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Economics 385

Research Paper

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Analyzing the Implications of Monetary Policy on Fiscal Policy

Introduction

Monetary and fiscal policies are important tools that governments use to control their economies. They both play important roles in shaping a country's economic well-being while having diverse goals and procedures. The central bank implements monetary policy, which includes changes to the money supply and interest rates to ensure long-term economic growth while addressing issues such as low inflation and unemployment. Fiscal policy, on the other hand, is the responsibility of the government and includes changes in taxation and government spending to establish economic stability, stimulate growth, and address concerns such as unemployment and inflation. These two policies frequently intersect and impact one another, emphasizing the necessity of understanding their interaction for politicians and economists. Monetary policy methods include open market operations, interest rates, and reserve requirements, whereas fiscal policy uses government spending and taxation to achieve its goals.

My research focuses on the impact of interest rate volatility on government spending. Higher interest rates result in higher borrowing costs, and because the United States government generates money through borrowing and taxing, knowing how these variations affect government expenditure is critical. I intend to investigate whether continuous high government spending can

be attributable solely to taxation and whether chronic low spending may be related to other variables. This research article expands on the current literature by examining the implications for government spending, providing a nuanced perspective on the effects of interest rate fluctuations.

How do interest rate swings affect government fiscal policy, specifically borrowing costs, revenue collection through taxation, and subsequent patterns of government spending?

In my research paper, I will begin by doing a review of the relevant literature connected to my study topic. The descriptive statistics for the data used in my research will next be presented. In addition to the presentation of descriptive statistics, I will give my data sources and a stationarity test. Then I'll go over the empirical procedures used in my research.

Literature Review

According to Ncube (2013), unexpected contractionary monetary policy shocks can have an impact on output. The research paper emphasizes the importance of unexpected monetary policy shocks, demonstrating their dramatic impact on important economic indices such as output and price levels. This means that changes in interest rates can have far-reaching consequences for an economy. I can draw a similar examination into how interest rate swings in the United States may lead to changes in government borrowing costs in my research. Furthermore, the paper shows that contractionary monetary policy shocks diminish output and alter nominal variables. Based on this fact, we might speculate that changes in interest rates, which directly affect borrowing costs, may have a significant impact on government spending.

Monetary and fiscal policy Interactions and fiscal stimulus by Davig et al highlight the fundamental importance of unexpected monetary policy shocks, highlighting their substantial impact on key economic indices like output and price levels. This demonstrates the far-reaching effects that interest rate fluctuations can have on an economy. The paper shows that contractionary monetary policy shocks cause output to fall and nominal variables to change. Based on this finding, we can hypothesize that change. Furthermore, Davig (2009)'s research emphasizes the critical role of current and predicted monetary and fiscal policy conduct in predicting the final consequences of government expenditure on consumption. They discover that the active or passive nature of various policy measures is inextricably tied to consumer dynamics.

Sherman J. Maisel's research focuses on the effects of monetary policy on spending in certain sectors of the economy from 1961 to the present. Maisel's analysis emphasizes the importance of monetary policy in shaping the economy, especially through its influence on spending in specific areas such as credit price, availability, and distribution. According to Maisel's research, legal and institutional issues play a significant role in determining how credit is dispersed among various expenditure sectors. Changes in supply and demand dynamics might generate changes in credit distribution. Furthermore, the movement of funds around financial institutions and markets can have an impact on expenditure that is comparable to, if not greater than, that of inflation. According to Maisel's research, higher interest rates, as a result of greater demand for funds, slower growth in the supply of funds, and disintermediation, led to a contraction in investment. This decrease in investment was most noticeable in the housing sector, but it also impacted plant and equipment investments and inventory levels. As a result, these declines had a cascade effect,

slowing the rise of income and, the growth of consumption. As a result, the economy's demand remained consistent with the potential growth rate of real output. When analyzing the interplay between monetary and fiscal policy, Wright (2019) emphasizes the necessity of nowcasting in developing reliable macroeconomic projections.

Estimating the consequences of fiscal policy in the context of a budget constraint by Claeys Peter provides alternative interpretations based on monetary policy reactions or supply-side impacts that are rejected as plausible explanations. This supports the premise that fiscal policy, particularly the interaction of government spending, taxes, and public debt, has a significant impact on economic outcomes.

According to the paper, Ricardian effects, in which families and corporations alter their behavior depending on expectations of future fiscal adjustments through tax hikes or spending cuts, maybe a major element in determining fiscal policy outcomes. This means that when fiscal expansions are likely to be offset by future fiscal adjustments, the economy may not be stimulated as predicted. Claeys' research defies common thinking by demonstrating that expansionary fiscal policy, which boosts government expenditure, can have unexpected contractionary impacts on both output and inflation.

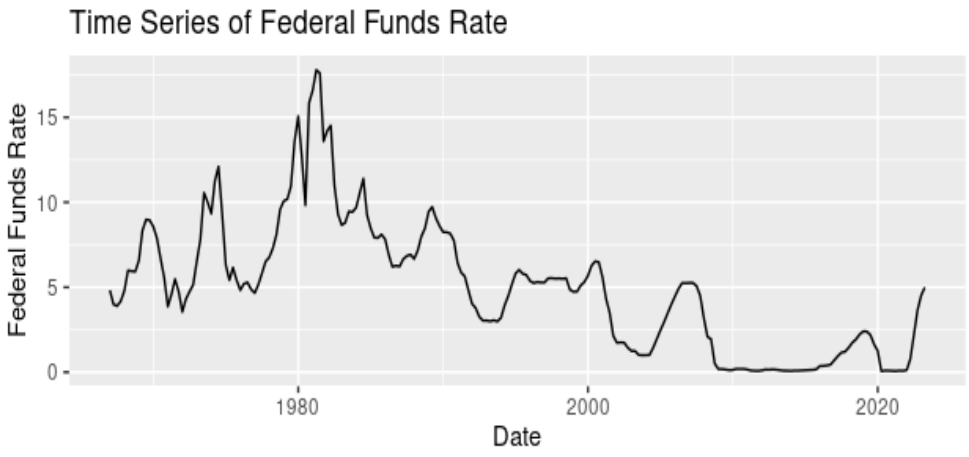
To add to the current literature, my research will look into how changes in interest rates can cause changes in government borrowing costs, affecting government expenditure patterns.

Descriptive statistics.

I will be evaluating data from two main sources: the Bureau of Economic Analysis for government total receipts, net lending and borrowing, total expenditures, and federal debt, with quarterly records spanning 1961 Q1 to 2023 Q2. In addition, I'll use statistics from the Federal

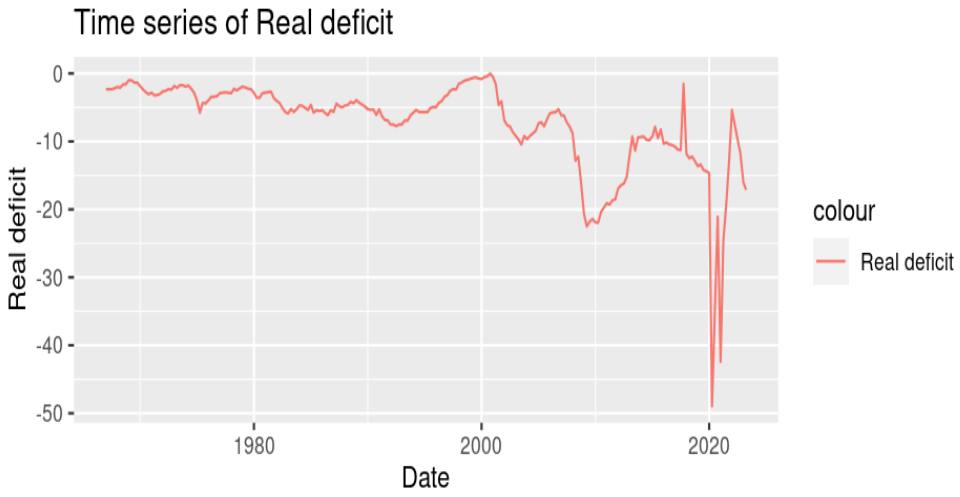
Reserve such as the federal funds rate, GDP deflator, and real GDP for my paper. The GDP deflator will be critical in converting government variables such as total receipts, net lending and borrowing, total expenditures, and federal debt into real terms, allowing for a more comprehensive analysis. The federal funds rate will be used to gauge the impact of fiscal policies, specifically on borrowing costs. These variables will help me discover the relationship between federal funds rate (monetary policy) shifts and fiscal policy dynamics by looking through implications on borrowing costs, revenue collection through taxation, and subsequent trends in government spending.

Federal Funds Rate



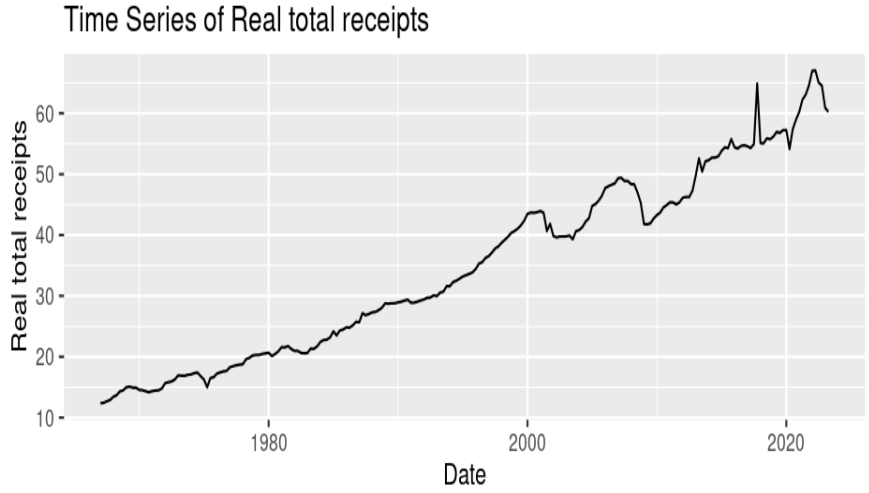
The left graph depicts the dynamic changes in the federal funds rate from 1967 to 2023. It shows a clear increasing trend beginning in 1967 and peaking about 1980, followed by a significant drop leading up to 2019. Notably, the graph reveals notable oscillations, such as those seen in the 1970s, around 2007, and in 2019, among other discernible spikes. The largest outlier happened in the early 1980s as a result of a recession at the time.

Government Net Borrowing or Lending



The annual changes in the country's net lending and borrowing are depicted in the time series data from 1967 to 2023. Sharp reductions are visible in 2007-2008 and 2019-2021, corresponding with economic downturns. Concurrently, the graph shows parallel spikes in the federal funds rate, which correlate to periods of increasing net lending and borrowing. Significant outliers arise in the late 2020s, mostly due to an increase in the COVID-19 pandemic.

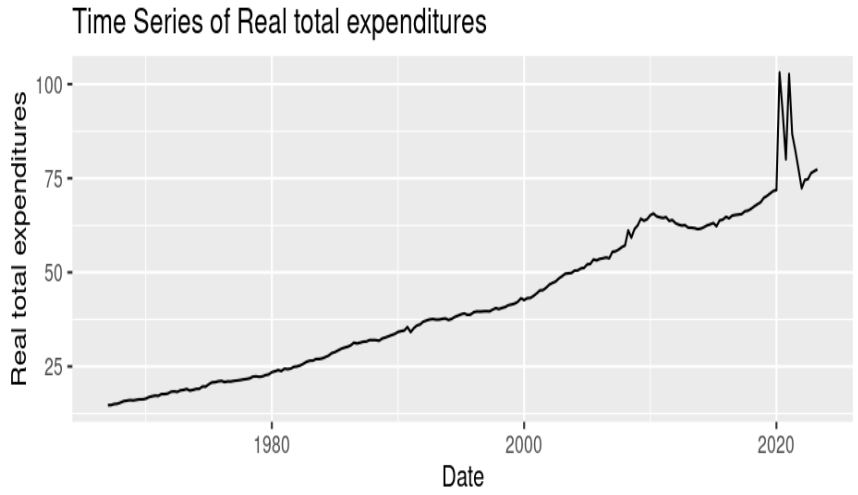
Government Total Receipts.



From 1967 to 2023, the graph on the right represents the government's revenue. Government income has shown a continuous upward trend during this

period, demonstrating a stable increase. The revenue-generating trend has been constant, with very minor deviations from an upward slope. One of the main outlier was in the late 2010's

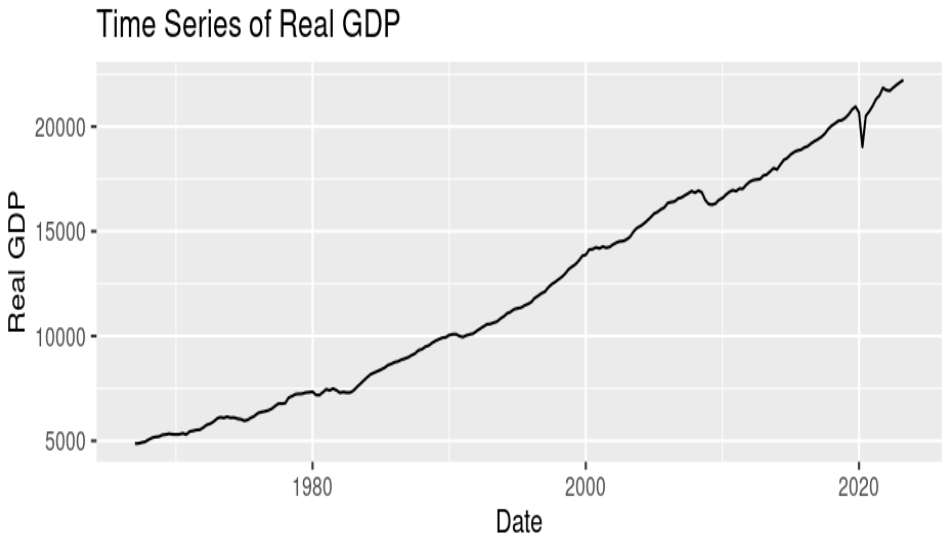
Government Expenditures



From 1967 to 2023, the time series of government expenditures shows a constant and primarily rising trend. However, considerable rises might be seen between 2019 and 2022. Significant outliers arose after 2020 as a result of increased government spending to aid economic recovery amid the COVID-19-induced recession.

Real GDP

Between 1967 and 2023, the trend in real GDP showed a continuously increasing tendency, interspersed by periods of increase. Throughout these years, the overall trend suggested a



strong and consistent rise, reflecting the country's economic prosperity and development. Notably, there were intermittent downturns in the late 2000s and 2021, when the economy underwent transitory contractions or decreases within an otherwise increasing trend. These brief decreases were anomalies to an otherwise consistent pattern of expansion, demonstrating the economy's resilience and progressive nature during this time period.The nation experienced a severe recession caused by the epidemic in the early 2020s, resulting in a fall in real GDP.

Federal Debt

From 1967 to 2023, the government debt shows a constant growing trend, with a noticeably increased increase between 2000 and 2023. A significant increase is visible in 2020, coinciding with the commencement of the COVID-19 pandemic. This increase in debt stands out dramatically when compared to previous years, coinciding with a major increase in government spending throughout that time period. These tendencies are strongly illustrated in the graph below.

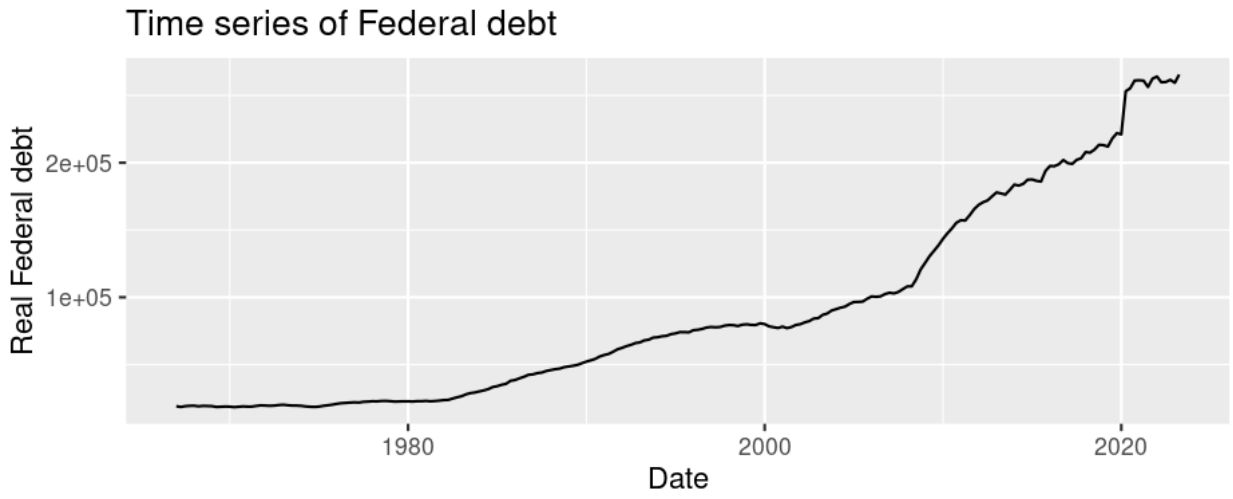


Table of Descriptive statistics

Descriptive statistics	Federal Funds rate	Federal Debt	Real GDP	Total receipts	Total expenditures	Net lending or net borrowing
Min	0.060	18405	4870	12.39	14.73	-48.95425
Mean	4.96332	89154	12239	34.75	42.00	-7.26808
Max	17.78692	265528	22225	67.03	103.10	-0.01091

My data is made up of 226 observations from quarter 1 1967 to quarter 2 2023. Using the Phillips-Perron Test, If test statistics and their absolute values are greater than the critical value (-2.88), we can conclude stationarity for the variable.The initial test statistics for the Phillips-Perron test indicated non-stationarity for most variables: -2.1589 for the federal funds rate (ffr), -3.6927 for the real deficit, -0.2334 for real total receipts, -0.4139 for real total expenditures, 1.8853 for real GDP, and 3.9694 for the federal debt. Notably, only the real deficit and the federal debt showed stationarity.

We altered the non-stationary variables using log differences or variable differences to overcome this. The Phillips-Perron test was subsequently rerun, yielding significantly lower test statistics demonstrating stationarity across all variables: -11.2196 for ffr, -11.8537 for federal debt,

-14.9155 for real GDP, -21.1744 for real total expenditures, -16.7131 for real total receipts, and -19.841 for real deficit. All variables have now achieved stationarity as a result of this modification. This transformation allowed us to achieve stationarity by strengthening the robustness of our findings and the reliability of the conclusions.

Empirical Methods.

The SVAR model provides simulations that show how changes in the federal funds rate affect governmental activities. By using lagged variables as instruments, these models efficiently resolve endogeneity concerns, allowing for a comprehensive understanding of how external shocks affect the system. Following an evaluation based on out-of-sample criteria such as AIC and BIC, the recommended SVAR model for my variables required the use of four lags , resulting in a Var(4) model. The variables used in my paper are d.ffr (growth rate of the Federal Funds Rate), d.debt (growth rate of real federal debt), d.government (real total government expenditures), d.deficit (real net lending and borrowing), d.taxes (real total receipts), and d.output (real GDP). The goal is to assess how changes in the Federal Funds Rate affect fiscal policy variables (government deficit, debt, taxes, and spending), with d.output serving as a control variable. The dataset contains 226 observations spanning from the first quarter of 1967 to the second quarter of 2023.

To avoid the issue of equation bias and feedback loops, causation between variables is difficult to

determine. I use Cholesky decomposition restrictions on my residual matrix as seen below.

$$\begin{pmatrix} e_{\text{ffr}_t} \\ e_{\text{debt}_t} \\ e_{\text{Government}_t} \\ e_{\text{deficit}_t} \\ e_{\text{taxes}_t} \\ e_{\text{output}_t} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a & 1 & 0 & 0 & 0 & 0 \\ b1 & b2 & 1 & 0 & 0 & 0 \\ c1 & c2 & c3 & 1 & 0 & 0 \\ d1 & d2 & d3 & d4 & 1 & 0 \\ e & e2 & e3 & e4 & e5 & 1 \end{pmatrix} \begin{pmatrix} \epsilon_{\text{ffr}_t} \\ \epsilon_{\text{debt}_t} \\ \epsilon_{\text{Government}_t} \\ \epsilon_{\text{deficit}_t} \\ \epsilon_{\text{taxes}_t} \\ \epsilon_{\text{output}_t} \end{pmatrix}$$

As a result from the equation above, I imposed 15 constraints, allowing for the identification of causation. The ordering of the variables in the residual matrix is based of economic intuition with The Federal Funds Rate's rate to investigate its impact on key economic indices. Then the real federal debt growth rate follows the Federal Funds Rate to understand how it reacts to changes in interest rates that affect the cost of borrowing, and borrowing patterns. After, total government spending in real terms following that is an examination of how the Federal Funds Rate and debt levels influence government spending decisions. Followed by net lending and borrowing in real terms, The impact of interest rates, debt, and government spending on the deficit is tracked. Then the real total receipts observe changes in tax revenue as a result of economic conditions and policy alterations driven by the preceding variables. Finally, real GDP serves as a control variable, allowing for an examination of how changes in the Federal Funds Rate affect fiscal policy variables and the broader economy via GDP swings.

Empirical Results

I used impulse response functions to analyze the influence of changes in the federal funds rate on key economic variables such as federal funds rate and real federal debt. I was particularly interested in determining the impact of changes in the federal funds rate on government

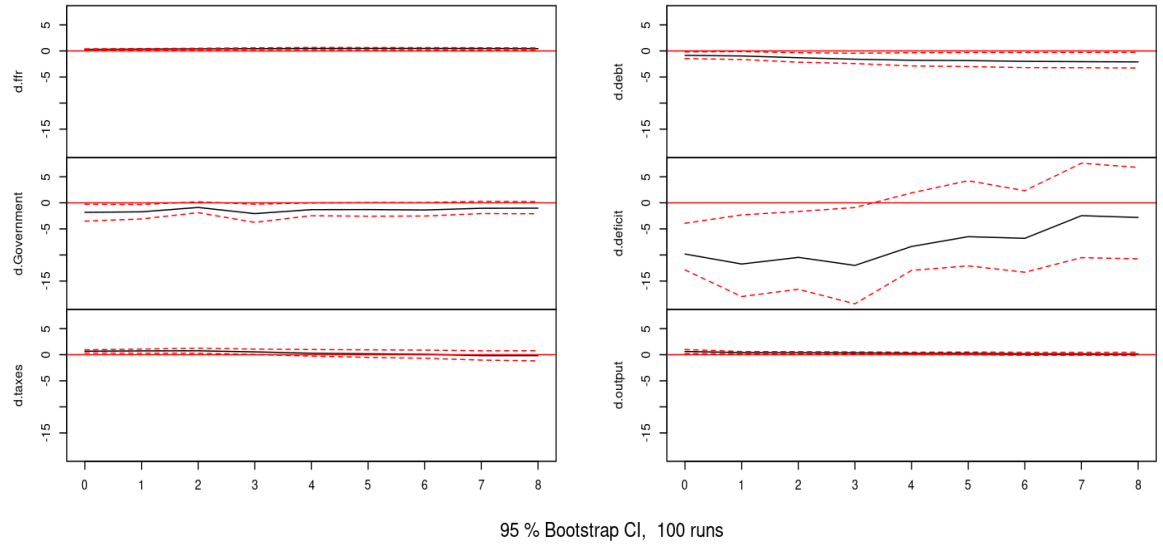
spending, debt, and revenue. I included variables such as real GDP to guarantee a full study and avoid omitted variable bias, as swings similarly influence these in the federal funds rate. The generalized impulse response functions allowed me to see how the federal funds rate affected all the model variables.

The Impulse Response Function for Federal Funds Rate

Table of results

$d.ffr						
	d.ffr	d.debt	d.Government	d.deficit	d.taxes	d.output
[1,]	0.2928036	-0.8517928	-1.8276922	-9.82065	0.673904	0.6256755
[2,]	0.3497228	-0.9669833	-1.7270427	-11.735155	0.7259136	0.4077798
[3,]	0.3949562	-1.2997811	-0.8860436	-10.460021	0.7502312	0.3973904
[4,]	0.4470589	-1.5831618	-2.0722698	-12.002501	0.5424837	0.3585972
[5,]	0.4790178	-1.7918228	-1.3057506	-8.366111	0.2842195	0.2734482
[6,]	0.4829118	-1.8506687	-1.2888638	-6.493504	0.1785461	0.2669013
[7,]	0.482411	-1.9968019	-1.3732587	-6.8074	0.0796592	0.1836922
[8,]	0.4750307	-2.0578983	-1.0470192	-2.461789	-0.1814536	0.1671781

A shock to the Federal Funds Rate (d.ffr) had an immediate favorable impact on itself (0.2928036) in the first period. This shock resulted in an instantaneous negative reaction in both government debt (-0.8517928) and government spending (-1.8276922). Furthermore, it had a significant negative impact on the deficit (d.deficit) (-9.820650), whereas taxes (d.taxes) responded positively (0.67390398). Similarly, output (d.output) responded positively (0.6256755). The Federal Funds Rate's response to its shock had diminished (0.4750307) by the eighth period, demonstrating a lessening impact over time. Similarly, between the seventh and eighth periods, both government debt (d.debt) and government spending (d.Government) showed lower negative reactions (-2.0578983 and -1.0470192, respectively) to the shock in d.ffr.By the eighth period, the influence on the deficit (d.deficit) had similarly lessened (-2.461789). By the seventh period, taxes (d.taxes) had maintained a negative response (-0.18145358), while the influence on output (d.output) had decreased (0.1671781) compared to its initial response to the shock in d.ffr.



The graph shows how an increase in the growth rate of the federal funds rate (ffr) and growth rate in the government deficit and government total expenditures connects with decreases in

growth rates of federal debt, output, and total government receipts . It shows a decline in output while also signifying an increase in the federal funds rate. This link implies that a positive shock to the federal funds rate causes interest rates to rise, hence boosting borrowing costs. As a result, the government would prefer to borrow less, resulting in lower investment, output, and overall income. As seen above, Government total increases but slightly, the rate at which the government borrows also slows down. The persistent growth in the government deficit reflects an ongoing trend of the US government consistently running deficit budgets. The higher Federal Funds Rate prompts reduced borrowing among individuals, leading to lower government receipts, which aligns with the observed trends in output.

The impulse response Function For Federal debt

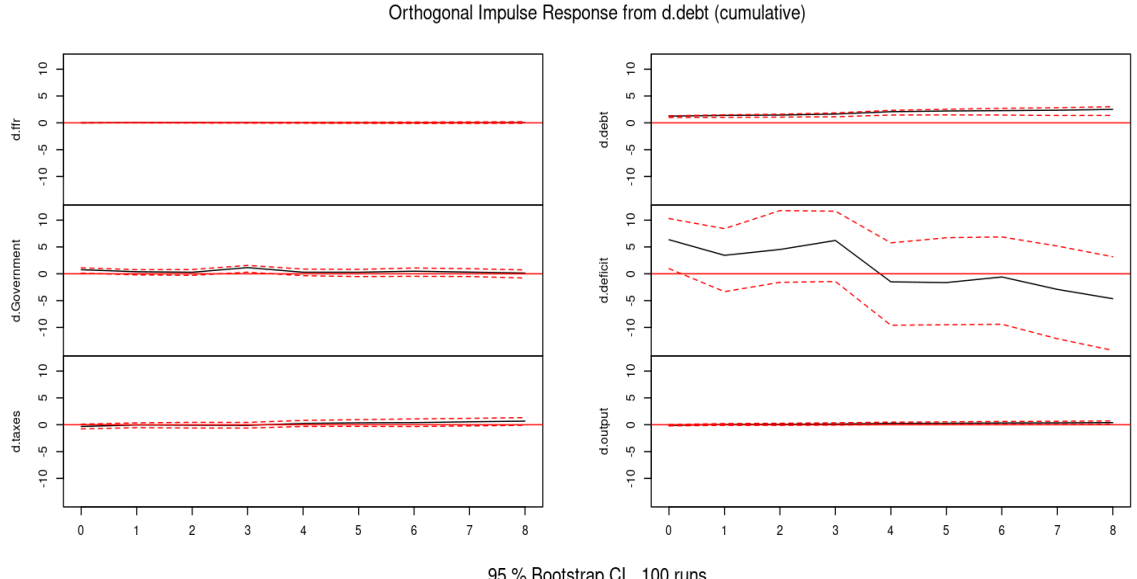
Table of results

$d.debt						
	d.ffr	d.debt	d.Government	d.deficit	d.taxes	d.output
[1,]	0	1.255766	0.7554373	6.3492093	-0.3298759	-0.1341855
[2,]	0.0401267	1.390674	0.3847449	3.4431471	-0.0454402	0.0563531
[3,]	0.0464558	1.453891	0.2831338	4.5337252	-0.0891555	0.0857746
[4,]	0.0303534	1.638281	1.1524935	6.2121335	-0.1210506	0.1309867
[5,]	0.0187519	2.080718	0.2887173	-1.5008256	0.2409373	0.2540968
[6,]	0.0124323	2.207969	0.2837565	-1.6339266	0.3552277	0.2680044

[7,]	0.0121745	2.271398	0.4871283	-0.5924219	0.3953972	0.3284601
[8,]	0.0252553	2.349498	0.3083015	-2.9070109	0.5445667	0.3439033

A shock to the Federal Funds Rate (d.ffr) resulted in an immediate positive response, influencing itself positively (1.255766). Government debt (d.debt) and government expenditure (d.Government) both saw rapid unfavorable reactions (0.7554373 and 6.3492093, respectively). The deficit (d.deficit) responded adversely (-0.32987592), although taxes (d.taxes) and output (d.output) both responded positively (-0.13418548 and -0.32987592).

The shock's influence on the Federal Funds Rate (d.ffr) has diminished (0.02525527) from its initial response by the eighth period, demonstrating a lessening impact over time. Similarly, between the first and eighth periods after the shock in d.ffr, government debt (d.debt) and government expenditure (d.Government) showed lower negative effects (-2.9070109 and 0.3083015, respectively). By the eighth period, the effect on the deficit (d.deficit) had similarly diminished (-2.9070109), indicating a declining impact with time. Furthermore, by the eighth period, taxes (d.taxes) had maintained a negative response (-0.5445667), whereas the impact on output (d.output) had diminished (0.34390334) compared to its initial response to the shock in d.ffr.



A shock to the debt causes a drop in the deficit's growth rate and a rise in debt. There is small rise towards the end to change in real gdp and the Federal Funds Rate. However, there is a modest increase in government spending at first, which then falls and returns to zero. This implies that the effect on government spending is just ephemeral.Slight growth in total receipts suggests that some individuals in the economy are benefiting from the money spent through government borrowing. The decreasing growth of the deficit indicates a trend of reduced government reliance on deficit budgets.

The slight increase in debt coincides with a slight rise in output, indicating potential investment in enhancing output. As output grows, there's a subtle increase in the Federal Funds Rate by the Fed, likely to prevent potential inflation resulting from increased economic activity.

While increased government spending aligns with higher borrowing, the subsequent drop raises questions. Further investigation is necessary to comprehensively understand the reasons behind this fluctuation in government spending.

My forecast variance decomposition

Forecast variance decomposition is a time series analytic tool for determining the causes of forecast inaccuracies. It deconstructs the total forecast error into distinct components, assigning forecast error variance to various variables.

The tables below depict contribution of federal funds shock and debt to the forecast error variance of the variables of interest (d.ffr, d.debt, d.Government, d.deficit, d.taxes, d.output) at various times in time.

$d.ffr	Column1	Column2	Column3	Column4	Column5	Column6
	d.ffr	d.debt	d.Government	d.deficit	d.taxes	d.output
[1,]	1	0	0	0	0	0
[2,]	0.9155961	0.0165695	0.0164754	0.0089998	0.0087369	0.0336224
[3,]	0.8904829	0.0161447	0.0275931	0.012895	0.0193864	0.033498
[4,]	0.848932	0.0172939	0.0680683	0.013404	0.0196572	0.0326446
[5,]	0.8246779	0.0177901	0.0875618	0.0140868	0.0244348	0.0314486
[6,]	0.8216772	0.0180688	0.0879034	0.0140333	0.0266329	0.0316844
[7,]	0.8191658	0.0180141	0.0878473	0.0151172	0.0280832	0.0317724
[8,]	0.8154639	0.0193939	0.0874282	0.0161503	0.0281077	0.033456

d.ffr's own innovation accounts for 100% of the forecast error variation (as indicated by '1' in the first column) and other variables' innovations are not credited with any contribution.

In addition, for period 8 (the last row):

Its innovation accounts for approximately 81.5% of the forecast error variation of d.ffr.

The remainder is ascribed to innovations in other variables: d.debt contributes approximately 1.94%, d.Government approximately 8.74%, d. deficit of approximately 1.62%, d.taxes approximately 2.81%, and d. output approximately 3.35% to the prediction error variance of d.ffr.

Table for debt

$d.debt						
	d.ffr	d.debt	d.Governmen t	d.deficit	d.taxes	d.output
[1,]	0.3151144	0.6848856	0	0.00E+00	0	0
[2,]	0.3044109	0.6572382	0.0043826	2.58E-05	0.0334542	0.0004883
[3,]	0.3209564	0.6041331	0.0071915	1.77E-02	0.0481449	0.0019133
[4,]	0.3283174	0.5766235	0.0072292	2.04E-02	0.0594621	0.0079703
[5,]	0.314062	0.5900716	0.0067633	1.86E-02	0.0568762	0.0135831
[6,]	0.310125	0.5857498	0.0067477	2.01E-02	0.0638776	0.0134408
[7,]	0.3111321	0.5763345	0.0068785	2.12E-02	0.0684577	0.0160248
[8,]	0.3081557	0.5705704	0.0090794	2.18E-02	0.0699694	0.0204625

For the first time period, d.debt's own innovation accounts for around 31.51% of its forecast error variance.d.ffr accounts for approximately 68.49% of the forecast error variation of d.debt. At time period eight, the change in the Federal Funds Rate (d.ffr) now contributes 57.06% to the forecast error variance of the change in debt (d.debt), while the change in debt itself contributes 30.82%. Changes in government (0.91%), deficit (2.18%), taxes (6.99%), and output (2.05%) also contribute to the predicted error variance of the change in debt.

Conclusion

My study focuses on the effects of interest rate changes on government spending, specifically how higher interest rates affect borrowing costs and revenue collection through taxation. The key subject concerns the relationship between interest rate swings and government fiscal policy, specifically how they affect borrowing, income collection, and future spending patterns. I then perform descriptive statistics using six variables and 226 observations, transforming the variables to stationary and analyzing empirical data with an SVAR model with four lags. The analysis uncovered important consequences for government spending, borrowing costs, tax collection, and subsequent spending trends.

The findings demonstrated that raising the Federal Funds Rate resulted in significant correlations between the growth rates of several fiscal variables. A positive shock to the Federal Funds Rate caused interest rates to rise, raising borrowing expenses. As a result, the government decided to borrow less, resulting in lower investment, output, and overall income.

The observed data demonstrated a steady increase in the government deficit, suggesting a reliance on deficit budgets. Higher Federal Funds Rates prompted consumers to borrow less, contributing to fewer government receipts and matching with trends seen.

A possible policy conclusion of my research would be that synchronizing monetary and fiscal policies in the face of interest rate changes is critical. Policymakers must weigh the effects of these adjustments on government borrowing costs, revenue, and spending. Reducing government borrowing due to increasing interest rates necessitates proactive budgetary measures. Diversifying revenue sources, improving spending efficiency, and modifying borrowing patterns can all help to manage diminished investment and productivity.

Encouraging sustainable borrowing patterns while maintaining appropriate revenue is critical. This could include adjusting taxing policies or looking for additional revenue sources to offset lower borrowing without jeopardizing necessary spending. In summary, policymakers require flexible fiscal policies to navigate economic upheavals while assuring stability and growth, particularly during volatile periods caused by interest rate increases.

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