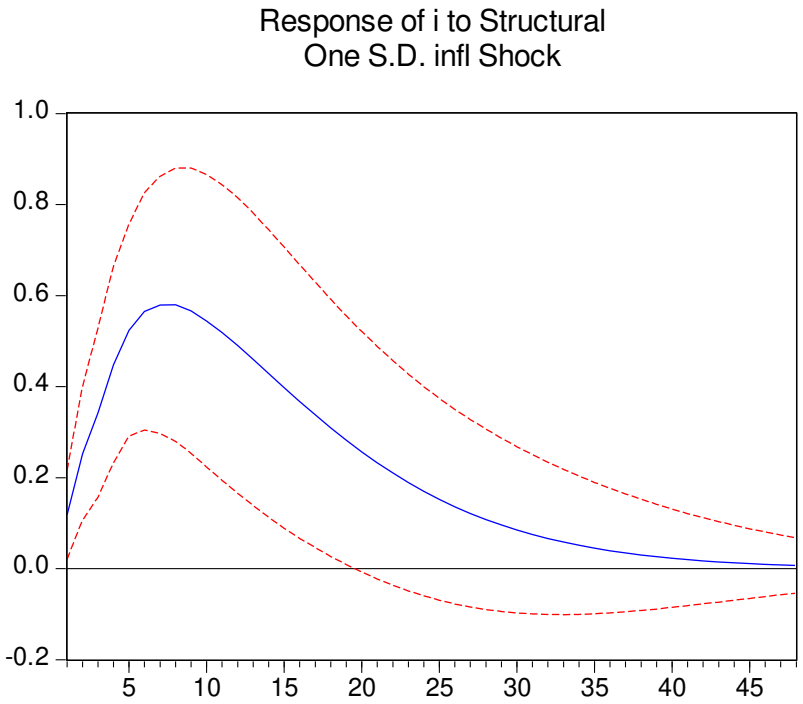


Figure 16: Impulse response of interest rate to a positive real income shock

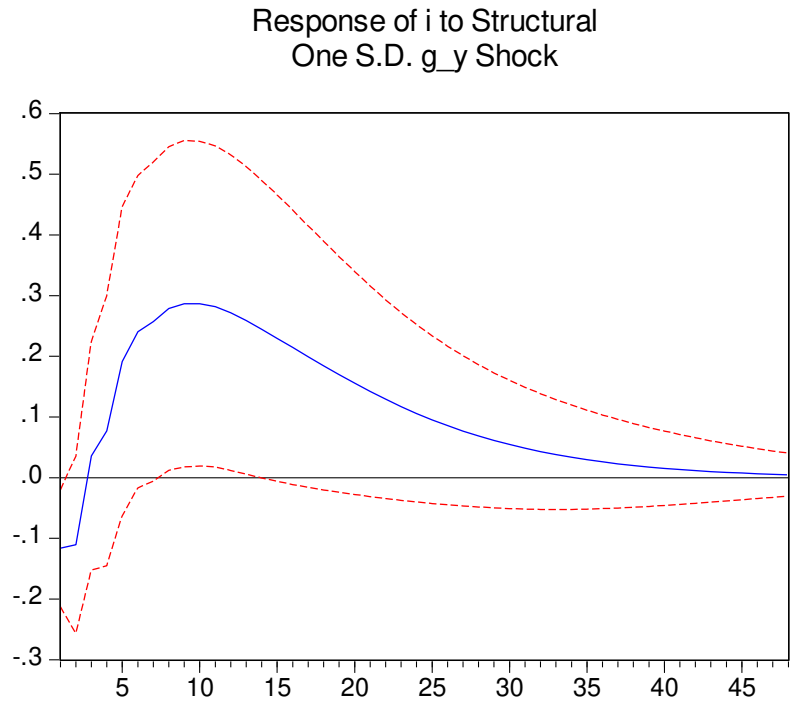


Figure 17: Impulse response of interest rate to positive shocks to money growth and budget deficit growth

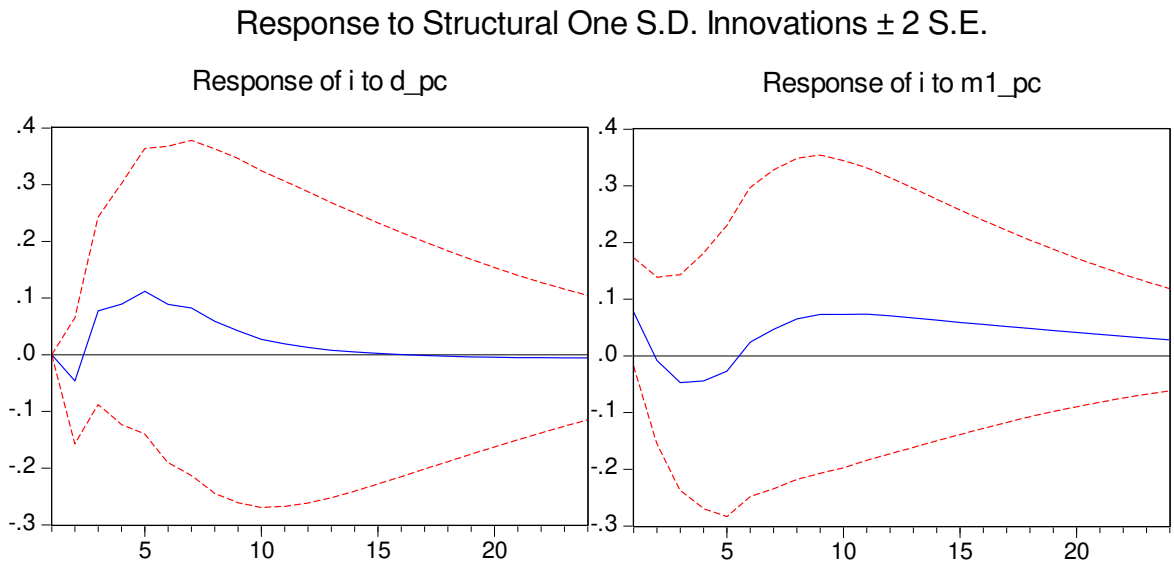


Figure 18: Impulse response of interest rate to its own shock

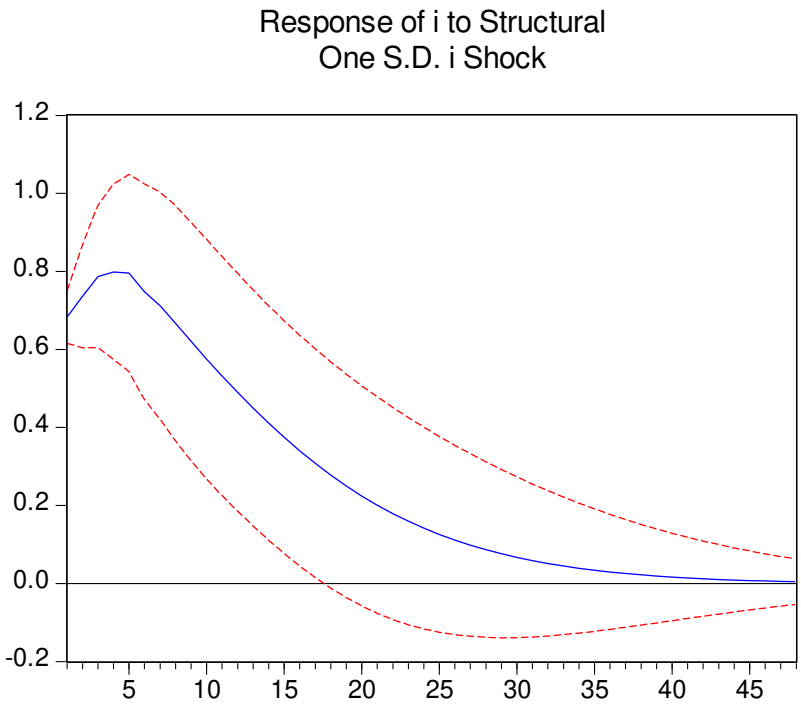


Figure 19: Robustness check

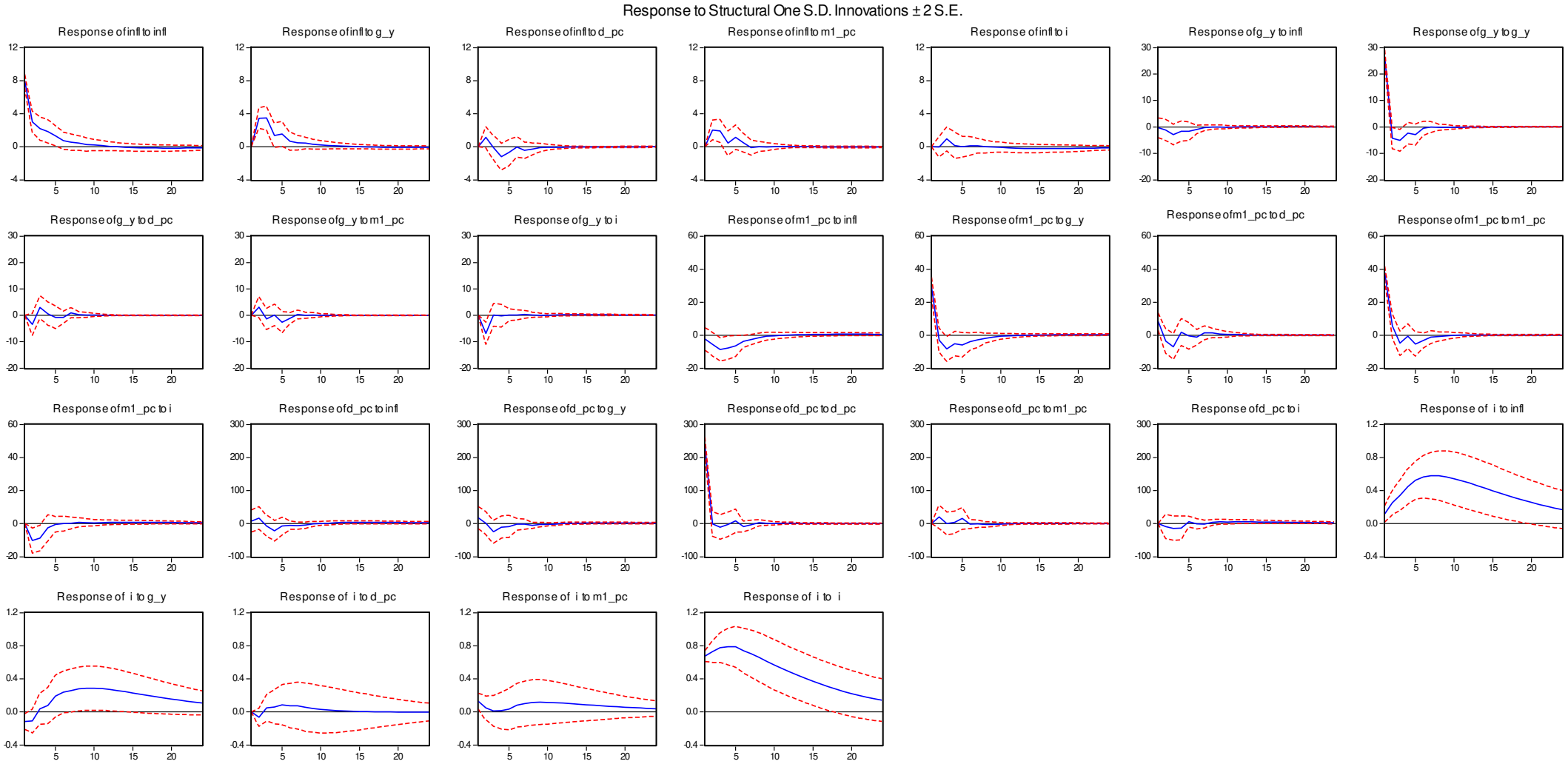
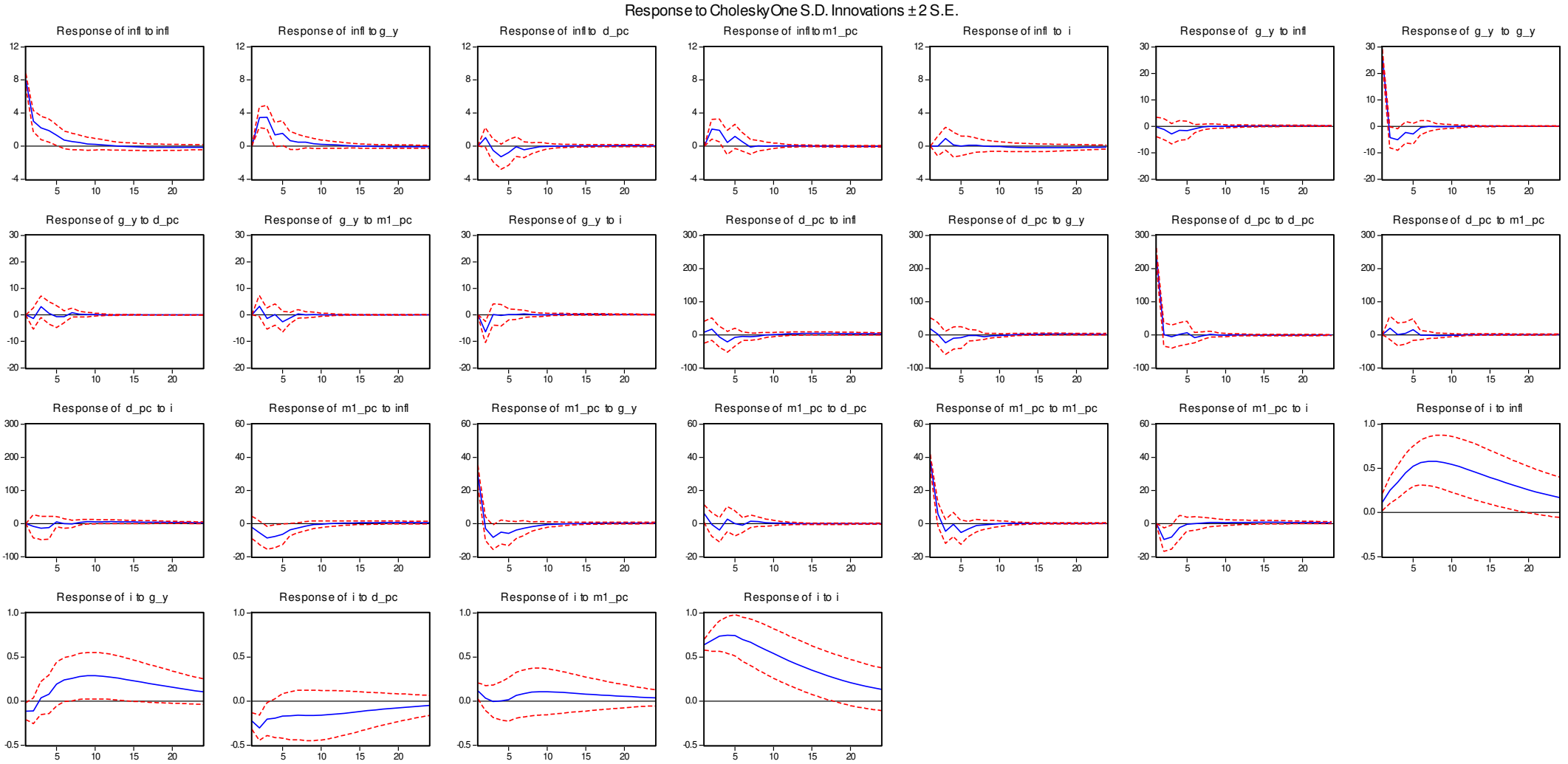


Figure 20: Robustness check (Recursive VAR)



References

Ahmad, J.S., & Sajad, J. (2011). Budget deficit and inflation: A sensitivity analysis to inflation and money supply in Iran. *Middle-East Journal of Scientific Research 8(1),* 257-260.

Akinboade, O.A., Siebrits, F.K., & Niedermeier, E.W. (2004). The Determinants of Inflation in South Africa: An Econometric Analysis. *AERC Research Paper 143.*

Allen, D.S., & Smith, D.M. (1983). Government borrowing and monetary accommodation. *Journal of Monetary Economics, 12*, 605-616.

Ashra, S., Chattopadhyay, S., & Chaudhuri, K. (2004). Deficit, money and price: The Indian experience. *Journal of Policy Modeling, 26*, 289-299.

Barnhart, W.S., & Darrat, F.A. (1988). Budget deficits, money growth and causality: Further OECD evidence. *Journal of International Money and Finance, 7,* 231-242.

Bradley, D.M. (1984). Federal deficits and the conduct of monetary. *Journal of Macroeconomics, 6*, 411-431.

Burdekin, C.K.R., & Wohar, E.M. (1990). Monetary institutions, budget deficits and in inflation: Empirical results for eight countries. *European Journal of Political Economy, 6*, 531-551.

Catao, Luis A.V., & Terrones, Marco E. (2005). Fiscal deficits and inflation. *Journal of Monetary Economics, 52,* 529-554.

Chimobi, O. P., & Igwe, O. L. (2010). Budget deficit, money supply and inflation in Nigeria. *European Journal of Economics, Finance and Administrative Sciences 19,* 52-60.

Chow, G.C., & Lin, A. (1971). Best Linear Unbiased Interpolation, Distribution, and Extrapolation of Time Series by Related Series. *The Review of Economics and Statistics, 53(4),* p.372-375.

Ekanayake, H.K.J. (2012). The Link Between Fiscal Deficit and Inflation: Do public sector wages matter? *ASARC Working Paper*.

El-Shagi, M., & Giensen, S. (2013). Money and inflation: Consequences of the recent monetary policy. *Journal of Policy Modeling, 35*, 520-537.

Haan, J.D., & Zelhorst, D. (1990). The impact of government deficits on money growth in developing countries. *Journal of International Money and Finance, 9*, 455-469.

Jeitziner, B. (1999). Deficits and Money Growth: Empirical Evidence for Switzerland. In *Political Economy of the Swiss National Bank* (pp. 93-124). Freiburg: Physica-Verlag HD.

Kia, A. (2006). Deficits, debt financing, monetary policy and inflation in developing countries: Internal or external factors? Evidence from Iran. *Journal of Asian Economics, 17*, 879-903.

Le, L., (2008). The linkage between budget deficits and inflation in Vietnam (in Vietnamese). *Journal of Banking, 18*, 24-35.

Lin, H.Y., & Chu, H.P. (2013). Are fiscal deficits inflationary? *Journal of International Money and Finance, 32,* 214-233.

Milo, P. (2012). The impact of the budget deficit on the currency and inflation in the transition economies. *Journal of Central Banking Theory and Practice, 1*, 25-57.

Mishkin, F.S. (2004). *The economics of money banking and financial markets* (7th ed.). Pearson-Addition Wesley.

Nguyen, H., & Nguyen, T. (2010, December). *Macroeconomic determinants of Vietnam's inflation 2000-2010: Evidence and analysis* (VEPR Working Paper WP-09). Retrieved October 30, 2012, from http://www.undp.org.vn/digitalAssets/24/24590_InflationFinalReport-E-formatx.pdf

Nina B., Wojciech M., Georges M., & Geomina T. (2006). Money, inflation and output in Romania, 1992-2000. *Journal of International Money and Finance, 25*, 330-347.

Tran, G. (2008). Addressing budget deficits in order to fight inflation (in Vietnamese). *Communist Review, 162*, 32-40.

The National Assembly of Vietnam (2002), *The Budget Act*, No. 01/2002/QH11 (in Vietnamese).

The National Assembly of Vietnam (1996), *The Budget Act* (in Vietnamese).

The National Assembly of Vietnam (2010), *The Law on the State Bank of Vietnam*, No. 46/2010/QH12 (in Vietnamese).

The National Assembly of Vietnam (1997), *The Law on the State Bank of Vietnam*, No. 01/1997/QH10 (in Vietnamese).