Budget deficits, money growth and inflation: empirical evidence from Vietnam

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Abstract

Purpose – This paper aims to uncover the nexus between budget deficits, money growth and inflation in Vietnam in the period 1995–2012.

Design/methodology/approach – The paper uses a structural vector auto-regressive model of five endogenous variables including inflation, real GDP growth, budget deficit growth, money growth and the interest rate.

Findings – It is found that inflation rose in response to positive shocks to money growth and that budget deficits had no significant impact on money growth and therefore inflation. This empirical evidence supports the hypothesis that fiscal and monetary policies were relatively independent. Money growth significantly decreased in response to a positive shock to inflation; interest rates had no significant effect on inflation but considerably increased in response to positive inflation shocks. This implies that the monetary base was more effective than interest rates in fighting inflation.

Originality/value – This paper sheds light into understanding the link between budget deficits, money growth and inflation in Vietnam during the high-inflation period 1995–2012. The finding supports the hypothesis that fiscal and monetary policies were relatively independent over the period.

Keywords Inflation, Budget deficit, Structural vector auto-regressive model, Vietnam

Paper type Research paper

1. Introduction

Price stability is the primary goal of the monetary policies of almost all central banks in the world. Thus, understanding the determinants of inflation is very important and therefore has received enormous interest from researchers and policymakers. Inflation, by definition, is a rapid and continuing rise in the price level and is caused by a high growth rate of the money supply. A budget deficit can be a source of inflation, but it depends on how long the deficit lasts, and how it is financed. On the one hand, a temporary budget deficit can lead to only a temporary increase in the price level no matter how the deficit is funded. On the other hand, if budget deficits are permanent and financed by money creation, inflation occurs. For example, the central bank and commercial banks purchase government bonds, leading to an increasing

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money supply. Permanent budget deficits do not contribute to money expansion if government bonds are traded only between firms and households.

Vietnam has persistently faced budget deficits since the beginning of the 1990s (Figure 1). Although the ratio of budget deficits to the gross domestic product (GDP) fell from 7% in 1990 to 1% in 1991, it tended to rise over the period 1992–2009. In particular, the ratio reached peak at 9% in 2009 before falling in the period 2009–2019. The increase in the ratio of budget deficits to the GDP was consistent with rising inflation in the period 2000–2008. In particular, inflation in the period 2004–2012 always remained above 7% per annum, which was higher than the average of the eight preceding years. Remarkably, inflation in 2008 and 2011 rocketed and established records of approximately 23% and 18.6%, respectively. The money supply has increased continuously since the early 1990s. The average growth rate of money supply over the period 1990–2019 was higher than 27%.

To sum up, the Vietnamese economy experienced three subperiods featuring three typical characteristics. The first subperiod, 1990–1994, witnessed large fluctuations in budget deficits, money growth and inflation. The second subperiod, 1995–2012, featured rising and large budget deficits in line with high inflation and money growth. The last subperiod, 2013–2019, exhibited decreasing budget deficits and relatively stable inflation and money growth.

These stylized facts give rise to the question: What are the effects of budget deficits on the money supply and inflation in Vietnam? In addition, we would like to understand how the State Bank of Vietnam adjusts its monetary policy in response to the increase in inflation.

The literature on the nexus between budget deficits and inflation is large, and the empirical evidence is mixed across countries and across periods of time (see Section 2). Empirical research on the impact of budget deficits on inflation in Vietnam is surprisingly limited. There have been a few qualitative research papers (Le, 2008; Tran, 2008), which drew conclusions simply based on observations of budget deficits, the money supply and inflation. Nguyen & Nguyen (2010) employed a vector error correction model (VECM) and found that the effect of budget deficits on inflation in Vietnam is not statistically significant. However, the authors mainly focused on the production side to discover the origins of inflation. More

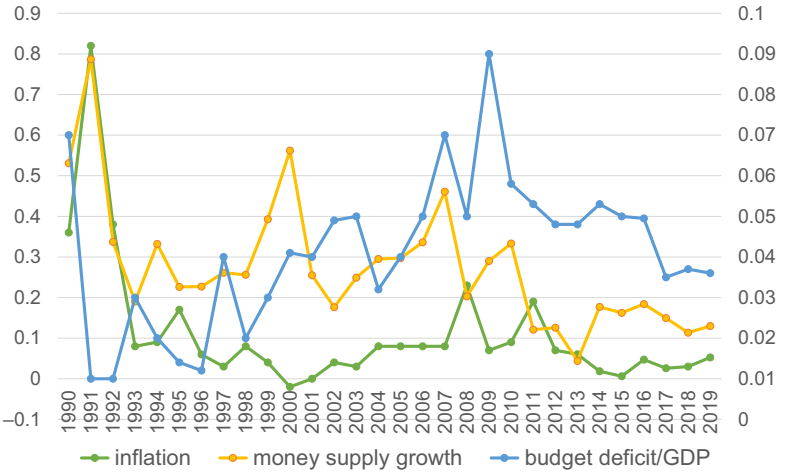

Figure 1.
Inflation, money supply growth and budget deficits in the period 1990–2019

Note(s): The left vertical axis displays the inflation and money supply growth values the right vertical axis displays the budget deficit/GDP ratio values
Source(s): International Monetary Fund (IMF) and the Vietnam Ministry of Finance

importantly, their impulse response analysis might not be robust because the impulse response functions have a problem with the standard error in the VECM.

This paper aims at understanding the nexus between budget deficits, the money supply and inflation in the high-inflation and large-budget-deficit period 1995–2012 in Vietnam. A structural vector auto-regressive (SVAR) model is used since this model takes into account the endogeneity of budget deficits, the money supply and inflation. In addition, I employ the interpolation method developed by Chow & Lin (1971) to convert the annual budget deficits series into a monthly series.

The rest of this paper is structured as follows. Section 2 provides a brief literature review of the empirical link between budget deficits and inflation. Section 3 discusses the key properties of fiscal and monetary policies in the research period. Section 4 presents the estimation methodology. Section 5 discusses the main results and Section 6 concludes.

2. Literature review

This paper is related to the literature on the nexus between budget deficits, money growth and inflation. The first strand of literature has found that budget deficits cause monetary growth. Allen & Smith (1983) found evidence of a positive and significant impact of total Treasury borrowing on the growth of the monetary base for the periods 1954–1961 and 196l–1974. Bradley (1984) also found that persistent federal deficits lead to money supply growth through an increase in reserves growth. Milo (2012) found that monetary financing constitutes a principal factor in the evolution of monetary aggregates in Albania, Bulgaria and Romania. Budget deficits were financed through the purchase of not only government bonds or direct loans to the state by the central banks but also government bonds or direct loans to state by the second-tier banks. The latter depends on whether the public debt securities enlarge banks' portfolios or substitute other assets in this portfolio, including loans to the economy.

The second strand of literature has found that the link between budget deficits and inflation differs across time periods and depends on the measure of the money supply. Jeitziner (1999) examined the relationship between fiscal deficits and growth rates of the monetary base and the narrow money supply M1 in Switzerland and found that the narrow money supply did not co-move with budget deficits and that budget deficits led to a faster growth rate of the monetary base. De Haan & Zelhorst (1990) investigated the relationship between government budget deficits and money growth in developing countries and found no clear relationship between budget deficits and money growth in the majority of countries in the sample. However, government budget deficits tended to affect money growth during high-inflation years.

The third strand of literature has found no empirical evidence for the effect of budget deficits on money growth. Barnhart & Darrat (1988) investigated the causal link between budget deficits and money growth in seven major Organisation for Economic Co-operation and Development (OECD) countries using multivariate Granger causality tests combined with Akaike's information criterion (AIC) and Zellner's iterative seemingly unrelated regressions. The authors found that the monetary and fiscal policies were independent in OECD countries and that budget deficits had little or no impact on money growth. Similarly, Ashra, Chattopadhyay & Chaudhuri (2004) found that there was no systematic relationship between budget deficits and money growth in India. Burdekin & Wohar (1990) examined the relationship between budget deficits and money growth in eight countries (Canada, France, Italy, Japan, Switzerland, the United Kingdom, USA and West Germany) in the period 1960Q1–1985Q4 and concluded that countries whose central banks are independent exhibit a poor link between fiscal deficits and the evolution of the money supply and that budget deficits tend to be related to money growth in countries where central banks have low independence. The authors argued that less independent central banks are sometimes under

pressure to finance government budget deficits, whereas independent central banks are more persistent to the price stability goal. This finding suggests that the independence of central banks determines the effect of budget deficits on money growth.

The fourth strand of literature provides empirical evidence for the effect of budget deficits on inflation. The first finding is a threshold effect of budget deficits on inflation. Catão & Terrones (2005) employed a panel data set of 107 countries over the period 1960–2001 to investigate the nonlinear effect of budget deficits on inflation. The authors found a strong positive relationship between fiscal deficits and inflation in high-inflation and developing countries but not in low-inflation advanced economies. Lin & Chu (2013) found that fiscal deficits have a strong impact on inflation in high-inflation periods and a weak impact in low-inflation episodes. The second finding is that budget deficits have a significant and positive effect on inflation in countries with low independence between fiscal and monetary policies and an insignificant effect in countries with high fiscal transparency (Hamburger & Zwick, 1981; Weil, 1987; Neyapti, 2003; Tekin-Koru & Özmen, 2003; Kia, 2006; Montes & da Cunha Lima, 2018).

The link between fiscal deficits and inflation in Vietnam has been investigated by Le (2008), Tran (2008) and Nguyen & Nguyen (2010). Le (2008) and Tran (2008) relied on simple statistical descriptions to conclude that fiscal deficits are a source of inflation in Vietnam. They argued that the fiscal policy in Vietnam is continuously expansionary, leading to, on average, a 5% ratio of budget deficits to the GDP. They argued that the Vietnamese government had issued a large amount of long-term government bonds to raise public investments. This expansionary fiscal policy led to a rise in money growth because the majority of undue government bonds were repurchased by the State Bank or commercial banks. Nguyen & Nguyen (2010) empirically examined the short- and long-run effects of budget deficits on inflation using the VECM and the cointegration test and found that there was no effect of budget deficits on inflation in the short run and that the impact is also unclear in the long run. Their results based on impulse response analysis, however, might not be robust due to instability of the VECM with respect to the standard error.

3. Fiscal and monetary policies in Vietnam

The literature review suggests that understanding the link between budget deficits and inflation requires understanding the structure of fiscal and monetary policies. This helps 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 aims at controlling inflation and stimulating economic growth. In practice, the monetary policy of the State Bank of Vietnam prioritized economic growth for many years. For example, between 2005 and 2008, the State Bank of Vietnam pursued a policy in favor of GDP growth provided that the inflation rate remained lower than the GDP growth rate. The State Bank of Vietnam was relatively dependent on the government in terms of setting goals and choosing instruments of the monetary policy. Therefore, the likelihood of financing budget deficits 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 primary goal of the monetary policy is price stability. 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, which means that the State Bank of Vietnam has obtained a certain level of independence in terms of using the instruments.

Regarding the fiscal policy, there is a legislative lag in the process of financing budget deficits. The 1996 and 2002 versions of the Budget Act state that the primary objective of the government expenditures is the development of the country as a whole, especially economic development. Government budget deficits are financed by domestic and

international borrowing, i.e. by issuance of domestic and international bonds. The borrowing is used for development purposes only. More importantly, determining the maximum level of budget deficits and how budget deficits are financed are at the discretion of the National Assembly of Vietnam. The 2015 Budget Act and its amended version in 2020 stress budget transparency, i.e. all relevant fiscal information must be fully disclosed in a timely and systematic manner.

4. Methodology

4.1 Choice of variables, data descriptions and model specification

Let us consider the long-run government budget constraint

$$\frac{B_{t-1}}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \frac{1}{(1+i_{t+j})^j} \left(T_{t+j} - G_{t+j} + \frac{M_{t+j} - M_{t-1+j}}{P_{t+j}} \right), \tag{1}$$

where B_{t-1}, P, i, T, G and M represent the nominal value of the government bonds issued in period $t-1$ with the maturity in period t, the price level, the short-term interest rate, tax revenues, government expenditures and money supply, respectively. The government's borrowing must not exceed the expected discounted value of future net income generated from the difference between tax revenues and expenditures and from money creation. This budget constraint can be written as

$$D_t = \frac{M_t - M_{t-1}}{P_t} + \mathbb{E}_t \sum_{j=1}^{\infty} \frac{1}{(1+i_{t+j})^j} \left(\frac{M_{t+j} - M_{t-1+j}}{P_{t+j}} - D_{t+j} \right), \tag{2}$$

where $D_t \equiv \frac{B_{t-1}}{P_t} + G_t - T_t$ is the budget deficit in period t, and $D_{t+j} \equiv G_{t+j} - T_{t+j}, j \geq 1$, represents the budget deficit in period $t+j$. Note that G_{t+j} $(j \geq 1)$ is the total government expenditures including payments for bonds issued in period $t+j-1$ and that mature in period $t+j$.

Eqn (2) displays the nexus between the budget deficit, money supply, price level and interest rates, which are selected as endogenous variables to estimate the SVAR model. The real GDP is added to the model to capture the income effect on inflation. Another reason for the inclusion of real GDP in the model is that GDP growth is an important goal of monetary and fiscal policies.

The data set covers the time period 1995–2012 because this period was marked by large budget deficits, high inflation and rapid money growth according to the discussion following Figure 1. As data on the real GDP and budget deficits are not available on monthly basis, the best linear unbiased interpolation method developed by Chow & Lin (1971) is used to convert the annual real GDP and budget deficits to their monthly counterparts. Due to this interpolation method, the time series used to estimate the SVAR model spans from January 1995 to December 2012. All growth rates are annualized. Thus, the SVAR model is estimated using five endogenous variables including annualized inflation rate, the annualized growth rate of money supply M1, the annualized growth rate of the budget deficits, the annualized growth rate of the real GDP and the annualized interest rate. Money supply M1 is chosen to better capture the contraction as well as the expansion of the monetary policy [1].

The data on inflation, real GDP, interest rate and money supply are acquired from the International Financial Statistics, and the data on budget deficits are acquired from the Ministry of Finance of Vietnam. The definitions of the variables used in the model and their data sources are reported in Table A1 in Appendix.

The SVAR model is of the following form [2]:

$$BY_t = B_0 + \sum_{k=1}^{l} B_k Y_{t-k} + u_t,\ l \geq 1, \tag{3}$$

where $Y_t = [\text{infl}, \text{g\_y}, \text{d\_pc}, \text{m1\_pc}, \text{i}]'$ is a 5×1 vector of five endogenous variables including annualized inflation rate, the annualized growth rate of real GDP, the annualized growth rate of budget deficits, the annualized growth rate of money supply M1 and the annualized interest rate, respectively. B is a 5×5 matrix of the contemporaneous impacts. B_0 is a 5×1 vector of intercept terms; $B_1, \ldots, B_l$ are 5×5 matrices of coefficients, and u_t is a 5×1 vector of structural innovations, which are uncorrelated and satisfy $\mathbb{E}_t\left[u_t u_t'\right] = I$.

4.2 Identification strategy

The SVAR model given by (3) could not be estimated without imposing further restrictions on the matrix of contemporaneous impacts. Eqn (3) can be rewritten as

$$Y_t = A_0 + \sum_{k=1}^{l} A_k Y_{t-k} + e_t,\ l \geq 1, \tag{4}$$

where $A_k = B^{-1}B_k$ for $k = 0, \ldots, l$, and $e_t \equiv B^{-1}u_t$ is a vector of reduced-form residuals. When we denote $C \equiv B^{-1}$, the reduced-form residuals satisfy $\mathbb{E}_t\left[e_t e_t'\right] = CC'$. When impose restrictions on the inverse of the matrix of contemporaneous impacts, C, Model (4) is identified.

As prices are more sluggish than the other endogenous variables, inflation is assumed to have contemporaneous impacts on the remaining variables. Real GDP growth is assumed to be contemporaneously influenced by inflation but has contemporaneous effects on the remaining variables. As discussed in Section 3, there are two possible channels to finance budget deficits. If budget deficits are financed by issuing government bonds, then the demand for loanable funds will increase, leading to a rise in interest rates. This channel is sluggish due to market imperfection. If budget deficits are financed by money creation, it is reasonable to assume that there is the so-called legislative lag to do so. Thus, budget deficits are assumed to have no contemporaneous impacts on the interest rate and the money supply. The nominal interest rate is assumed to be contemporaneously affected by other endogenous variables except budget deficits. Specifically, an increase in inflation will cause the nominal interest rate to rise because of the Fisher effect. The growth in the real GDP leads to an increase in the money demand, which, in turn, leads to a rise in interest rates. Finally, changes in the money supply will clearly affect the equilibrium interest rate in the money market. These restrictions can be represented in terms of reduced-form residuals and structural innovations [3] below.

$$\begin{bmatrix} e_{\text{inf}} \\ e_{\text{g\_y}} \\ e_{\text{d\_pc}} \\ e_{\text{m1\_pc}} \\ e_{\text{i}} \end{bmatrix} = \begin{bmatrix} c_{11} & 0 & 0 & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 & 0 \\ c_{31} & c_{32} & c_{33} & 0 & 0 \\ c_{41} & c_{42} & 0 & c_{44} & 0 \\ c_{51} & c_{52} & 0 & c_{54} & c_{55} \end{bmatrix} \times \begin{bmatrix} u_{\text{inf}} \\ u_{\text{g\_y}} \\ u_{\text{d\_pc}} \\ u_{\text{m1\_pc}} \\ u_{\text{i}} \end{bmatrix} \tag{5}$$

5. Estimation results and discussion

5.1 The unit root tests and the optimal lag

The augmented Dickey-Fuller (ADF) test is used to examine whether the time series have a unit root. The null hypothesis is that the series have a unit root. Table 1 shows the null hypothesis that all variables have a unit root is rejected at the 5% significance level.

There are several criteria for choosing the optimal number of lags, such as Likelihood ratio (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (BIC) and Hannan-Quinn information criterion (HQ). This study will mainly use the BIC together with the test for autocorrelation among the residuals and the roots of the characteristic polynomial to determine the optimal number of lags. The BIC and HQ select one lag, while the AIC, FPE, and LR suggest longer lags (see Table A2 in appendix). To conclude the optimal lag and stability of the model, the study then tests for autocorrelation among the residuals and examines the roots of characteristic polynomial. The autocorrelation Lagrange multiplier (LM) test shows that there is no autocorrelation among residuals in the model estimated with four lags (see Table A3 in Appendix). In addition, all the roots of the characteristic polynomial are less than unity, which implies that the model satisfies the stability condition (see Table A4 in Appendix). Therefore, the optimal number of lags is four.

5.2 Impulse responses of inflation

We are now in the position to understand the impulse responses of the endogenous variables using the identification restrictions given by (5). Figure 2 shows that an increase in the growth rate of the money supply accelerates inflation (the top left panel). Specifically, inflation increases for three months due to a positive shock to the growth rate of the money supply. In particular, the effect of money growth on inflation is strongest in the second month after the occurrence of the shock, which implies that the transmission mechanism of the credit channel into inflation is fairly fast. 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 aims to significantly reduce the inflation rate as of today, then the Bank should lower money growth at least two months earlier. In addition, in high-inflation periods, it might be necessary to decrease money growth consecutively several times because the effect of each money growth shock on inflation is statistically significant for only three months.

The top middle panel of Figure 2 shows that a positive shock to the growth rate of the budget deficit has no significant effect on inflation. Thus, provided that the fiscal policy works effectively, the fragile relationship between budget deficits and inflation suggests that the fiscal policy might be prioritized to stimulate economic growth in the short run without concern about inflation pressure because the monetary policy could stimulate aggregate demand and therefore output but could also intensify inflation pressure.

A positive shock to real GDP growth causes inflation to rise for three months, and the shock fuels inflation most significantly in the third month (the top right panel of Figure 2). A positive shock to the interest rate is usually expected to hinder inflation because a higher interest rate reduces investment and consumption and therefore reduces aggregate demand. However, the impulse response analysis suggests that a positive shock to the interest rate has no impact on inflation (the bottom left panel of Figure 2). This finding suggests that the interest rate is not an effective instrument for the State Bank of Vietnam to fight inflation.

The bottom right panel shows that inflation increases considerably due to its own shock. Specifically, an 11% increase in the inflation rate in the current period will contribute

Variables	ADF test statistic	1%	5%	10%	*p*-value	Decision
Infl	−8.81	−3.46	−2.87	−2.57	0.00	I(0)
g_y	−9.85	−3.46	2.88	−2.57	0.00	I(0)
d_pc	−14.01	−3.46	−2.87	−2.57	0.00	I(0)
m1_pc	−4.63	−3.46	−2.88	−2.57	0.00	I(0)
i	−2.95	−3.46	−2.88	−2.57	0.04	I(0)

Table 1. The ADF tests for a unit root

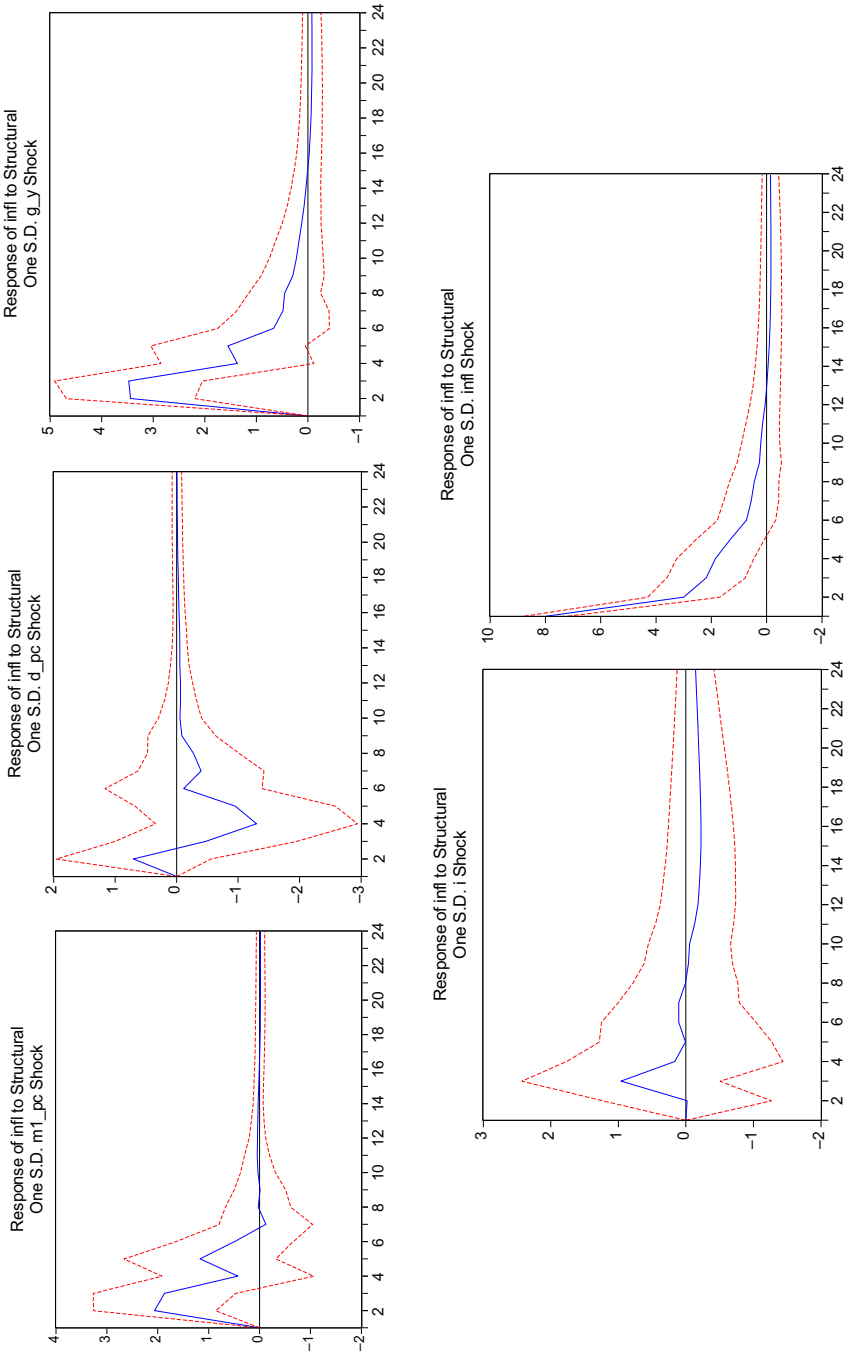

Figure 2.
Impulse responses of inflation

approximately 8% to the inflation rate in the next period. The effect of the shock wears off after then and vanishes as of the sixth month. The responses of inflation to its own shock suggest an essential characteristic of inflation in Vietnam: Inflation is retentively memorized and highly expected. This typical characteristic of inflation suggests that the State Bank of Vietnam should commit to attaining and sustaining a proper target level of the inflation rate to gain credibility from the public. This, in turn, facilitates the implementation of the monetary policy to combat inflation.

5.3 Impulse responses of money growth

In high-inflation periods, a rise in the inflation rate is usually expected to have a negative impact on money growth because central banks lower money growth to combat inflation. The top left panel of Figure 3 shows that money growth decreases in response to a positive shock to inflation. Specifically, an 11% increase in the inflation rate leads to an 8.8% decrease in the growth rate of the money supply in the third month. Money growth falls until the sixth month, and the decreasing effect vanishes after then. The growth rate of the money supply declines most significantly in the third month after the occurrence of the shock, implying that the State Bank of Vietnam fully recognizes and strongly responds to inflation shocks after three months. This also implies that the monetary policy is relatively slow in responding to inflation shocks.

In addition to price stability, economic growth is an important goal that the State Bank of Vietnam pursues. The top middle panel of Figure 3 shows that the State Bank of Vietnam quickly responds to a positive shock to real GDP growth by increasing money growth to further stimulate economic growth. However, the money supply increases only once in the first month to avoid an unexpected inflation shock in the future.

A positive shock to budget deficit growth has no effect on money growth (the top right panel). This implies that budget deficits had been unlikely to be financed by money creation in the period 1995–2012. This result is consistent with the analysis of impulse responses of inflation to budget deficit growth because a neutral relationship between money growth and budget deficits justifies a poor relationship between budget deficits and inflation.

A positive shock to the interest rate reduces money growth for three months (the bottom left panel). Interest rates in Vietnam in the period 1995–2012 increased mainly because of high inflation. Thus, a decrease in money growth in response to an increase in interest rates is due to the State Bank of Vietnam's effort to cope with inflation.

The bottom right panel shows that a 52.2% increase in the growth rate of the money supply is followed by a 38.4% increase in the next month. The effect quickly vanishes within two months, implying that the State Bank of Vietnam responded quickly and strongly to a positive shock to the money supply.

5.4 Impulse responses of budget deficits

Borrowers would gain and lenders would lose if inflation occurred because unexpected inflation lowers the real value of money. Thus, a positive shock to inflation is expected to increase budget deficits because the government is the borrower when issuing bonds. Similarly, a positive shock to money growth is also expected to accelerate budget deficits due to the reduction of the interest rate, i.e. the cost of borrowing.

The top panels of Figure 4 show that positive shocks to inflation, money growth and the interest rate have no impact on budget deficit growth. As discussed in Section 3, the primary goal of the fiscal policy in Vietnam has been economic growth for many years. Thus, the fiscal policy must have served as a key instrument used by the government to boost the economy. This justifies why budget deficit growth is unlikely to be affected by inflation, money growth and interest rates.

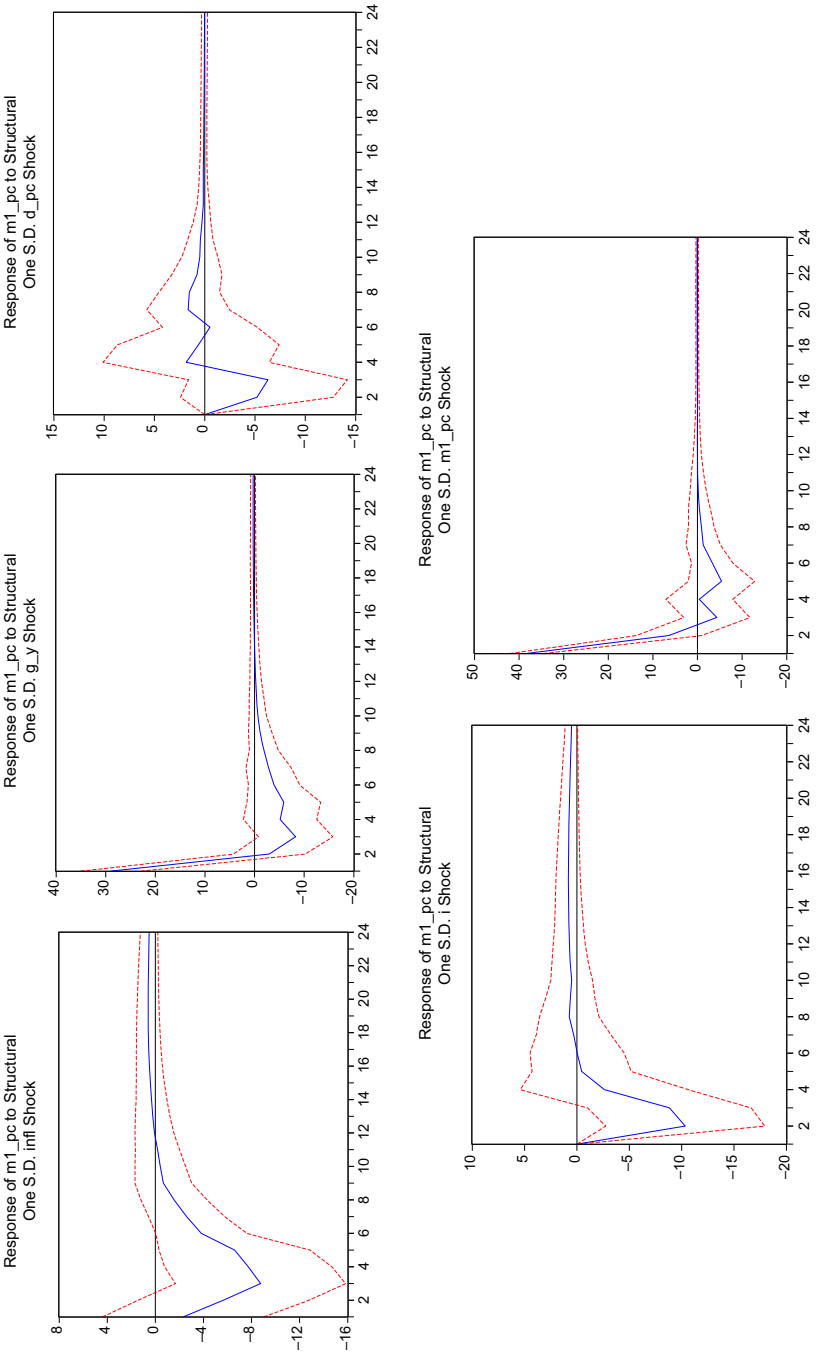

Figure 3.
Impulse responses of money growth

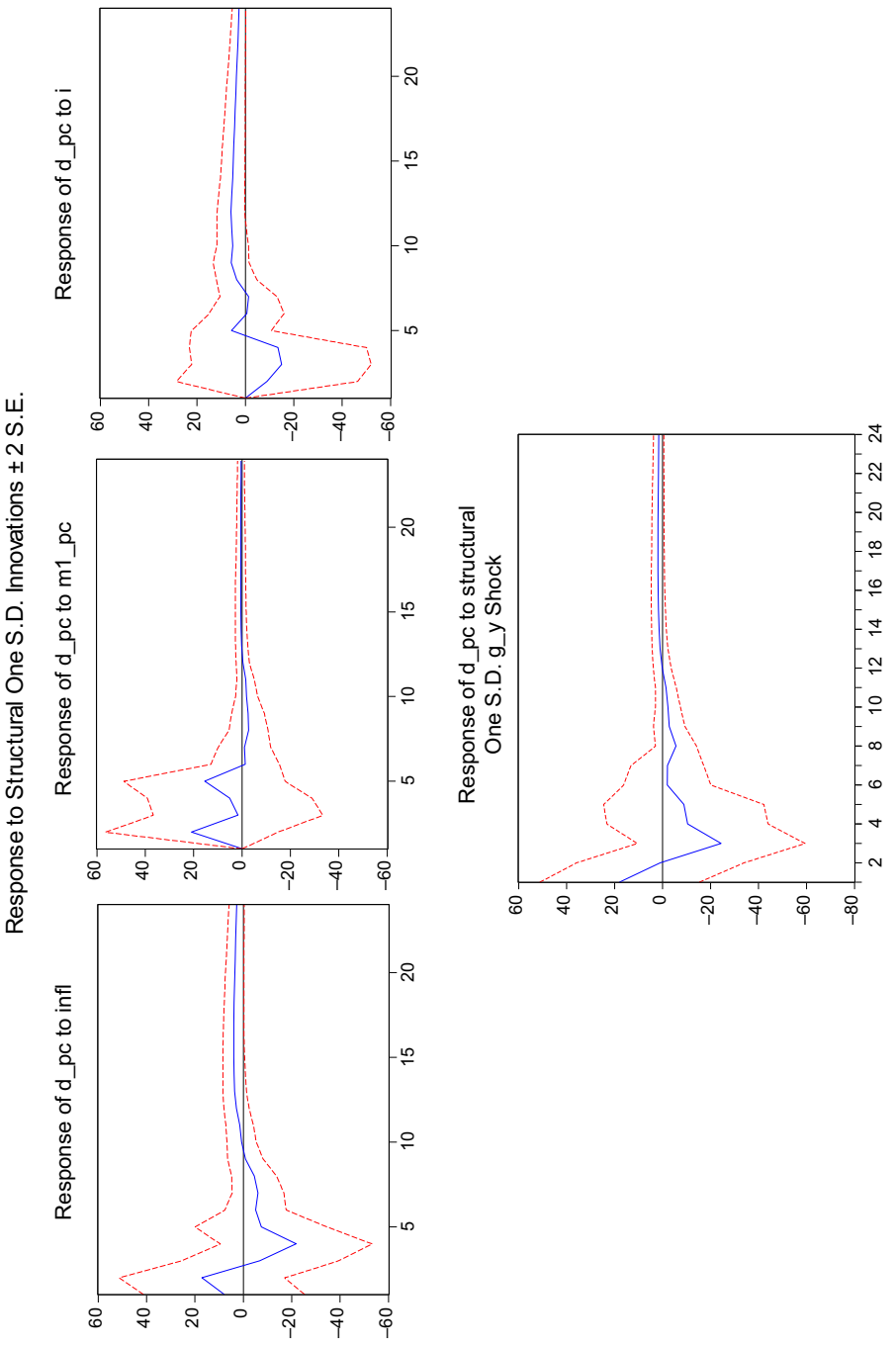

Figure 4.
Impulse responses of budget deficits

The bottom panel, however, shows that a positive shock to real GDP growth has no significant effect on budget deficit growth. Note that this does not necessarily mean that the government's revenues remain unchanged. For instance, during the economic booms, the government collects more taxes but also increases investment expenditures on infrastructure. There is no significant change in budget deficits as a result. This is because the budget balance has been targeted on a yearly basis. In other words, budget deficits were planned in advance; a temporary increase in real GDP growth has no significant impact on the growth rate of budget deficits in the short run. This implies a challenge for the Ministry of Finance, especially during the current COVID-19 pandemic. Although the government's revenues are negatively affected due to the shutdowns and contraction of firms, the government has to spend more on the measures coping with the pandemic.

5.5 Impulse responses of real GDP growth

Theoretically, nominal variables have no impact on real GDP growth in the long run; it is a technology progress that determines real output growth in the long run. For example, money growth does not affect real output growth but is translated into inflation in the long term, which is the so-called neutrality of money. As can be seen in Figure 5, positive shocks to inflation, budget deficit growth and money growth have no significant effect on real GDP growth (the top panels). A positive shock to the interest rate reduces real GDP growth in the second month after the occurrence of the shock (the bottom panel). This is because an increase in the interest rate has negative impacts on investment and consumption and therefore aggregate demand.

5.6 Impulse responses of the interest rate

A positive shock to inflation causes the interest rate to rise according to the Fisher effect (the top left panel of Figure 6). In particular, the effect of the positive shock to inflation on the interest rate is quite persistent because it lasts for 19 months. This implies that to stabilize interest rates, inflation must be kept under control.

In theory, a rise in real income will boost money demand, which, in turn, leads to an increase in interest rates. As shown in the top middle panel in the figure, a positive shock to real GDP growth has a positive impact on the interest rate from the 8th month to the 13th month. This implies that the interest rate reacts to a shock to real income slowly and persistently. The bottom panels show that positive shocks to money growth and budget deficit growth have no impact on the interest rate. Finally, the top right panel suggests that shocks to the interest rate in the past are retentively memorized. Specifically, the interest rate rises for 17 months due to its own shock.

5.7 Variance decomposition

Variance decomposition analysis helps understand how variations of each of the five endogenous variables are attributed to the other variables' shocks and its own innovations (Figure 7). The top left panel shows that variations in inflation in the first month are due only to its own shock. This is actually because of the assumption that inflation is contemporaneously affected by its own shock only. After the second month, the role of inflation in explaining its own variations decreases, while the importance of money growth and real GDP growth increases. Specifically, in the second month, approximately 81.4% of the variations in inflation are due to its own shocks, while money growth and real GDP growth account for about 4.8% and 13.3%, respectively. The contributions of the five variables to the variations in inflation become gradually unchanged after the 8th month. Specifically, real GDP growth, budget deficit growth, money growth and the interest rate

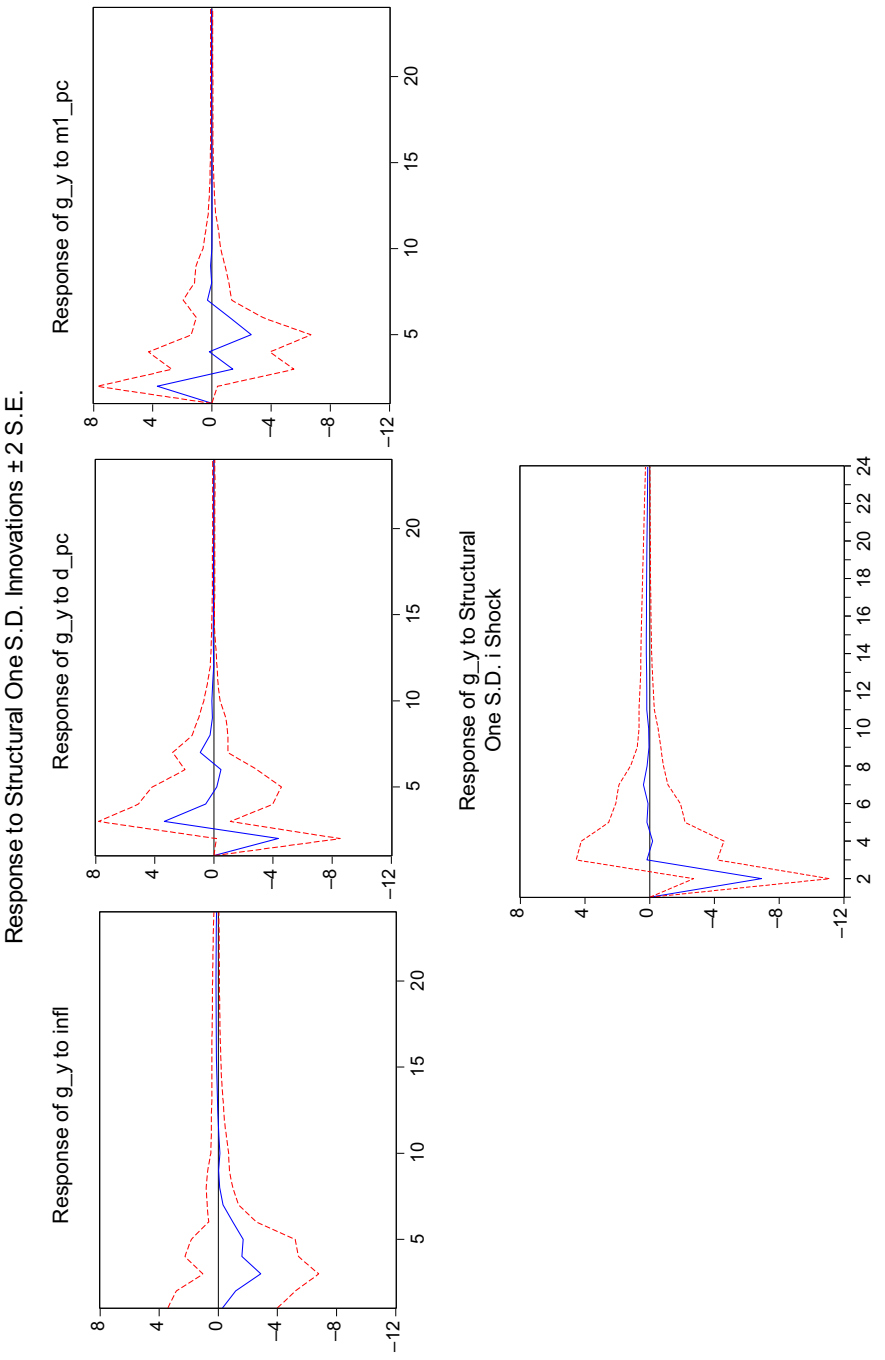

Figure 5.
Impulse responses of real GDP growth

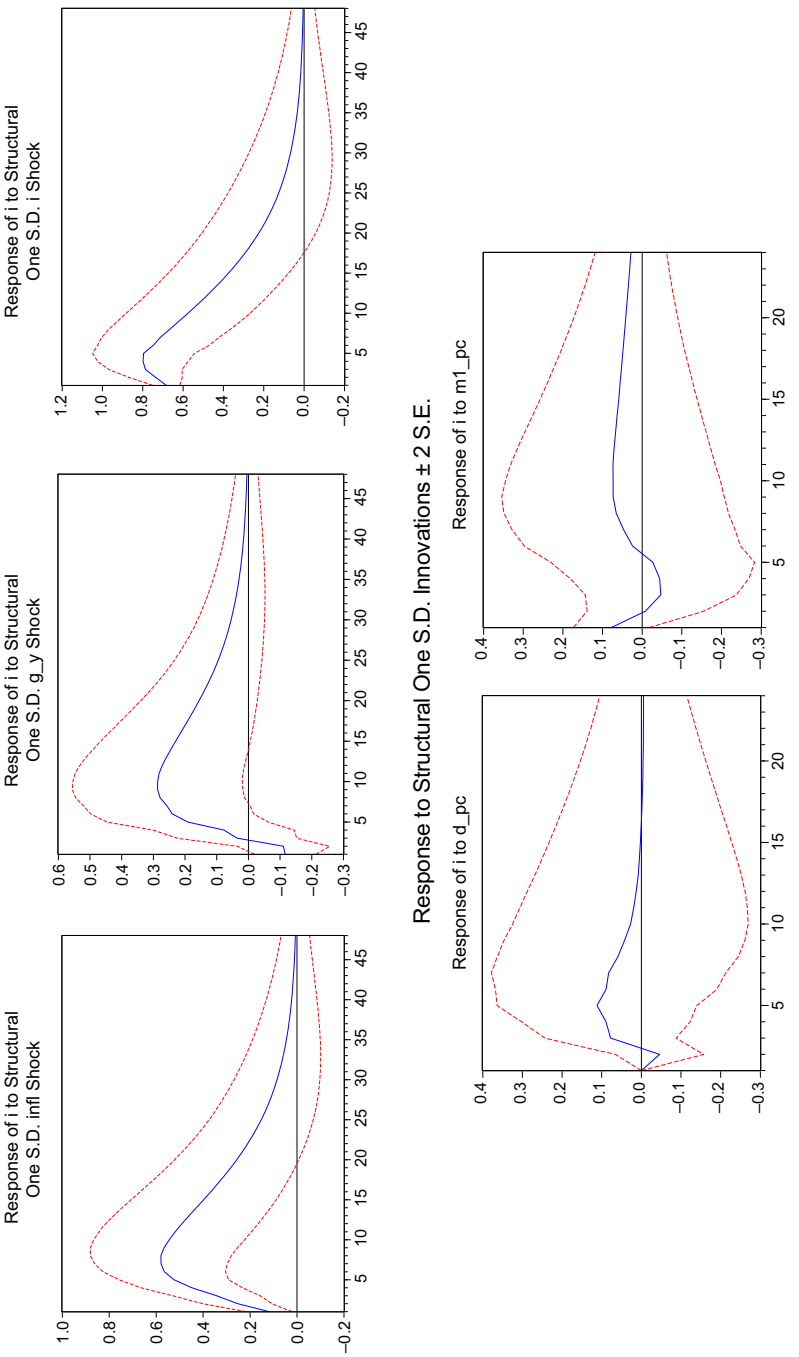

Figure 6.
Impulse responses of the interest rate

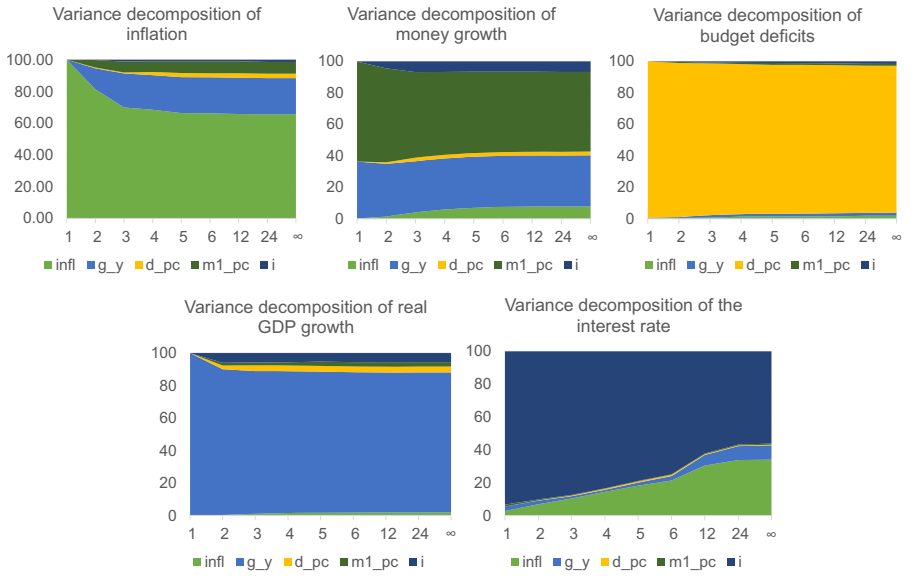

Figure 7.
Variance decomposition

account for 22.9%, 2.8%, 7.5% and 0.8%, respectively. The contributions of budget deficits and interest rates to explaining the variations in inflation are trivial. This is consistent with the impulse response analysis of inflation, in which shocks to budget deficit growth and the interest rate are unlikely to impact inflation, while inflation is mostly affected by shocks to real GDP growth and its own shocks.

The top middle panel shows that more than 50% of the variations in money growth are due to its own shocks. Precisely, its own shocks account for 63.5% and 51% of the variations in the first month and after the 8th month, respectively. Real GDP growth and inflation explain roughly 32.5% and 7.8% of the variations of money growth over time, implying real GDP growth seems more important than inflation with respect to designing and implementing the monetary policy. This clarifies why Vietnam experienced high inflation over the period 1995–2012. The contribution of the interest rate to innovations of money growth, which stands at roughly 6.5%, is also significant. The role of budget deficit growth in explaining the variations in money growth is limited. Specifically, budget deficit growth contributes only 2.5% to the variations in money growth. This implies that there was a certain level of independence between the monetary policy and the fiscal policy in Vietnam in the period 1995–2012.

The top right panel shows that the main source of the variations in budget deficit growth is its own shocks. Approximately 93.4% of the variations in budget deficit growth are generated by its own shocks. As discussed in the analysis of the impulse response of budget deficit growth, Vietnam had been in the transition stage of development and needed to establish and develop its infrastructure. Thus, the fiscal policy decisions are likely to be affected by its own position rather than money growth, inflation or interest rates.

Variations in real GDP growth are mainly attributed to its own shocks, too. Specifically, about 86.3% of the variations in real GDP growth over time are due to its own innovations. Shocks to the interest rate are the second biggest contributor to the fluctuations in real GDP growth, while inflation, money growth and budget deficits have a trivial effect on the fluctuations of real GDP growth (the bottom left panel).

Fluctuations in the interest rate are mostly attributed to its own shocks and inflation. In particular, 93.3% of variations in the interest rate are generated by its own shocks in the first month; the contribution stands at roughly 56.3% over time. Inflation is important in explaining the variations in the interest rate. Although the contribution is only 2.8% in the first month, it remains approximately 34.1% over time. Real GDP growth is the third important factor that explains the fluctuations in the interest rate, while the effect of budget deficit growth and money growth is negligible (the bottom right panel).

5.8 Robustness check

This section discusses two alternative identification restrictions to check the robustness of the baseline results. First, let us consider the baseline restriction plus the restriction that budget deficit growth has a contemporaneous impact on money growth, which means there is no legislative lag. This restriction is represented in terms of structural innovations and reduced-form residuals as in (6):

$$\begin{bmatrix} e_{\text{inf}} \\ e_{\text{g\_y}} \\ e_{\text{d\_pc}} \\ e_{\text{m1\_pc}} \\ e_{\text{i}} \end{bmatrix} = \begin{bmatrix} c_{11} & 0 & 0 & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 & 0 \\ c_{31} & c_{32} & c_{33} & 0 & 0 \\ c_{41} & c_{42} & c_{43} & c_{44} & 0 \\ c_{51} & c_{52} & 0 & c_{54} & c_{55} \end{bmatrix} \times \begin{bmatrix} u_{\text{inf}} \\ u_{\text{g\_y}} \\ u_{\text{d\_pc}} \\ u_{\text{m1\_pc}} \\ u_{\text{i}} \end{bmatrix} \tag{6}$$

The estimation results generated by using this identification restriction are roughly similar to the baseline results (see Figure A1 in Appendix). There are two minor differences, however. The first difference is that money growth is contemporaneously affected by a positive shock to budget deficit growth due to the alternative restriction imposed. However, the magnitude of the effect is extremely small. The second difference is the contemporaneous impact of money growth on the interest rate. However, the effect occurs one time only and is small.

The second alternative identification restriction is a combination of the first alternative restriction and the restriction that budget deficit growth has a contemporaneous impact on the interest rate. This implies that whenever the government budget ran into a deficit, the government was able to borrow promptly and that the bond markets were perfect. These assumptions essentially imply a recursive VAR model with structural innovations and reduced-form residuals presented in (7). The impulse responses generated from this alternative identification restriction are roughly similar to the baseline results (see Figure A2 in Appendix). One minor difference is that the interest rate is negatively affected by budget deficit growth, but the size of the effect is quite small:

$$\begin{bmatrix} e_{\text{inf}} \\ e_{\text{g\_y}} \\ e_{\text{d\_pc}} \\ e_{\text{m1\_pc}} \\ e_{\text{i}} \end{bmatrix} = \begin{bmatrix} c_{11} & 0 & 0 & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 & 0 \\ c_{31} & c_{32} & c_{33} & 0 & 0 \\ c_{41} & c_{42} & c_{43} & c_{44} & 0 \\ c_{51} & c_{52} & c_{53} & c_{54} & c_{55} \end{bmatrix} \times \begin{bmatrix} u_{\text{inf}} \\ u_{\text{g\_y}} \\ u_{\text{d\_pc}} \\ u_{\text{m1\_pc}} \\ u_{\text{i}} \end{bmatrix} \tag{7}$$

6. Concluding remarks

This paper uncovers the nexus between budget deficits, money growth and inflation in Vietnam in the period 1995–2012 using a SVAR model. There are four novel findings. First, inflation rose for three months in response to a positive shock to money growth. In particular, the strongest effect of a positive shock to money growth on inflation was observed in the 2nd month after the occurrence of the shock. Second, budget deficits had no effect on money

growth and therefore, inflation, implying a certain level of independence between the monetary policy and the fiscal policy. Third, money growth decreased after three months in response to an increase in inflation. This implies that it took three months for the State Bank of Vietnam to fully respond to inflation shocks. The State Bank of Vietnam aimed to lower money growth to curb inflation in the period 1995–2012. Fourth, budget deficit growth was unaffected by shocks to real GDP growth to the interest rate in the short run because the budget deficit growth was quite persistent. Fifth, the interest rate was not an effective instrument for the State Bank of Vietnam to combat inflation because interest rate changes had no effect on inflation. Finally, inflation and interest rates in Vietnam were persistent because they were highly expected and retentively memorized. This requires that an inflation fighting policy must be transparent and that the State Bank of Vietnam must commit to pursuing it.

The empirical evidence for the insignificant effect of budget deficits on money growth and inflation and the significant effect of money growth on inflation in the high-inflation period 1995–2012 carries an implication for the later period 2013–2019. The relatively stable inflation and money growth exhibited in the later period imply that the link between money growth and inflation holds not only in high-inflation episodes but also in low-inflation periods. Therefore, reducing money growth is key to control inflation in Vietnam. A research extension would be to answer the question what the decrease in budget deficits in the period 2013–2019 was attributed to. Was it due to the rise in real GDP growth and/or the enactment of the Budget Act in 2015?

The exchange rate was a tool of the monetary policy in the period 1995–2012. Over the period, Vietnam adopted three exchange rate regimes, including conventional fixed peg arrangements, crawling bands and crawling peg. Understanding the effect of the exchange rate under different regimes on inflation would be an interesting research extension. In particular, when there are large capital inflows and outflows, there will be huge pressure on the exchange rate, which then has an impact on inflation expectations and on the stability of the financial markets.

Notes

1. Broad money supply M2 better reflects the dynamics of money markets but has a loose link to the monetary policy.
2. The SVAR model is a reduced form of a Dynamic stochastic general equilibrium (DSGE) model. See Khieu (2015, 2018) for an analysis of monetary and fiscal policies in a DSGE framework.
3. Khieu (2013) employs a VAR model of output growth, real exchange rate, trade balance, and money growth, and assumes that output growth has a contemporaneous impact on money growth.

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Appendix

The Appendix file is available online for this article.

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