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RESEARCH ARTICLE

Macroeconomic Fluctuations in the United States: The Role of Monetary and Fiscal Policy Shocks

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Abstract

We assess the relative importance of fiscal and monetary policy shocks in explaining macroeconomic fluctuations in the United States. Using a Bayesian structural vector autoregressive model, we identify fiscal and monetary policy shocks based on a penalty function approach. We find that monetary policy shocks are relatively more important than fiscal policy shocks in explaining key macroeconomic variations and especially inflation variations. Our results provide evidence in support of a monetarist explanation of US business cycles.

Keywords Fiscal shocks · Monetary shocks · Output · Inflation · Business cycles

JEL classification: E32 · E52 · E58 · E62 · E63

1 Introduction

In 2007 and 2008, the economy of the United States was hit by a contractionary oil price shock and the global financial crisis. In 2020, it was hit by an even larger shock due to the Covid-19 outbreak that led to lockdowns and unprecedented cuts in production and aggregate spending. During both the global financial crisis and the Covid-19 recession, because conventional fiscal policy actions were not sufficient to deal with the crises, the US government enacted massive fiscal policy support in the trillions of dollars. Moreover, the Federal Reserve took aggressive monetary policy

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actions, reducing its policy rate to the zero lower bound and broadening its provision of liquidity well beyond its traditional lending to financial institutions.

During the great recession and the coronavirus recession, the US government accumulated debt at alarming rates and the Federal Reserve implemented unconventional monetary policies in a zero lower bound environment. In the aftermath of the coronavirus recession the inflation rate increased well above the target level of 2%, reaching 9.0% in June 2022, the highest in the past 40 years. The return of high inflation in the United States has raised questions regarding the credibility of the Federal Reserve and the role of monetary and fiscal policies, re-igniting interest in the monetarist-Keynesian debate on the relative importance of monetary and fiscal policy shocks.

According to Friedman's (1968, pp. 39) famous proposition, "inflation is always and everywhere a monetary phenomenon," but according to Sargent's (2013, pp. 243) variation of Friedman's proposition, "persistent high inflation is always and everywhere a fiscal phenomenon." More recently, in reference to the high inflation in the United States in the aftermath of the coronavirus pandemic, Cochrane (2022, pp. 9) argues that "in this case, there has been a fiscal shock, producing a period of inflation. That is, roughly, where we are now, in my view, and we are asking monetary policy to offset this fiscal inflation by adding monetary disinflation via interest rates."Clearly, there is a need for a better understanding of how monetary and fiscal policies affect inflation and the level of economic activity. In this regard, Hall et al. (2023) study the drivers of the current inflationary trends in the United States, the euro area, and the United Kingdom using both the standard Cholesky decomposition and a novel identification through solving the VAR backward. They find that in the United States, the current inflation is due to monetary expansion, government spending, and supply chain constraints. The principal cause of inflation in the euro area is supply chain bottlenecks while in the United Kingdom, is monetary expansion, supply issues, and wages. They also find significant and consistent spillover effects of US inflation shocks to the euro area and the United Kingdom.

In this paper, we contribute to the comparative and joint analysis of monetary and fiscal policies. In this regard, Waud (1974) using reduced form estimation analyzes the effect of monetary and fiscal influences and finds that both monetary and fiscal policy affect economic activity significantly and equally. Cardia (1991) evaluates the relative importance of monetary and fiscal shocks compared to technology shocks and concludes that monetary and fiscal policy shocks are trivial in explaining output variation compared to technology shocks. Rossi and Zubairy (2011) is one of the few recent studies to assess the importance of monetary and fiscal policy shocks in a unified framework. They rely on the Cholesky decomposition for identification of shocks and find monetary policy shocks to be more importance in explaining US business cycles.

It is to be noted that prior to the Rossi and Zubairy (2011) paper, researchers mainly focused on analyzing the importance of only one of these shocks. For example, Christiano et al. (1999, 2005) and Romer and Romer (1989, 1994) focus only on monetary shocks while Blanchard and Perotti (2002), Perotti et al. (2007), Ramey and Shapiro (1998), Ramey (2011), and Galí et al. (2007) study the importance of fiscal shocks. However, as noted by Rossi and Zubairy (2011, pp. 1248), "since both monetary and fiscal policy simultaneously affect fluctuations in macroeconomic time series data, it is important to qualitatively analyze their roles and to quantitatively evaluate their importance in explaining these fluctuations."

Since the work by Rossi and Zubairy (2011), and despite significant advances in macroeconometrics that give more diverse means for the identification of shocks in structural VAR models, there have been remarkably very few studies that attempt to investigate the relative importance of monetary and fiscal policy shocks, particularly in a unified framework as advocated by Rossi and Zubairy (2011). Our study is related to and inspired by Rossi and Zubairy (2011) and Hall et al. (2023) in using state-of-the-art econometrics. We use a Bayesian structural VAR and the penalty function approach to investigate the role of monetary and fiscal policy shocks in affecting US macroeconomic fluctuations. We also examine how the relative importance of monetary and fiscal policy shocks is affected by the way the stance of monetary policy is represented, making a distinction between monetary policy shocks based on the interest rate (the federal funds rate), the growth rate of the money supply, the growth rate of the monetary base, and unconventional monetary policy such as quantitative easing as captured by the growth in assets held by the Federal Reserve.

We find that monetary policy shocks are relative more important than fiscal policy shocks in explaining key macroeconomic variations in the US, in line with monetarist explanations of the business cycle. While fiscal policy shocks account for 20% of the variation in output, monetary policy shocks are responsible for 26% of the fluctuations in output. A trivial percentage of fluctuations in inflation (1%) and personal consumption expenditure (4%) is attributable to fiscal policy shocks. On the contrary, apart from being significant driver of output variation, monetary policy shocks are also a significant driver of fluctuations in inflation (38%) and personal consumption expenditure (30%).We also find that monetary policy strategy that target the growth rate a properly constructed monetary aggregate (such as a broad Divisia aggregate) significantly outperforms other monetary policy procedures.

The rest of the paper is organized as follows. Section 2 discusses the data. Section 3 presents the structural VAR model while Section 4 discusses identification and estimation details. Section 5 presents the empirical results and Section 6 is concerned with how the way we measure the stance of monetary policy affects our conclusions regarding the relative importance of monetary and fiscal policy shocks. The final section briefly concludes.

2 The Data

We use quarterly data for the United States over the period from 1973q1 to 2022q2 to assess the role of fiscal and monetary policy shocks as sources of business cycle fluctuations. The model consist of the output growth rate, y_t, the Personal Consumption Expenditure (PCE) inflation rate, π_t, the federal funds rate, i_t, personal consumption expenditure (PCE), c_t, stock market returns, s_t, and the government budget deficit/surplus, b_t.

Table 1 Unit root tests

	ADF t-statistic
Real GDP growth rate	-7.65774***
Fed funds rate	-3.39185*
Inflation rate	-3.38879*
PCE growth rate	-7.03719***
Stock market returns	-7.6786***
Divisia M3 growth rate	-5.07522***
Budget Deficit/surplus (% of GDP)	-3.97576*
Monetary base growth rate	-6.69938**
Fed total assets growth rate	-7.07225**

1% (***) significance level critical value = -4.00788

5% (**) significance level critical value = -3.43378

10% (*) significance level critical value = -3.14050

Even though the federal funds rate is predominantly used as the main indicator of the stance of monetary policy, in recent times the stance of monetary policy could be better captured by other indicators such as the monetary growth rate, as noted by Belongia and Ireland (2017, 2018, 2022). We are inspired by some of these recent suggestions to consider and assess other potential indicators of the monetary policy stance, and investigate if the relative importance of fiscal and monetary policy shocks varies by the choice of the indicator for the stance of monetary policy. In this regard, in alternative estimations, we assess other indicators of the stance of monetary policy such as the total assets held by the Federal Reserve, a_t, the Fed's monetary base, h_t, and a measure of the money supply, μ_t. With regards to the choice of the money supply measure, we use the Center for Financial Stability (CFS) broad Divisia M3 monetary aggregate, in conformity with the recommendations by Jadidzadeh and Serletis (2019) and Dery and Serletis (2021b). See Barnett (1980) and Barnett et al. (2013) for details on the Divisia monetary aggregates.

All variables are in growth rate form (year-over-year percentage growth rate) except for the federal funds rate and the government budget deficit/surplus. The output growth rate, y_t, is calculated based on real GDP, while the stock market returns series is the year-over-year percentage growth rate of the NASDAQ index. The federal funds rate is in quarterly percentage terms and the fiscal policy variable is the budget deficit/surplus (the difference between government total expenditure and federal government current tax receipts) expressed as a percentage of GDP. Except for the Divisia money measure, all variable are obtained from the Federal Reserve Economic Database (FRED). The Divisia money measure is from the CFS. Figure 1 shows the time series plots of all the variables and Table 1 shows that all the variables are stationary at conventional significance levels.

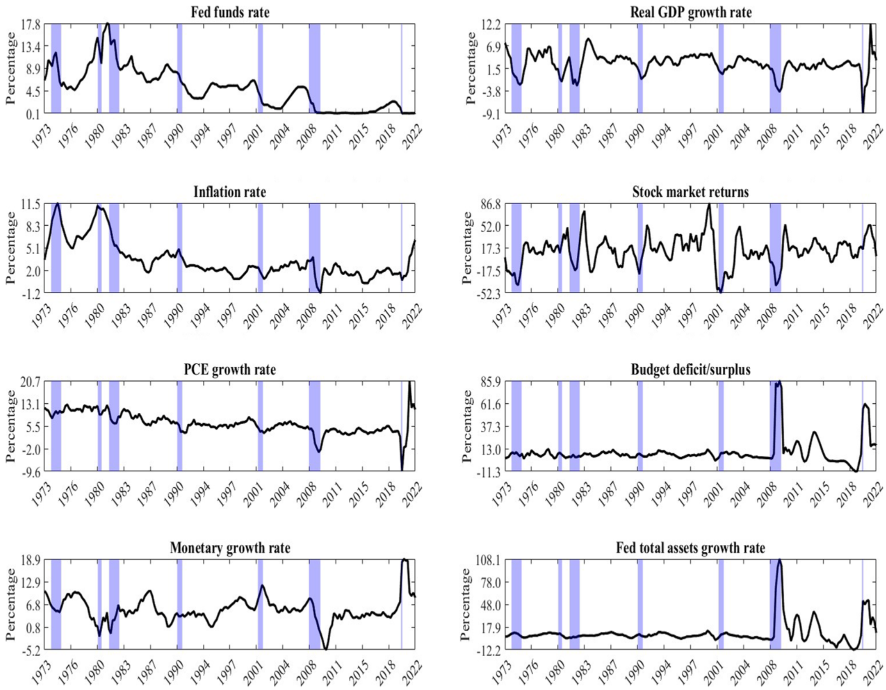

Fig. 1 Time series of all the variables

3 The Structural VAR Model

We provide in this section a brief exposition of the structural model of interest. As a starting point, consider a standard structural model with p-lags of the form

$$AZ_t' = \Gamma_0 + \sum_{k=1}^{p} \boldsymbol{Z}_{t-k}'\boldsymbol{\Gamma}_k + \boldsymbol{\varepsilon}_t' \tag{1}$$

where $\boldsymbol{Z}_t'$ is a $n \times 1$ vector of the relevant variables, $\boldsymbol{A}$ is a $n \times n$ matrix of contemporaneous coefficients, $\boldsymbol{\Gamma}_0$ is a $n \times 1$ vector of constants, $\boldsymbol{\Gamma}_k$ are $n \times n$ matrices of slope coefficients, and $\boldsymbol{\varepsilon}_t'$ is a $n \times 1$ vector of structural disturbances with variance-covariance matrix $\boldsymbol{D}$. The model can be written compactly as

$$\boldsymbol{A}\boldsymbol{Z}_t' = \boldsymbol{X}_t'\boldsymbol{B} + \varepsilon_t'$$

where $\boldsymbol{B} = \left[\boldsymbol{B}_1', ..., \boldsymbol{B}_p', \boldsymbol{\Gamma}_\mathbf{0}'\right]$, $\boldsymbol{X}_t' = \left[\boldsymbol{Z}_{t-1}', ..., \boldsymbol{Z}_{t-p}', \mathbf{1}\right]$, and $\boldsymbol{B}$ is $(np+1) \times n$. The reduced-form VAR is

$$\boldsymbol{Z}_t' = \boldsymbol{X}_t'\boldsymbol{\Phi} + \boldsymbol{u}_t'$$

where $\boldsymbol{\Phi} = \boldsymbol{B}A^{-1}$, $\boldsymbol{u}_t' = \boldsymbol{\varepsilon}_t'\boldsymbol{A}^{-1}$, and $E\left[\boldsymbol{u}_t\boldsymbol{u}_t'\right] = \boldsymbol{\Omega}$.

In this paper, we identify fiscal and monetary policy shocks by relying on the penalty function approach, initially introduced by Faust (1998) and further extended by Uhlig (2005) and Mountford and Uhlig (2009) to accommodate multiple shock identifications. In this section, we follow Caldara et al. (2016) and Dery and Serletis (2021a, c) in discussing the penalty function approach. With this approach, identification of the parameters of the model involves maximizing a criterion function subject to inequality constraints. The criterion function is the sum of the impulse responses of the target variables while the inequality constraints correspond to sign restrictions on these impulse responses for a predefined period.

Specifically, consider a given draw of structural parameters $\{\boldsymbol{A}, \boldsymbol{B}\}$ and let $\boldsymbol{L}_h(\boldsymbol{A}, \boldsymbol{B})_{ij}$ denote the impulse response function of the i^{th} variable to the j^{th} structural shock at a finite horizon h. Also define $\boldsymbol{F}$ and $\boldsymbol{J}$ as follows

$$\boldsymbol{F} = \begin{pmatrix} \boldsymbol{B}_1\boldsymbol{A}^{-1} & \boldsymbol{I}_n & \dots & \boldsymbol{0} \\ \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{B}_{p-1}\boldsymbol{A}^{-1} & \boldsymbol{0} & \dots & \boldsymbol{I}_n \\ \boldsymbol{B}_p\boldsymbol{A}^{-1} & \boldsymbol{0} & & \boldsymbol{0} \end{pmatrix} \text{ and } \boldsymbol{J} = \begin{pmatrix} \boldsymbol{I}_n \\ \boldsymbol{0} \\ \vdots \\ \boldsymbol{0} \end{pmatrix}.$$

Then $\boldsymbol{L}_h(\boldsymbol{A}, \boldsymbol{B})_{ij}$ is row i and column j of $\left[\boldsymbol{A}^{-1}\boldsymbol{J}'\boldsymbol{F}^h\boldsymbol{J}\right]'$ and $\boldsymbol{L}_0(\boldsymbol{B}\boldsymbol{A}^{-1}) = \boldsymbol{A}^{-1}$ is the contemporaneous matrix of the impulse response functions. We follow the literature and characterized the set of all possible impulse response functions with an $n \times n$ orthonormal matrix $\boldsymbol{S} \in \zeta(n)$, where $\zeta(n)$ is the universe of all orthonormal $n \times n$ matrices — see Uhlig (2005) and Caldara et al. (2016). Then identification is achieved by placing the appropriate restrictions on $\boldsymbol{S}$ matrix.[1], where $\boldsymbol{T}$ is a Cholesky factorization of $\boldsymbol{\Omega}$.

Let $\boldsymbol{s}_j = \boldsymbol{S}\boldsymbol{e}_j$, $j = \{1, 2\}$, be the subsets of shocks identified out of the possible n shocks in the system, where e_j is the jth column of $\boldsymbol{I}_n$. Particularly, consider identification of the j-th structural shock based on restrictions which requires the impulse response functions of a set of variables to be positive and others to be negative indexed respectively by $I_j^+ \subset \{0, 1, \dots, n\}$ and $I_j^- \subset \{0, 1, \dots, n\}$. If those restrictions are binding for $H \geq 0$ periods, then the penalty function approach to identification of $\boldsymbol{s}_j$ is the solution to the following optimization problem

$$\boldsymbol{s}_j^* = \arg\min_{\boldsymbol{s}_j} \Psi(\boldsymbol{s}_j)$$

subject to

$$\boldsymbol{e}_i'\boldsymbol{L}_h\left(\boldsymbol{T}^{-1}, \boldsymbol{\Phi}\boldsymbol{T}^{-1}\right)\boldsymbol{s}_j > 0, \; i \in I_j^+ \text{ and } h = 0, \dots, H \tag{2}$$

$$\boldsymbol{e}_i'\boldsymbol{L}_h\left(\boldsymbol{T}^{-1}, \boldsymbol{\Phi}\boldsymbol{T}^{-1}\right)\boldsymbol{s}_j > 0, \; i \in I_j^- \text{ and } h = 0, \dots, H \tag{3}$$

[1] Since for any orthonormal matrix $\boldsymbol{S}$, $\widetilde{\boldsymbol{A}}^{-1} = \boldsymbol{T}\boldsymbol{S}$ is also a decomposition that satisfies $[\widetilde{\boldsymbol{A}}\widetilde{\boldsymbol{A}}']' = \boldsymbol{\Omega}$

$$\boldsymbol{S}^{*\prime}_{j-1}\boldsymbol{s}_j = 0$$

where

$$\boldsymbol{\Psi}(\boldsymbol{s}_j) = \sum_{i \in I_j^+} \sum_{h=0}^{H} \left(\frac{-\boldsymbol{e}_i^{\prime}\boldsymbol{L}_h\left(\boldsymbol{T}^{-1}, \boldsymbol{\Phi}\boldsymbol{T}^{-1}\right)\boldsymbol{s}_j}{\omega_i} \right) + \sum_{i \in I_j^-} \sum_{h=0}^{H} \left(\frac{\boldsymbol{e}_i^{\prime}\boldsymbol{L}_h\left(\boldsymbol{T}^{-1}, \boldsymbol{\Phi}\boldsymbol{T}^{-1}\right)\boldsymbol{s}_j}{\omega_i} \right) \quad (4)$$

and ω_i is the standard deviation of variable i, and $\boldsymbol{S}^*_{j-1} = \left[\boldsymbol{s}^*_1, \ldots, \boldsymbol{s}^*_{j-1}\right]$, for $j = 1, \ldots, n$.

Note that the constraints in (2) and (3) do not identify the model, as they only provide a set of admissible rotation matrices from which $\boldsymbol{S}^*$ is chosen. This, as noted by Caldara et al. (2016), makes the penalty function approach significantly different from the traditional pure sign restrictions approach. By computing the impulse response functions based on the rotation matrix $\boldsymbol{S}^*$ that minimizes the criterion function (4), it allows the penalty function approach to retain the theoretical appeal and simplicity of the pure sign restrictions approach, yet avoid some of its most significant criticism such as the 'model identification problem,' as noted by Fry and Pagan (2011).[2]

4 Identification and Estimation

We are interested in the role of fiscal and monetary policy shocks as sources of macroeconomic fluctuations. In this section, we provide details of the implementation of the penalty function approach described above. One advantage of this approach is that it is invariant with respect to the ordering of the variables. As such we do not need to impose ordering restrictions. For the purposes of this section however, and without loss of generality, we use the following ordering of the variables in our baseline model: federal funds rate, i_t, output growth rate, y_t, inflation rate, π_t, stock market returns, s_t, growth rate of personal consumption expenditure, c_t, and federal government budget deficit/surplus, b_t. That is

$$\boldsymbol{Z}_t = [i_t \; y_t \; \pi_t \; s_t \; c_t \; b_t].$$

Identification of the shocks is however sequential, and assumptions must be made regarding which shock of interest is the most exogenous in the system. This means that the penalty function approach is not invariant to the ordering of the shocks, but it is invariant to the ordering of the variables. The sequential nature of identification implies that shock 1 is identified first and conditional on being orthogonal to shock

[2] This refers to the problem that with pure sign restrictions, there are many models with identified parameters that rationalize the data. Hence, even though pure sign restriction achieves parameter identification, it does not necessarily achieve model identification. Thus, summarizing the responses using for instance the median response and conventional error bands represent the spread of the responses distribution across these models – see Fry and Pagan (2011).

1 and satisfying the inequality constraints, shock 2 is identified. As we will show in our results section, our findings are not sensitive to the ordering of the shocks.

In our baseline identification scheme, we assume that fiscal policy shocks are the most exogenous of the two and so are ordered first. Consequently, we identify the fiscal policy shock as an innovation that produces the largest increase in the government budget surplus as a percentage of GDP with a concurrent decrease in the output growth rate for one quarter.[3] Alternatively, the admissible set of rotation matrices from which a contractionary fiscal policy shock is chosen is the set with an increase in the impulse response of the federal budget surplus and a concurrent decrease in output for a quarter. The corresponding penalty function is

$$\boldsymbol{\Psi}(\boldsymbol{s}_1) = \sum_{h=0}^{1}\left(\frac{-\boldsymbol{e}_6'\boldsymbol{L}_h(\boldsymbol{T}^{-1},\boldsymbol{\Phi}\boldsymbol{T}^{-1})\boldsymbol{s}_1}{\omega_6}\right) + \sum_{h=0}^{1}\left(\frac{\boldsymbol{e}_2'\boldsymbol{L}_h(\boldsymbol{T}^{-1},\boldsymbol{\Phi}\boldsymbol{T}^{-1})\boldsymbol{s}_1}{\omega_2}\right)$$

with

$$\boldsymbol{e}_6'\boldsymbol{L}_h(\boldsymbol{T}^{-1},\boldsymbol{\Phi}\boldsymbol{T}^{-1})\boldsymbol{s}_1 > 0, \text{ for } h = 0, 1$$

$$\boldsymbol{e}_2'\boldsymbol{L}_h(\boldsymbol{T}^{-1},\boldsymbol{\Phi}\boldsymbol{T}^{-1})\boldsymbol{s}_1 < 0, \text{ for } h = 0, 1$$

where $j = 1$, because we identify the first shock, and $i = \{6, 2\}$, because the target variable for fiscal policy (budget deficit/ surplus) and output is the sixth and second variable in the VAR, respectively.

We then identify the monetary policy shock as an innovation that produces the largest increase in the federal funds rate with a concurrent decrease in output and inflation for one quarter and is orthogonal to the already identified fiscal policy shock in the first step. This gives the following penalty function

$$\boldsymbol{\Psi}(\boldsymbol{s}_2) = \sum_{h=0}^{1}\left(\frac{-\boldsymbol{e}_1'\boldsymbol{L}_h(\boldsymbol{T}^{-1},\boldsymbol{\Phi}\boldsymbol{T}^{-1})\boldsymbol{s}_2}{\omega_1}\right) + \sum_{\gamma=2}^{3}\sum_{h=0}^{1}\left(\frac{\boldsymbol{e}_\gamma'\boldsymbol{L}_h(\boldsymbol{T}^{-1},\boldsymbol{\Phi}\boldsymbol{T}^{-1})\boldsymbol{s}_2}{\omega_\gamma}\right)$$

with

$$\begin{gathered}\boldsymbol{e}_1'\boldsymbol{L}_h(\boldsymbol{T}^{-1},\boldsymbol{\Phi}\boldsymbol{T}^{-1})\boldsymbol{s}_2 > 0, \text{ for } h = 0, 1\\ \boldsymbol{e}_2'\boldsymbol{L}_h(\boldsymbol{T}^{-1},\boldsymbol{\Phi}\boldsymbol{T}^{-1})\boldsymbol{s}_2 < 0, \text{ for } h = 0, 1\\ \boldsymbol{e}_3'\boldsymbol{L}_h(\boldsymbol{T}^{-1},\boldsymbol{\Phi}\boldsymbol{T}^{-1})\boldsymbol{s}_2 < 0, \text{ for } h = 0, 1\\ \boldsymbol{S}_1^*\boldsymbol{s}_2 = 0\end{gathered}$$

Again $j = 2$, because we identify the first shock, and $i = 1, 2, 3$, because the federal funds rate, output, and inflation are the first, second, and third variables in the VAR, respectively. Consequently, the admissible set rotation matrices from which a

[3] We show in the results section that using 2 or even 3 quarters gives similar results but we impose the restrictions for 1 quarter here to reflect our desire to have less restrictive assumptions

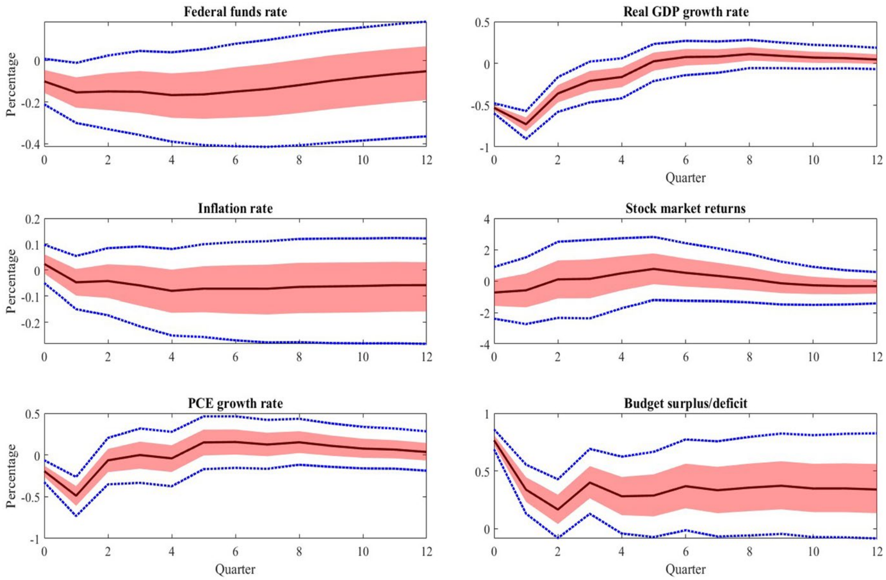

Fig. 2 Impulse responses to a fiscal policy shock

contractionary monetary policy shock is chosen is that for which there is an increase in the impulse response of the federal funds rate with a concurrent decrease in output and the inflation rate for a quarter.

As in Caldara et al. (2016), we utilize Bayesian estimation, imposing a Minnesota prior on the reduced form VAR parameters using dummy observations. The model is trained with two years of data and we obtain the hyper parameters which govern the prior distributions and VAR lag length p by maximizing the marginal data density. The maximization is done with the Hansen et al. (2003) CMA-ES evolutionary algorithm. All results are based on 500,000 draws from the posterior distribution of the structural parameters with the first 25% as burn-in.

5 Empirical Evidence

We assess the relative importance of fiscal and monetary policy shocks as drivers of business cycle fluctuations in the United States. We provide evidence of the role of these shocks in affecting macroeconomic variations in terms of dynamic impulse responses and forecast error variance decomposition of the variables of interest (output growth rate, inflation rate, stock market returns, and personal consumption expenditure (PCE) growth rate). Figures 2 and 3 show the dynamic responses of these variables to fiscal and monetary policy shocks, respectively, with shaded areas showing the 68% credibility region and dashed lines showing the 95% confidence band of the median response.

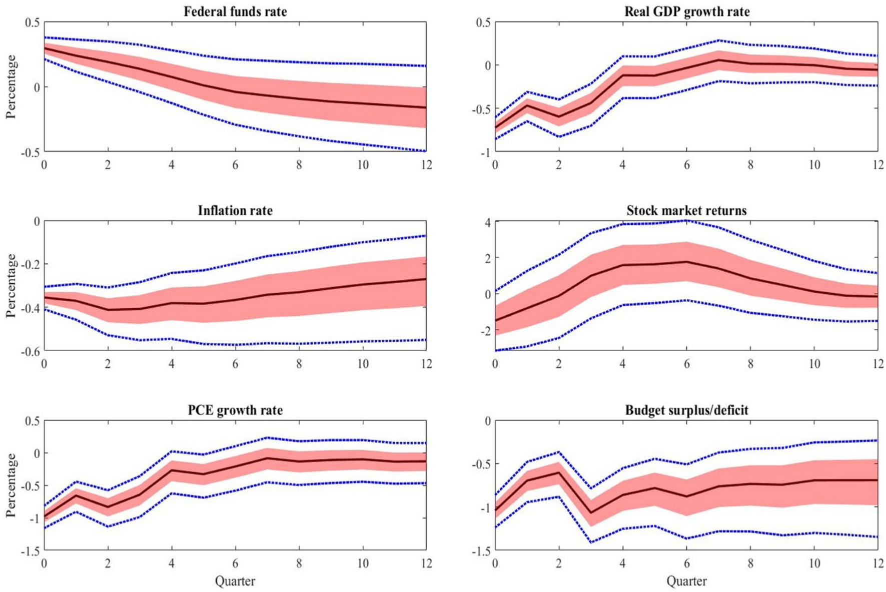

Fig. 3 Impulse responses to a monetary policy shock

In Fig. 2, we show the dynamic responses of the variables of interest to a contractionary fiscal policy shock. As mentioned earlier, a contractionary fiscal policy shock is the innovation that produces the largest increase in the government budget surplus (as a percentage of GDP) with a concurrent decrease in the output growth rate for one quarter. As expected, the fiscal contraction produces a statistically significant decline in the output growth for almost a year. It also produces a significant but transient reduction in the PCE growth rate that lasts for at most two quarters. We do not find support for the Giavazzi and Pagano (1990) 'expansionary fiscal contraction.'[4] The deflationary effects of this fiscal contraction are very muted while the interest rate and stock market responses are negative but statistical insignificant.

The responses of the variables of interest to a contractionary monetary policy shock are shown in Fig. 3. The monetary policy shock generates significant contraction in the output growth rate, the inflation rate, and PCE growth rate. There is also a very significant increase in the budget deficit, indicating a possible fiscal expansion in response to the general economic contraction. The stock market response is potentially larger than in the case of the fiscal contraction but is still barely significant statistically.

In Fig. 4, we present the variance decomposition of the fiscal policy shock (top panel) and monetary policy shock (bottom panel) for the output growth rate,

[4] This is the hypothesis that a contractionary fiscal policy could produce an expansion in private consumption and ultimately an expansion in output. See Giavazzi and Pagano (1990), Barry and Devereux (1995), and Bergman and Hutchison (2010) for more details.

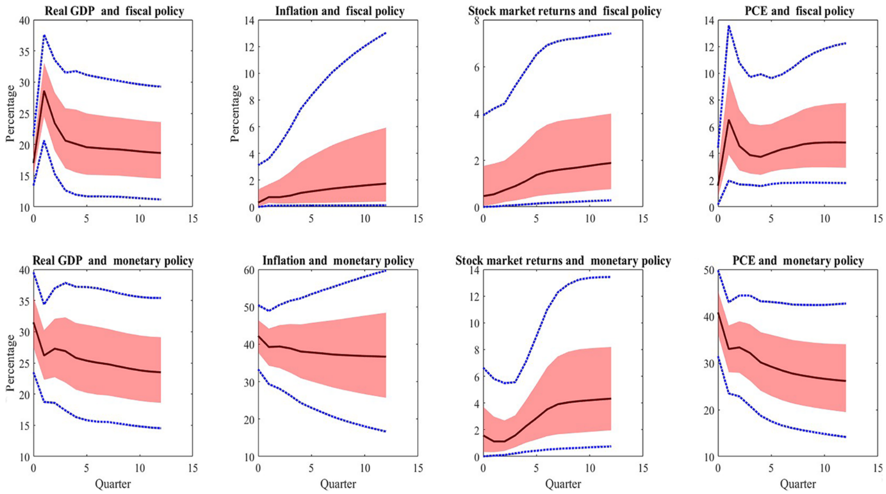

Fig. 4 Variance decomposition of fiscal and monetary policy shocks

inflation rate, stock market returns, and personal consumption expenditure growth rate. The top panel of Fig. 4 shows that fiscal policy shocks are significant drivers of output variations, explaining on average 20% of fluctuations in output. On the other hand, fiscal policy shocks are not a significant source of variations in the inflation rate, stock market returns, and personal consumption expenditure. On average, we find a trivial percentage of fluctuations in inflation (1.1%), stock returns (1.3%), and personal consumption expenditure (4.3%) attributable to fiscal

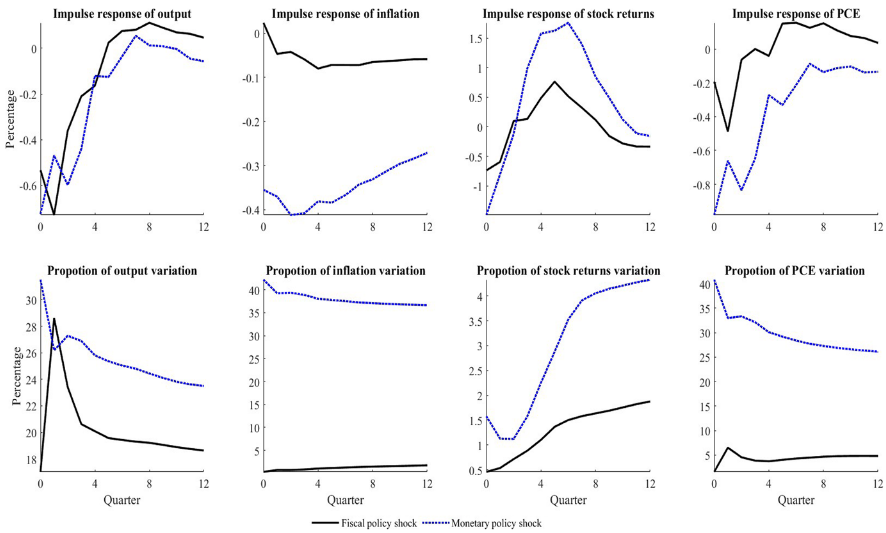

Fig. 5 Impulse responses and variance decomposition of fiscal and monetary policy shocks

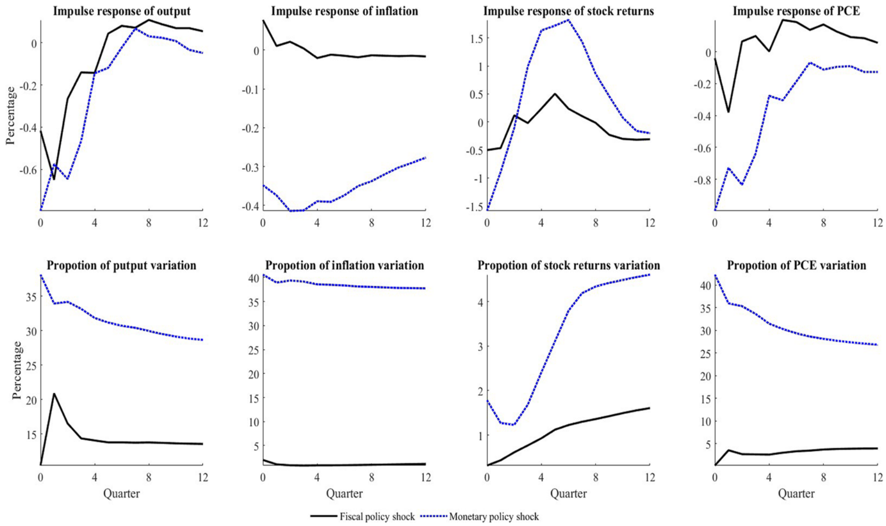

Fig. 6 Impulse responses and variance decomposition of fiscal and monetary policy shocks when the monetary policy shock is identified first

policy shocks. On the contrary, monetary policy shocks are shown (in bottom half of Fig. 4) to be a significant driver of fluctuations in output, inflation, and personal consumption expenditure, accounting for 26%, 38%, and 30%, respectively.

In Fig. 5, we provide a direct comparison of the dynamic responses and variance decomposition of the variables of interest to fiscal and monetary policy shocks. As shown in the figure, monetary policy shocks are the most significant source of macroeconomic fluctuation, both in terms of impulse responses and forecast error variance decomposition. Specifically, while monetary policy shocks accounts for 26%, 38%, and 30% of the variation in output, inflation, and personal consumption expenditure, the corresponding percentages for fiscal policy shocks are 20%, 1.1%, and 4.3%.

We conclude that monetary policy shocks are relatively more important than fiscal policy shocks in explaining key macroeconomic variations in the United States. In particular, a fiscal contraction does not seem to be a viable alternative for achieving deflation in the United States economy. Both monetary and fiscal policy shocks are not significant sources of fluctuations in one of the most important financial market in the economy, the stock market.

So far, we have provided evidence based on the assumption that fiscal policy shocks are the most exogenous of the two shocks and so are ordered first in the sequential identification procedure. In Fig. 6, we present evidence that our results are not sensitive to changes in the order of the identification of the shocks. In Fig. 6, monetary policy shocks are identified first and then, conditional on being orthogonal to monetary policy shock and satisfying the other restrictions, fiscal policy shocks are identified. Figure 6 is identical to Fig. 5 both in terms of

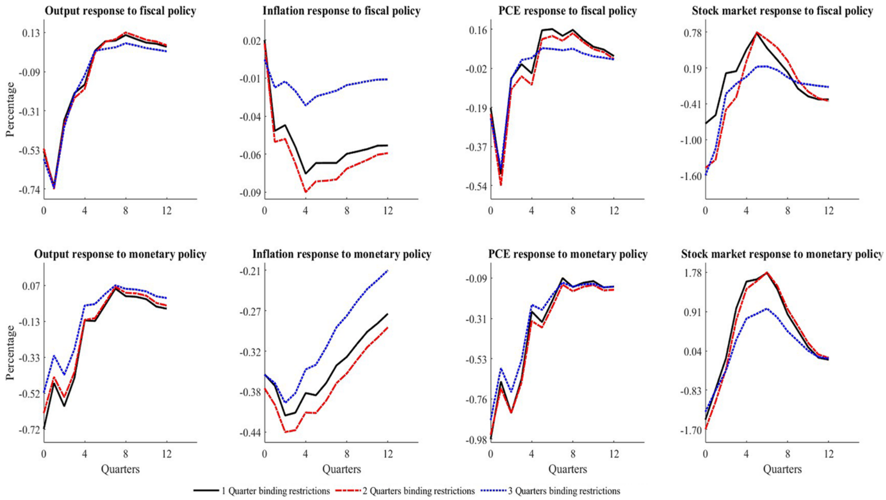

Fig. 7 Responses of variables of interest to fiscal and monetary policy shocks under different binding restrictions

impulse responses and variance decomposition, confirming that our results are invariant to the ordering of the shocks.

Further, our findings remain stable under different lengths of binding restrictions. As stated earlier, our baseline results are based on restrictions enforced on the penalty function for one quarter. In Figs. 7 and 8, we show that the results are not sensitive to changes in the length of time for which the restrictions are

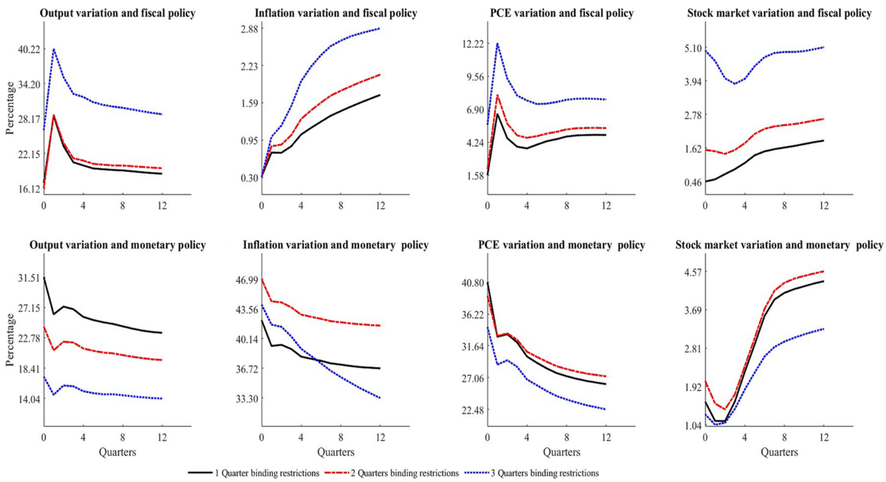

Fig. 8 Variance decomposition of variables of interest to fiscal and monetary policy shocks under different binding restrictions

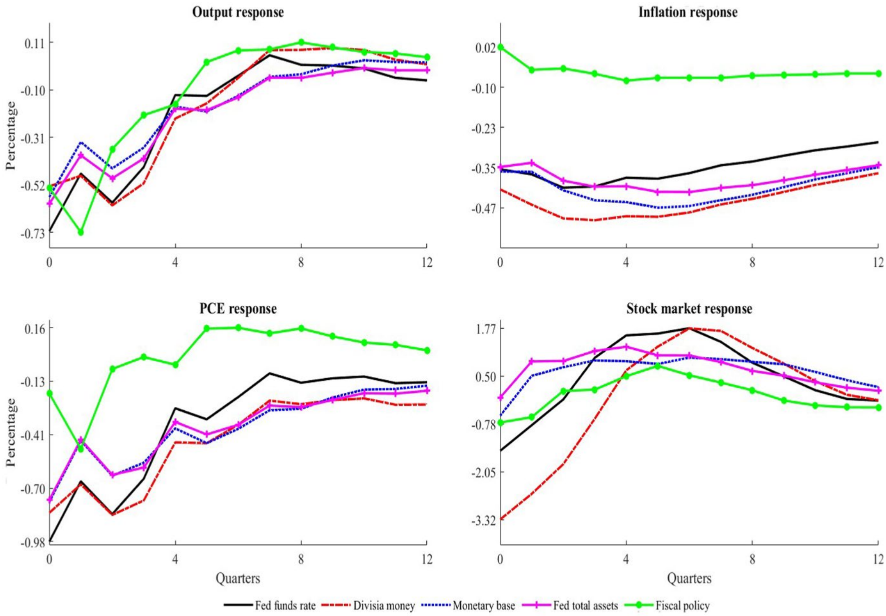

Fig. 9 Impulse responses to fiscal and monetary policy shocks under alternative indicators of the stance of monetary policy

binding. We present results for 1 quarter (baseline), 2 quarters, and 3 quarters binding restrictions and arrive at the same conclusions.

6 On the Stance of Monetary Policy

In our baseline results so far, the federal funds rate is the indicator variable for the stance of monetary policy. However, the federal funds rate is as less relevant indicator of the stance of monetary policy when at the effective zero lower bound. In this section, we investigate the robustness of our results to different indicators of the stance of monetary policy, as has been advocated by Belongia and Ireland (2015, 2017, 2022), among others. In particular, we assess the importance of the federal funds rate, the CFS Divisia M3 monetary aggregate, the monetary base, and total assets held by Federal Reserve as alternative indicators of the stance of monetary policy.

In Fig. 9 we present summary results of the impulse responses of the variables of interest under alternative indicators of the stance of monetary policy — the federal funds rate, the Divisia M3 money growth, the growth rate of the monetary base, and the growth rate in total assets of the Federal Reserve — and continue to provide a comparison with the impulse responses to a fiscal policy shock. In Fig. 10, we provide a similarly comparative graphs for the variance decomposition.

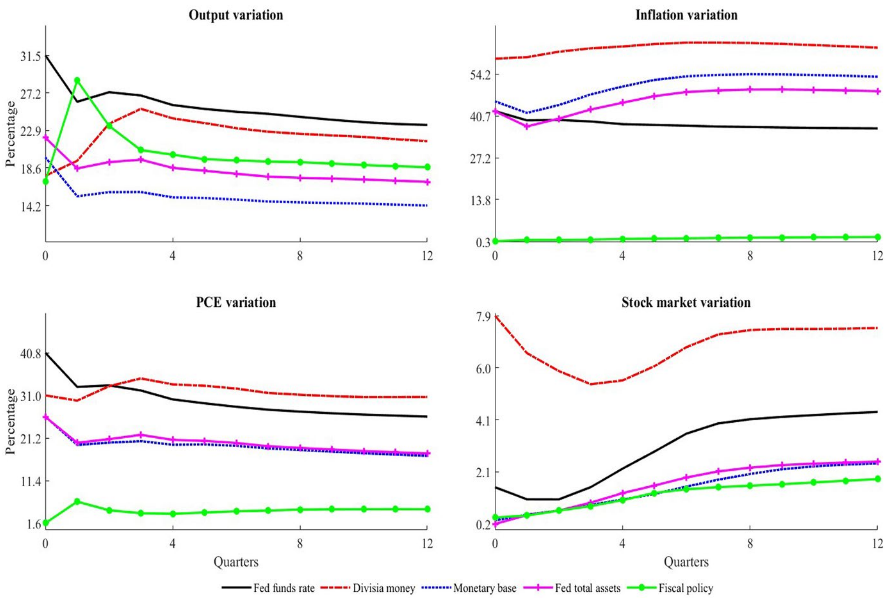

Fig. 10 Variance decomposition of fiscal and monetary policy shocks under alternative indicators of the stance of monetary policy

Across both Figs. 9 and 10, we see that using a properly constructed monetary aggregate, like the CFS Divisia M3 aggregate, and targeting the growth rate of the aggregate performs better than any other indicator of the monetary policy stance for inflation management purposes.[5] Such a monetary policy tool also has clear advantages in accounting for variations in personal consumption expenditure and stock market fluctuations. Specifically, it outperforms the current federal funds rate and also the total assets held by the Federal Reserve system, both of which have been and are central to the current inflation management mandate by the Fed. Note that we use total assets held by the Fed as a measure of unconventional monetary policy such as quantitative easing. Lastly, Figs. 9 and 10 also support the findings of Hall et al. (2023) that the recent inflation trend in the US is mainly due to shocks to the money supply among other factor.

We therefore find evidence in support of Belongia and Ireland (2015, pp. 268) who "call into question the conventional view that the stance of monetary policy can be described with exclusive reference to its effects on interest rates and without consideration of simultaneous movements in the monetary aggregates."

[5] In this regard, see for example Barnett and Chauvet (2011), Hendrickson (2014), Selertis and Gogas (2014), and Belongia and Ireland (2014, 2015, 2016, 2018) for other dimensions of the superiority of the Divisia monetary aggregates.

7 Conclusion

We use a Bayesian structural VAR to assess the dynamic effects and relative importance of fiscal policy and monetary policy as key drivers of business cycles in the United States. We use the penalty function approach allowing us to retain the appealing simplicity of pure sign restrictions but avoid some of its most severe criticism as raised by Fry and Pagan (2011). The penalty function approach identifies a shock as the solution to an optimization problem that consist of the sum of the impulse response functions of the target variable(s) subject to some inequality constraints.

We find that monetary policy shocks are relatively more important than fiscal policy shocks in explaining key macroeconomic variations. Specifically, both fiscal and monetary policy shocks are significant sources of output variation accounting for 20% and 26% of the observed output fluctuations, respectively. A trivial percentage of fluctuations in inflation (1%) and personal consumption expenditure (4%) is attributable to fiscal policy shock. On the contrary, apart from being significant drivers of output variations, monetary policy shocks are also a significant driver of fluctuations in the inflation rate inflation (38%) and personal consumption expenditure (30%). Lastly, the stance of monetary policy may be better captured by the growth rate of a properly constructed broad money measure such as the CFS broad Divisia monetary aggregates.

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