The effect of Government Spending on Macroeconomic Activity : a SVAR Analysis

Victoria Godio, Baptiste Messant & Raphaël Perilhou

Toulouse School of Economics

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Abstract

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This empirical analysis examines the impact of government spending shocks on the economic activity, focusing on real GDP, real consumption, and the Economic Policy Uncertainty index. Using quarterly U.S. data from 1947 to 2015, we estimate a four-variable structural vector autoregressive (SVAR) model identified through a recursive Cholesky decomposition. The transmission of government spending shocks is analysed using impulse response functions and forecast error variance decompositions over a six-year horizon. Our results indicate that output responds positively in the short run before turning negative at longer horizons, while consumption exhibits a small and negative response and the economic policy uncertainty responds countercyclically, but only slightly.

Contents

1 Introduction

Understanding the effects of government spending on the economy is essential in macroeconomic theory and economic policy. According to Keynes (1936), in periods of economic downturn, fiscal policy must be used by the State as a tool to support the propensity to consume, aggregate demand, sustain employment, and foster economic recovery. More recently, the role of public spending has been further emphasised in the context of large-scale fiscal programs implemented in response to major economic crises, such as the Global Financial Crisis through the American Recovery and Reinvestment Act (2009)[1] and the COVID-19 pandemic through the CARES Act (2020)[2], both of which occurred in the United States.

However, the empirical effects of government spending on macroeconomic aggregates remain subject to debate. While standard Keynesian theory predicts a positive fiscal multiplier, Neoclassical models highlight the crowding-out effect and the forward-looking behaviour (Ricardian equivalence), implying a decrease of the consumption and investment after a positive government spending shock. The transmission channels of government spending shocks are therefore still debatable in the empirical literature.

Firstly, Blanchard and Perotti (2002) have found through a SVAR model, that a positive structural shock on the governement spending has a positive impact on the output. However, they also find that the multipliers are always small and often close to one. This reflects the fact that a government spending shock implies two opposite effects on the components of output : while private consumption increases, private investment is crowded out and both imports and exports decrease. In addition, Ramey (2011) showed that when governemnt spending shocks are identified using a narrative approach, private consumption drops in response to a positive government spending shock, while the standard VAR approach by Blanchard and Perotti (2002) predicts a positive consumption reponse.

Ramey and Shapiro (1998) studied the effects of government spending and show that fiscal shocks are highly sector-specific. Moreover, they argue that accounting for sectoral composition of government spending and costly capital mobility is crucial, as both can significantly affect output and real consumption. Their identification relies on capturing the major military buildups through a dummy variable created using narratives techniques. With this method they found opposite results compared to SVAR literature. Later, Ramey (2011) try to exlain this difference and shows that Ramey and Shapiro (1998) war dates granger-cause the SVAR shocks.

Moreover, Belke and Goemans (2019) study the impact of government spending shocks on output during tranquil and uncertain times, allowing uncertainty to react endogenously to fiscal spending. They find that while fiscal expansions are associated with positive output effects in tranquil periods, they become contractionary during times of high uncertainty. This result can be explained by the fact that higher uncertainty triggers precautionary saving by households

[1] Federal Communications Commission (FCC), *American Recovery and Reinvestment Act of 2009*, official homepage.

[2] U.S. Economic Development Administration (EDA), *CARES Act Recovery Assistance*, official website of the United States government.

and real option effects for firms, which can dominate the direct demand stimulus and lead to a decline in output.

In this paper, we present the results of an empirical analysis examining the impact of governement spending shocks to the GDP, consumption and the Economic Policy Uncertainty (EPU) index. The EPU index has been developped by Baker et al. (2016) and is defined as policy-related economic uncertainty index based on 12,000 newspaper coverage frequency. The authors have found that the EPU index is associated, with higher stock price volatility and a decrease of investment and employment for specific sectors.

Our empirical analysis relies on a quaterly data frequency from the U.S from 1947 to mid-2015. We rely on a structural vector autoregressive (SVAR) model identified through a Cholesky decomposition, following the approach of Blanchard and Perotti (2002), which assumes that government spending is predetermined within the quarter due to decision and implementation lags. We study dynamic transmission of government spending shocks using impulse response functions (IRF) and forecast error variance decomposition (FEVD) with a time horizon of six years, in order to analyse their impact on real GDP, real consumption, and the economic policy uncertainty (EPU) index. In the literature, the VARs which identification relies on the assumption that government spending is predetermined within the quarter usually find an increase in consumption after a positive government spending shock (Blanchard and Perotti, 2002; Galí et al., 2007; Fatás and Mihov, 2001; Caldara and Kamps, 2008). Altough we use the same identification assumption, we found opposite results.

Indeed, the impulse response analysis shows that following a one–standard-deviation government spending shock, public expenditure reaches a peak after one year and gradually returns to its trend after six years. The government spending shock is therefore temporary but persistent in the short to medium run. GDP responds positively to the spending shock before turning negative after the twentieth quarter. In contrast, consumption exhibits a small and short-lived negative response, quickly reverting to its long-run trend. Finally, the EPU index responds countercyclically, but only slightly to the government spending shock: it initially declines, reaches its minimum around the seventh quarter, and slowly returns to its trend after six years. The forecast error variance decomposition further indicates that government spending and the EPU index are largely driven by their own structural shocks. In addition, GDP fluctuations are mainly explained by their own innovations, with consumption representing the most important external source of variation, and consumption itself is significantly influenced by GDP shocks.

This empirical paper is organised as follows: Section 2 provides the data description and variables construction. This section discusses the non-stationarity issue, the ADF and Johansen cointegration tests. Section 3 introduces the four-variable SVAR representation, including the Cholesky decomposition, variables ordering and lag selection. Section 4 reports the results of the impulse response functions and the forecast error variance decompositions. Finally, Section 5 concludes and discusses the limitations and the possible extensions.

2 Data Description and Construction

This study uses two different datasets to analyse the impact of government spending shocks on three U.S. macroeconomic variables: GDP, consumption and the Economic Policy Uncertainty Index (EPU). The first database comprises several U.S. macroeconomic variables, including nominal GDP, nominal durable and non-durable consumption, nominal total investment and nominal government purchases. These data are available at a quarterly frequency from 1947 to mid-2015. The second database provides the EPU index at a monthly frequency from 1900 to 2025.

2.1 Macroeconomic variables

From the first database, the following variables are used for this analysis :

- Nominal GDP
- Nominal Durable and Services Consumption
- Nominal Government Purchases

The first step in the data construction consists in transforming nominal macroeconomic variables into real variables. This transformation is achieved by deflating each nominal series using the corresponding price deflator at the quarterly frequency. For each quarter q of year y, the real macroeconomic variables are computed as follows:

$$\text{Real GDP}_{y,q} = \frac{\text{Nominal GDP}_{y,q}}{\text{GDP Deflator}_{y,q}}.$$

$$\text{Real Consumption}_{y,q} = \frac{\text{Nominal Nondurable Consumption}_{y,q} + \text{Nominal Services Consumption}_{y,q}}{\text{Consumption Deflator (Nondurable + Services)}_{\ y,q}}$$

$$\text{Real Government Spending}_{y,q} = \frac{\text{Nominal Federal Government Purchases}_{y,q}}{\text{Government Purchases Deflator}_{y,q}}$$

Subsequently, all three real variables are expressed in natural logarithms.

2.2 Economic Policy Uncertainty Index

The last variables that must be added to the analysis is the Economic Policy Uncertainty Index. This Index is originally available at a monthly frequency. To ensure consistency with the quarterly macroeconomic variables, the EPU series is aggregated to a quarterly frequency by computing the simple average of monthly observations within each quarter. The quarterly EPU index is then merged with the macroeconomic dataset. The period is then adjusted to ensure that all variables share a common start and end date, resulting to a merged database from 1947 to mid-2015 at a quaterly frequency.

2.3 Non stationarity and Detrending

In time-series analysis, it is essential to work with stationary variables. In this section, we test whether the macroeconomic time-series variables are stationary and, if necessary, choose the appropriate detrending method.

According to Blanchard and Perotti (2002), to address the potential non-stationarity of the macroeconomic variables the authors considered two alternative specifications. The first is the deterministic trend (DT) specification, we assume that each variable contains a linear deterministic trend and no stochastic trend (ST). Formally, in this case we estimate the following equation:

$$Y_t = \alpha + \beta t + u_t \tag{1}$$

with

$$Y_t' = \Big(\log(\text{Real GDP}_t) \quad \log(\text{Real Consumption}_t) \quad \log(\text{Real Government Spending}_t)\Big)$$

and take the residuals u_t as the detrended, stationary series for each macroeconomic variables to be used in the VAR model.

Secondly, under the stochastic trend specification, we assume that the variable contains a stochastic trend (unit root) and detrend the series by taking first differences.

$$\Delta Y_t = Y_t - Y_{t-1} \tag{2}$$

2.3.1 Visual Inspection

Following Blanchard and Perotti (2002), we first inspect the data visually and then perform formal unit-root test (Augmented Dickey–Fuller deterministic trend) to assess whether the series are better characterized as deterministic trend or stochastic trend in the sample period.

Figure 1 displays three time series plots showing the evolution of the macroeconomic variables : Real GDP, Real Consumption and Real Gouvernement spendings, all expressed in logarithms. A deterministic trend implies that the realizations of a time series follow a fixed function of time, whereas a stochastic trend arises when shocks to the underlying random process have permanent effects on the evolution of the time series[3]. Therefore, at the first sight, for the GDP and consumption series, we observe a clear upward trend over time, suggesting the presence of a deterministic trend component. The government spending series also exhibits an upward trend, although it appears to be more volatile. However, we cannot rule out the presence of a deterministic trend in this case as well. Therefore, this observation motivates us to use a formal test, the Augmented Dickey-Fuller Unit Root test as done by Blanchard and

[3]See Jude C. Hays (2024), *Time Series Analysis: Models with Trends*, lecture notes, September 25.

Perotti (2002).

2.3.2 Formal Unit Root Test

The Augmented Dickey-Fuller test examines whether the time series contains a stochastic trend by testing the null hypothesis of a unit root, that is, whether the series is non-stationary. Table 1 reports the results of the Augmented Dickey–Fuller (ADF) unit root test, including the ADF test statistics and the corresponding 5% critical value with the intercept and selecting the lag using the AIC criterion. For real GDP and real consumption, we fail to reject the null hypothesis of a unit root at the 5% significance level, whereas the null hypothesis is rejected for real government spending.

Accordingly, real GDP and real consumption are likely to be non-stationary time series , in other words they are likely $I(1)$, while real government spending appears to be stationary. As two variables are not stationary, therefore we will proceed to Johansen Cointegration Test.

2.3.3 Johansen Cointegration Test

The Johansen Cointegration Test, introduced by Johansen (1988), is a statistical method designed to assess cointegration among non-stationary time series variables. This test provides two approaches to determine the number of cointegrating relationships: the Trace test and the Maximal Eigenvalue test. Table 2 reports the results of the Johansen cointegration test between real GDP and real consumption, both of which are non-stationary variables in the analysis. The table presents the trace statistic and the 5% critical value. The cointegration test is conducted with a constant in the cointegrating equation and four lags in the VAR model. The null hypothesis of no cointegration (r=0) is rejected, as the trace statistic exceeds the 5% critical value (73.954 > 19.96), indicating the existence of at least one cointegrating relationship between the variables. Given that the system is bivariate, this result implies a unique cointegrating relationship between real GDP and real consumption. This finding is consistent with the economic literature, which predicts that consumption and output move together in the long run. Indeed, in the model Real Business Cycle (RBC) model, due to intertemporal optimization (Euler equation) and a constant saving rate, the consumption represents a constant rate of the output, implying that consumption and output move together in the long run.

2.3.4 Detrending method from Blanchard and Perotti (2002)

As a cointegration between two variables exists, we choose not to estimate a Vector Error Correction Model (VECM), as it is above our level. Engle and Granger (1987) highlights the fact that when there is cointegration between variables, the technique used to detrend non-stationary variables using the first difference is misspecified. Hence, we pursue with the deterministic trend specification using linear and quadratic detrending as suggested by Blanchard and Perotti (2002). To ensure stationarity, we remove deterministic trends from the macroeconomic variables. Specifically, we detrend the log of consumption, GDP and gouvernment spending by regressing each series :

$$Y_t = \alpha + \beta t + \gamma t^2 + u_t, \tag{3}$$

We extract the residuals from each regression, which capture only the deviations from the long-run deterministic trend. Afterwards, we performed an Augmented Dickey-Fuller test on the detrended residuals with a quadratic trend, including the intercept and selecting the lag using the AIC criterion. Table 3 indicates that the null hypothesis of a unit root is rejected at a 5% signifiance level for real GDP and real gouvernement spending as the ADF statistics are lower than the 5% critical value (-3.251 and -3.636 respectively). For real consumption, the null hypothesis is rejected at the 10% but close to 5% (-2.615). Overall, this results demonstrate that the detrended residuals are stationary, supporting the assumption that non-stationarity in the orignal series arises from the deterministic trend.

The final result is completed by a final visual inspection of the quadratic detrended series Figure 2. The graphical representation shows that, after removing the deterministic trend, the long-run growth present in the original series is eliminated, leaving only stationary cyclical fluctuations around zero.

To ensure consistency with the residuals obtained from the detrending of GDP, consumption, and government spending, we demean the EPU index so that all variables included in the VAR model have a mean equals to zero. Therefore, in the the VAR model we will remove the constant in the regression equation. Figure 3 plots all the detrended macroeconomic variables of the analysis and the EPU index standardized over time. The consumption and the GDP comove quite closely, while government spending appears more volatile and less correlated with the other macroeconomic variables. The EPU index displays a distinct dynamic, with large spikes especially from the beginning of the 2000s, and does not always align with movements in the macroeconomic aggregates.

3 The VAR

3.1 Baseline model

In this study, we consider a four-variable VAR(p) that includes real government spending (in logs, g_t), real GDP (in logs, y_t), real consumption (in logs, c_t), and the Economic Policy Uncertainty (EPU) index.

$$Y_t = \sum_{i=1}^{p} A_i Y_{t-i} + u_t \tag{4}$$

where

$$Y_t \equiv \begin{pmatrix} g_t \\ y_t \\ c_t \\ EPU_t \end{pmatrix}$$

where the vector u_t denotes the canonical innovations, with covariance matrix Σ_u, and the matrices A_i characterize the dynamic interactions among g_t, y_t, c_t, and the Economic Policy Uncertainty (EPU) index.

3.2 SVAR Model

3.2.1 Structural Shocks

According to Ramey (2016), it exists an ambiguity in the economic literature concerning the notion of structual shocks. Some papers use the term "shock" to refer to reduced-form VAR innovations or instruments, rather than to structural economic disturbances.

This analysis will rely on the definition proposed by Bernanke (1986) and Blanchard and Watson (1986), according to which *"the shocks should be primitive exogenous forces that are uncorrelated with each other and they should be economically meaningful"*. These structural shocks should have the following chracteristics (Ramey, 2016) :

- The shocks should be exogenous with respect to the lagged endogenous varibales in the model
- The shocks should be uncorrelated with the other exogenous shocks
- The shocks represent either unanticipated movements in exogenous varibales or news about future movements in exogenous variables

3.2.2 Identification Scheme

To recover economically meaningful disturbances, we impose short-run identifying restrictions through a Chloesky decomposition.

We assume the reduced-form innovations are a linear combinaisons of structural shocks :

$$\underbrace{\begin{pmatrix} u_{g,t} \\ u_{y,t} \\ u_{c,t} \\ u_{EPU,t} \end{pmatrix}}_{u_t} = \underbrace{S}_{4\times 4} \underbrace{\begin{pmatrix} \varepsilon_t^g \\ \varepsilon_t^y \\ \varepsilon_t^c \\ \varepsilon_t^{EPU} \end{pmatrix}}_{\varepsilon_t}.$$

where ε_t is a n x 1 vector of structural shocks for each four variables in the analysis such as $E(\varepsilon_t) = 0$ and $\mathbb{E}(\varepsilon_t \varepsilon_t') = I_n$.

where S is a matrix of contemporaneous coefficients mapping structural shocks to reduced-form innovations. The structural shocks are assumed to be mutually orthogonal and computed such that :

$$\Sigma_u = SS'.$$

We impose the short-run restrictions on the matrix S making it lower triangular. It implies the latter is lower triangular and therefore, varibales ordered earlier do not respond instantaneously to shocks in the variables ordered later. Hence the matrix S will take the following form:

$$S = \begin{pmatrix} s_{11} & 0 & 0 & 0 \\ s_{21} & s_{22} & 0 & 0 \\ s_{31} & s_{32} & s_{33} & 0 \\ s_{41} & s_{42} & s_{43} & s_{44} \end{pmatrix}$$

With the Cholesky decomposition, we get the following SVAR model :

$$\begin{pmatrix} g_t \\ y_t \\ c_t \\ EPU_t \end{pmatrix} = \sum_{i=1}^{p} A_i \begin{pmatrix} g_{t-i} \\ y_{t-i} \\ c_{t-i} \\ EPU_{t-i} \end{pmatrix} + S \begin{pmatrix} \varepsilon_t^g \\ \varepsilon_t^y \\ \varepsilon_t^c \\ \varepsilon_t^{EPU} \end{pmatrix}, \tag{5}$$

Without loss of generality, we can decompose the SVAR representation into the following system of equations:

$$g_t = \sum_{i=1}^{p} \Big(a_{i,11} g_{t-i} + a_{i,12} y_{t-i} + a_{i,13} c_{t-i} + a_{i,14} EPU_{t-i} \Big) + s_{11}\, \varepsilon_t^g, \tag{6}$$

$$y_t = \sum_{i=1}^{p} \Big(a_{i,21} g_{t-i} + a_{i,22} y_{t-i} + a_{i,23} c_{t-i} + a_{i,24} EPU_{t-i} \Big) + s_{21}\, \varepsilon_t^g + s_{22}\, \varepsilon_t^y, \tag{7}$$

$$c_t = \sum_{i=1}^{p} \Big(a_{i,31} g_{t-i} + a_{i,32} y_{t-i} + a_{i,33} c_{t-i} + a_{i,34} EPU_{t-i} \Big) + s_{31}\, \varepsilon_t^g + s_{32}\, \varepsilon_t^y + s_{33}\, \varepsilon_t^c, \tag{8}$$

$$EPU_t = \sum_{i=1}^{p} \Big(a_{i,41} g_{t-i} + a_{i,42} y_{t-i} + a_{i,43} c_{t-i} + a_{i,44} EPU_{t-i} \Big) + s_{41}\, \varepsilon_t^g + s_{42}\, \varepsilon_t^y + s_{43}\, \varepsilon_t^c + s_{44}\, \varepsilon_t^{EPU} \tag{9}$$

Government spending is ordered first in the four-dimensional vector Y_t, reflecting the assumption that fiscal policy does not respond to GDP, consumption, or the economic policy uncertainty index shocks within the same quarter. For this choice we relied on the paper from Blanchard and Perotti (2002), where government spending is assumed to be predetermined within the quarter due to decision and implementation lags, implying little discretionary fiscal response to macroeconomic shocks. Additionnaly, in the US the federal gouvernment spending is decided through an annual budgetary process and has to be approved by the Congress ahead of the fiscal year [4]. Hence, we assumed that the structural gouvernement spending shock is the only shock that modifies immediately gouvernement spending.

Real GDP is ordered second in the vector, implying that real GDP reacts instantaneously to government spending and its own shocks, but does not respond immediately to shocks in consumption or economic policy uncertainty.

This choice is justified by the paper from Ravn et al. (2007) and Tenhofen (2010) the authors assumed that the GDP does not react instantaneously to consumption, while consumption

[4] https://www.usa.gov/federal-budget-process

does react immediately to shocks in GDP within the same period. Indeed, according to the Intertemporal Consumption Theory households want to smooth their consumption overtime (between investment and consumption) in order to face BaU or exogenous diasters shocks. Hence, the consumption of household react to current econonomic conditions, measured by the GDP. As the GDP is defined as *"standard measure of the value added created through the production of goods and services in a country during a certain period"* [5], we assume that a consumption shock does not react immediately into changes in GDP. These consumption fluctuations could be absorbed through inventories or importations.

Therefore, the real consumption is placed at the third place, implying that the real consumption is affected immediately by gouvernement spending, GDP and its own shocks.

Finally, the last component of the VAR vector is the Economic Policy Uncertainty index. We assumed that EPU reacts instantaneously to all structural shocks from the gouvermenent spending, the GDP, the consumption and itself. However, in this model the EPU index does not affect immediately any other variables. The empirical paper by Baker et al. (2016) introduces the Economic Policy Uncertainty (EPU) index as a quantitative indicator of economic policy uncertainty. They find that an increase in the EPU index from 2005–06 to 2011–12 foreshadows a future, rather than instantaneous, decline of about 6% in investment, 1.2% in GDP, and 0.35% in employment in the United States, using a panel VAR model. Moreover, as the EPU Index is built from press and forcasts, which reflects the structural shock of macroeconomic varibales. It is therefore logical to assume that EPU reacts instantaneously to shocks within the same quarter.

3.2.3 Lag selection

Following the VAR identification strategy introduced by Sims (1980), we have previously imposed a recursive ordering on contemporaneous interactions via a triangular Cholesky decomposition. This structure captures institutional decision lags and adjustment costs that could generate delayed responses of some macroeconomic variables. For instance, Blanchard and Perotti (2002) assumed that government expenditure does not react within the same period to fluctuations in output or taxes. In this analyis, we imposed four lags, meaning each variable in the model is allowed to depend on its own past values and on the past values of all other variables up to four periods earlier. As we are in a quaterly setting, four lags correspond to one year of past information. This choice relies on Galí et al. (2007) and Blanchard and Perotti (2002), both of whom study the impact of government spending shocks using quarterly data and impose four lags for each variable.

[5] OECD definition of nominal gross domestic product (GDP).

4 Results

4.1 Impulse Response Function

In this section, we will examine the effects of a one-standard-deviation government spending shock. To do so, we will examine the impulse response function (IRF) of our VAR model. The time horizon is 24 periods after the shock, which corresponds to six years, since we have quarterly data. It shows the response after a one standard deviation government spending shock of : the Government Spending itself, the GDP, the Consumption, the EPU index.

As mentioned previously, the variables are ordered in the same way in both the VAR and the IRF.

Figure 4 shows the effect of the shock on the variables over time. The solid line shows the estimated response, while the two dashed lines show the 68% confidence interval. Table (insert number when filtering) summarises the responses of all four variables on a yearly basis, starting at t = 0 and ending at t = 24. It also shows the peak response. As the variables are the log of real variables and then detrended, the impulse response function shows the deviation of those variables from their trend as a percentage for the log variables and as a point for the EPU index. Finally, the shock we are looking at corresponds to a shock equal to one standard deviation of government spending.

Examining the government's response to its own shock, we can observe a positive response. On impact, government spending deviates by 1.3% from its trend, reaching a peak of 2.3% by the end of the first year (4 quarters). After this quick increase, we can see that government spending response slowly returns to its trend. It shows that the effect of government spending on itself is not permanent. However, as it takes more than six years to return to its trend, we can conclude that this shock has a persistent effect in the short and medium term. Additionally, we observe no fluctuations in the response, nor any turning points or changes in sign. Furthermore, our findings regarding government spending are significant: the confidence interval is narrow and typically excludes zero.

On the other hand, if we look at the GDP response to the government spending shock, we can see that, on impact, GDP deviates by 0.2% from its trend, which is also its peak (quarter 0). In comparison to government spending, GDP deviates on impact and its response begins to decrease slowly and almost linearly over time, showing a negative response around the 20th quarter. Nevertheless, we can see that its response is persistent in the short to medium term, since it also takes more than six years to return to its trend. Here, we can also see that the GDP response seems to be persistent over time, but not permanent. Finally, as our analysis is based on a six-year horizon, we cannot see if GDP continues to decrease after the 24th quarter. If this were the case, it would mean that GDP's response to a government spending shock and its own response would be permanent over time. However, as we have seen in class, a permanent impact would require a world without frictions, and since our data is real, this is not the case. A reasonable assumption would be that GDP returns to its trend later on.

The results of the next two variables are not statistically significant, since the 68% confidence interval always includes 0 over the 24 quarters. While it is possible to interpret the results, it is important to bear in mind that they do not differ significantly from zero.

Examining the response of consumption to a government spending shock reveals that the initial response is small and negative. On impact, consumption deviates from its trend by only -0.01%. Furthermore, consumption responds negatively to the shock and GDP response; the peak of the response is reached in the second quarter, when the deviation from the trend is -0.07%. Additionally, after the peak, the consumption response quickly returns to its trend, reaching zero just before the eighth period. Finally, from around the thirteenth period onwards, the response deviates negatively from its trend until the end of our time horizon. The first thing to note here is that consumption responses oscillate over time, mainly having a negative impact, but becoming positive for some quarters (still no significantly though). It is also important to note that, even though the response is not large, it is persistent over the short and medium term. Nevertheless, as previously mentioned, these results are not significant, so it is not possible to determine whether consumption actually responds to such a shock based on our data.

Finally, looking at the EPU index, it is clear that it does not react much on impact, deviating from its trend by only 0.022 points. After the impact, the EPU reacts negatively, decreasing relatively quickly over the first four periods and reaching its peak at the seventh period, deviating by -1.12 points from its trend. After reaching its peak, the EPU response slowly returns to the trend, reaching it in the final quarter. An important point to note is that the cumulative response of government spending, GDP and consumption decreases uncertainty over time. This is evident in the first period, as uncertainty over public spending decreases immediately after the shock. It is also important to note that the response is persistent over time, as it takes six years to return to the trend. Finally, it can be observed that the EPU index moves countercyclically with the government spending response. This implies that an increase in government spending decreases uncertainty over time. However, the magnitude is very small and as previously mentioned these results are not significant, so it is not possible to determine whether economic policy uncertainty actually responds to such a shock based on our data.

Figure 5 shows the same results with the 90% confidence interval. By construction, the results are the same except we have even less signficance.

4.2 Forecast Error Variance Decomposition

In addition to impulse response functions, forecast error variance decomposition (FEVD) are also commonly used in the economic literature to analyse the relationships among variables in a VAR model. In this section, we examine the results of the Forecast Error Variance Decomposition (FEVD) obtained from the VAR model estimated previously. The FEVD depicts the four detrended time-series variables and is computed over the same horizon as the IRFs, namely 24 quarters, corresponding to six years. From Othman (2025)'s paper the FEVD represents the percentage of the h-step-ahead forecast error variance of variable j that that may be explained by innovations. Following the paper from Othman (2025) and Pfaff (2013), Figure 6 reports the FEVDs for the four variables included in the VAR model. The FEVD of government spending shows how shocks to GDP, consumption and the EPU index contribute to government spending changes. It indicates that, at short horizons, 100% of the variance is explained by its own structural shock. As the horizon increases, shocks to GDP and EPU index gradually contribute to the variance, although the government spending shock remains dominant even at long horizons.

The second panel reports the FEVD for GDP and illustrates how GDP is affected by shocks to government spending, consumption and the EPU index. The FEVD for GDP indicates that, at short horizons, almost all of variance is explained by its own structural shock. As the horizon increases, consumption shocks account for an increasing share of its variance, reaching up to 37.5%, while government spending and EPU shocks play a marginal role.

The third panel presents the FEVD for consumption. Interestingly, it shows that, across all horizons, about 75% of its variance is explained by its own structural shocks, while a stable share of approximately 25% is attributable to GDP shocks.

Finally, the last panel of the FEVD for the EPU shows that the dynamics of the EPU index are almost entirely driven by its own shocks at all horizons.

In short, these FEVD results complement the IRF analysis by quantifying the importance of each structural shock in determining the dynamics of all the variables included in the model. Three main patterns emerge: (i) government spending and EPU index are largely autonomous, with minimal contributions from other variables even at long horizons; (ii) While GDP fluctuations are predominantly driven by their own structural shocks, consumption shocks represent the most important external source of its variance (37.5%), suggesting that household consumption plays an important role in the GDP dynamics; and (iii) consumption exhibits stable dynamics with a persistent 25% contribution from GDP shocks, indicating strong bilateral linkages between these two aggregate. Overall, the FEVD analysis reveals limited gouvernement spending shock transmission and highlights consumption as one of the primary driver of macroeconomic fluctuations in our model.

5 Conclusion

This paper investigated the effect of government spending shocks on U.S. macroeconomic activity. In particular, in focuses on real GDP, real consumption and economic policy uncertainty. Using a quarterely structural VAR model over the period 1947-2015, we identified government spending shocks through a recursive Cholesky decomposition. We analyse the transmission of these shocks through impulse response functions and forecast error variance decompositions.

Our empirical results suggest limited macroeconomic transmission of government spending shocks. While government spending responds positively and persistently to its own structural shock, the responses of GDP, consumption, and the EPU index are small and statistically weak. GDP displays a small positive response that is significant only within the first year. Consumption and the EPU index show no statistically significant response, although both tend to react negatively. The consumption response appears permanent, whereas the response of the EPU index is persistent but transitory. Our result contrasts with with the commonly found procyclical consumption response in the SVAR literature (Blanchard and Perotti, 2002; Galí et al., 2007). Our finding is more consistent with forward-looking agents behaving in line with the ricardian equivalence and the Friedman (1957) permanent income hypothesis, where households anticipate future fiscal adjustments and smooth consumption accordingly.

The forecast error variance decomposition reinforces these findings by showing that the dynamics of government spending and the EPU index are dominated by their own shocks, suggesting that these variables are largely autonomous. In contrast, although the variances of GDP and consumption are mainly explained by their own shocks, each variable explains a substantial share of the other's variance.

In this paper, we use a change in government spending as a shock. However, as emphasises by Ramey (2011), it can be argued that our SVAR miss to identify unanticipated shocks because government spending shocks are anticipated at least several quarters in advance. Hence, the identified shocks may partly reflect predictable policy change rather than pure innovations. This concern potentially conflicts with our definition of shocks as representing either unanticipated movements in exogenous variables or news about future movements in those variables. Thus, it may lead to an attenuation of the estimated fiscal effects.

By detrending the variables, we remove low-frequency movements. However, as observed in Figure 1, the variables exhibit such low-frequency dynamics. For instance, the government spendings approximately follow an inverted U-shape between 1962 and 1967. As a result, detrending may discard economically relevant information, potentially weakening cross-variable transmission and biasing the SVAR estimates. This issue may be particularly relevant for fiscal policy analysis, where effects are often persistent.[6]

Furthermore, with quarterly data and 4 lags, our wide confidence intervals may be explained by few data per parameters.

In light of this, further research could be done using alternative identification schemes in order to capture anticipations, long-run relationship and low-frequency variations.

[6]see Fatás and Mihov (2001) for persistence of the effects.

6 Appendix

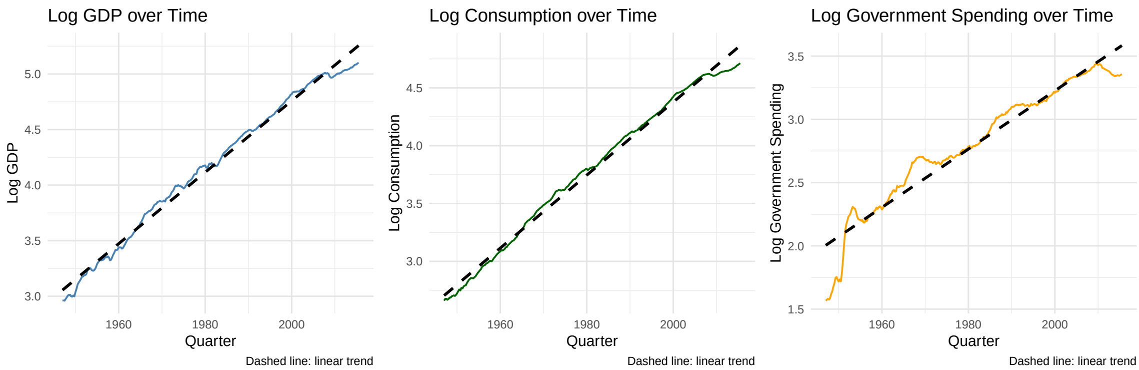

Figure 1: Three time series plots of Log GDP, Log Comsumption and Log Gouvernment Spending over time

Table 1: ADF Unit Root Tests on Log-Level Series (with Linear Trend)

Variable	ADF_Statistic	Critical_Value_5pct
Real GDP (log)	-1.393	-3.420
Real Consumption (log)	0.895	-3.420
Real Government Spending (log)	-3.460	-3.420

Table 2: Johansen Cointegration Test Results

Rank	Trace_Statistic	Critical_Value_5pct
r = 0	73.954	19.960

Table 3: ADF Unit Root Tests on Quadratic Detrended Series (with Drift)

Variable	ADF_Statistic	Critical_Value_5pct	Critical_Value_10pct
Real GDP (log)	-3.251	-2.870	-2.570
Real Consumption (log)	-2.615	-2.870	-2.570
Real Government Spending (log)	-3.636	-2.870	-2.570

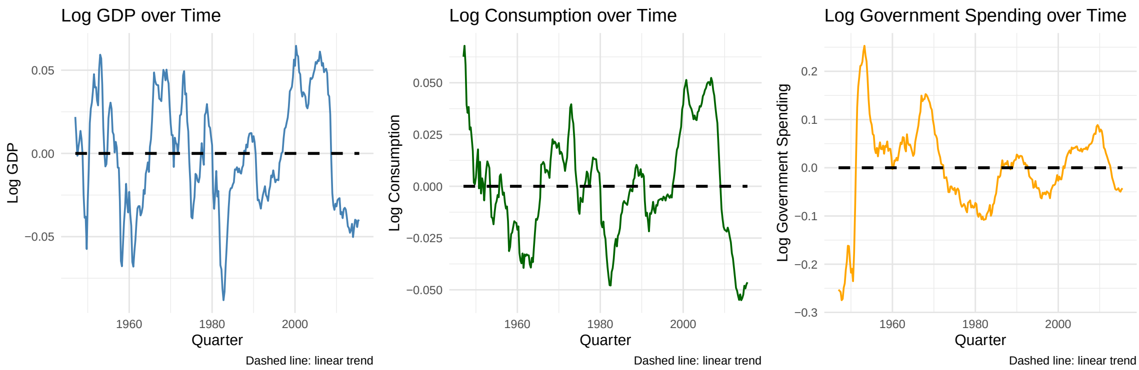

Figure 2: Detrended Macro variables representation overtime

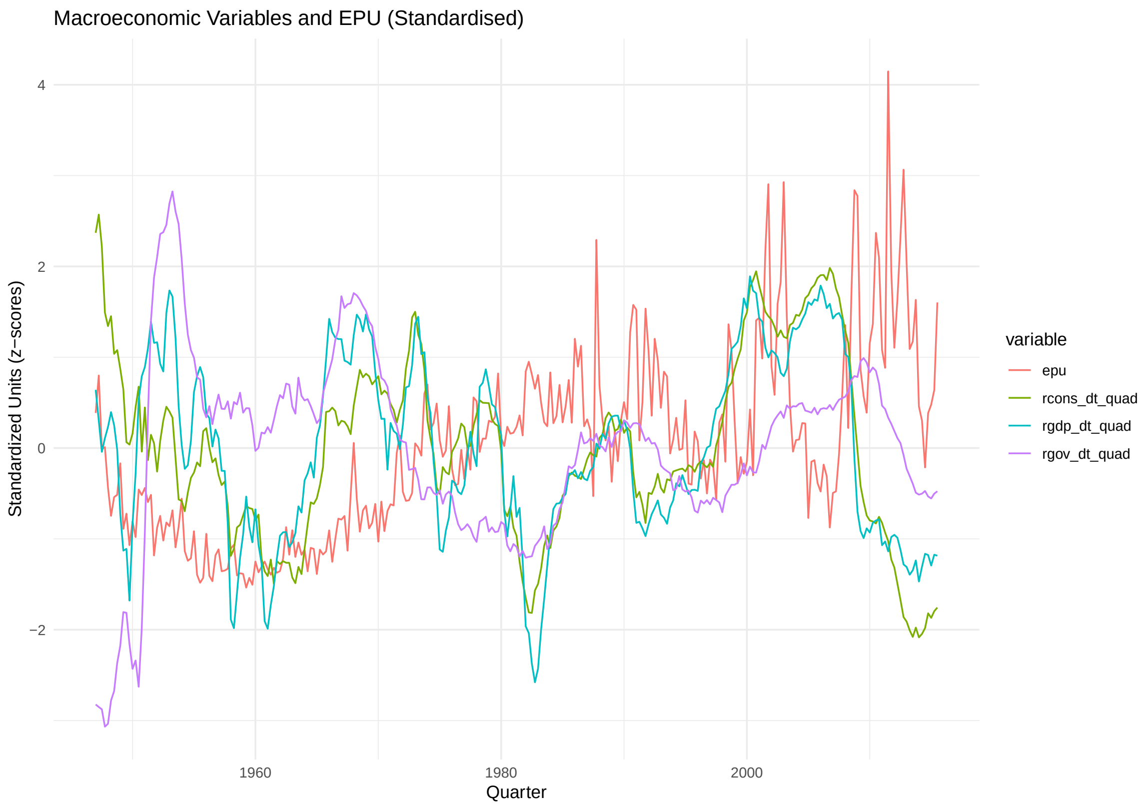

Figure 3: Standardized Macroeconomics and EPU variables over time

Table 4: Covariance Matrix of Reduced-Form VAR Residuals

	rgov_dt_quad	rgdp_dt_quad	rcons_dt_quad	epu_dm
rgov_dt_quad	0.0002	0.00003	-0.00000	0.0004
rgdp_dt_quad	0.00003	0.0001	0.00002	-0.018
rcons_dt_quad	-0.00000	0.00002	0.00002	-0.012
epu_dm	0.0004	-0.018	-0.012	367.486

Table 5: Correlation Matrix of Reduced-Form VAR Residuals

	rgov_dt_quad	rgdp_dt_quad	rcons_dt_quad	epu_dm
rgov_dt_quad	1	0.272	-0.025	0.002
rgdp_dt_quad	0.272	1	0.433	-0.118
rcons_dt_quad	-0.025	0.433	1	-0.135
epu_dm	0.002	-0.118	-0.135	1

Table 6: Covariance Matrix of Structural Shocks

	rgov_dt_quad	rgdp_dt_quad	rcons_dt_quad	epu_dm
rgov_dt_quad	1	0	0	0
rgdp_dt_quad	0	1	0	0
rcons_dt_quad	0	0	1	0
epu_dm	0	0	0	1

	rgov_dt_quad	rgdp_dt_quad	rcons_dt_quad	epu_dm
rgov_dt_quad.l1	1.359***	−0.019	−0.007	18.563
	(0.065)	(0.040)	(0.023)	(96.811)
rgdp_dt_quad.l1	0.151	1.059***	0.083*	−247.818
	(0.117)	(0.072)	(0.041)	(175.443)
rcons_dt_quad.l1	−0.169	0.656***	1.096***	−122.076
	(0.188)	(0.115)	(0.066)	(280.928)
epu_dm.l1	0.000	−0.000	−0.000	0.589***
	(0.000)	(0.000)	(0.000)	(0.063)
rgov_dt_quad.l2	−0.297**	0.044	−0.046	−78.594
	(0.110)	(0.067)	(0.039)	(164.072)
rgdp_dt_quad.l2	−0.032	−0.129	−0.064	434.318
	(0.161)	(0.099)	(0.057)	(241.125)
rcons_dt_quad.l2	0.155	−0.278	0.020	368.832
	(0.263)	(0.161)	(0.093)	(393.431)
epu_dm.l2	−0.000	0.000	0.000	−0.014
	(0.000)	(0.000)	(0.000)	(0.072)
rgov_dt_quad.l3	−0.069	−0.005	0.113**	6.953
	(0.110)	(0.067)	(0.039)	(163.903)
rgdp_dt_quad.l3	0.113	−0.137	−0.077	−96.978
	(0.159)	(0.098)	(0.056)	(238.106)
rcons_dt_quad.l3	−0.232	−0.226	−0.011	−231.559
	(0.260)	(0.160)	(0.092)	(388.979)
epu_dm.l3	−0.000	−0.000	−0.000	0.205**

	rgov_dt_quad	rgdp_dt_quad	rcons_dt_quad	epu_dm
	(0.000)	(0.000)	(0.000)	(0.072)
rgov_dt_quad.l4	−0.051	−0.015	−0.062**	46.152
	(0.062)	(0.038)	(0.022)	(92.263)
rgdp_dt_quad.l4	−0.115	0.048	0.069	−50.729
	(0.110)	(0.067)	(0.039)	(163.896)
rcons_dt_quad.l4	0.149	−0.009	−0.143*	−14.706
	(0.189)	(0.116)	(0.067)	(282.325)
epu_dm.l4	−0.000	0.000	0.000	0.142*
	(0.000)	(0.000)	(0.000)	(0.063)
R^2	0.977	0.948	0.969	0.749
Adj. R^2	0.975	0.944	0.967	0.734
Num. obs.	271	271	271	271

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 7: VAR(4) Estimation Results

Table 8: Responses to a government spending shock (68% bootstrap CI). * indicates 0 outside CI.

	Responses (quarters after shock)						
Variable	0q	4q	8q	12q	20q	24q	peak
rgov_dt_quad	0.013211*	0.023093*	0.017476*	0.010350*	0.002434	0.000902	0.023093* (4)
rgdp_dt_quad	0.002208*	0.001366	0.001316	0.000891	-0.000131	-0.000286	0.002208* (0)
rcons_dt_quad	-0.000121	-0.000346	0.000019	0.000016	-0.000300	-0.000346	-0.000747 (2)
epu_dm	0.022666	-1.105312	-1.023444	-0.615407	-0.191569	-0.126209	-1.123345 (7)

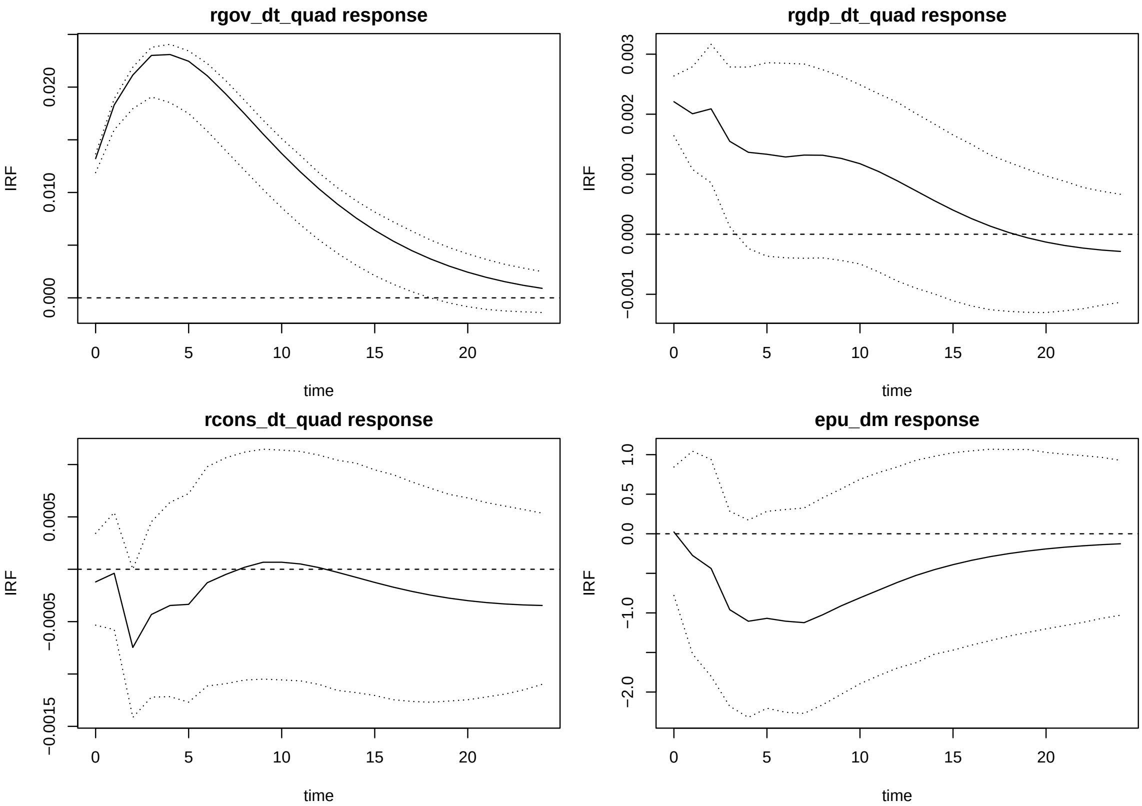

Figure 4: impulse responses to a government spending shock (68% CI).

Table 9: Responses to a government spending shock (90% bootstrap CI). * indicates 0 outside CI.

	Responses (quarters after shock)						
Variable	0q	4q	8q	12q	20q	24q	peak
rgov_dt_quad	0.013211*	0.023093*	0.017476*	0.010350*	0.002434	0.000902	0.023093* (4)
rgdp_dt_quad	0.002208*	0.001366	0.001316	0.000891	-0.000131	-0.000286	0.002208* (0)
rcons_dt_quad	-0.000121	-0.000346	0.000019	0.000016	-0.000300	-0.000346	-0.000747 (2)
epu_dm	0.022666	-1.105312	-1.023444	-0.615407	-0.191569	-0.126209	-1.123345 (7)

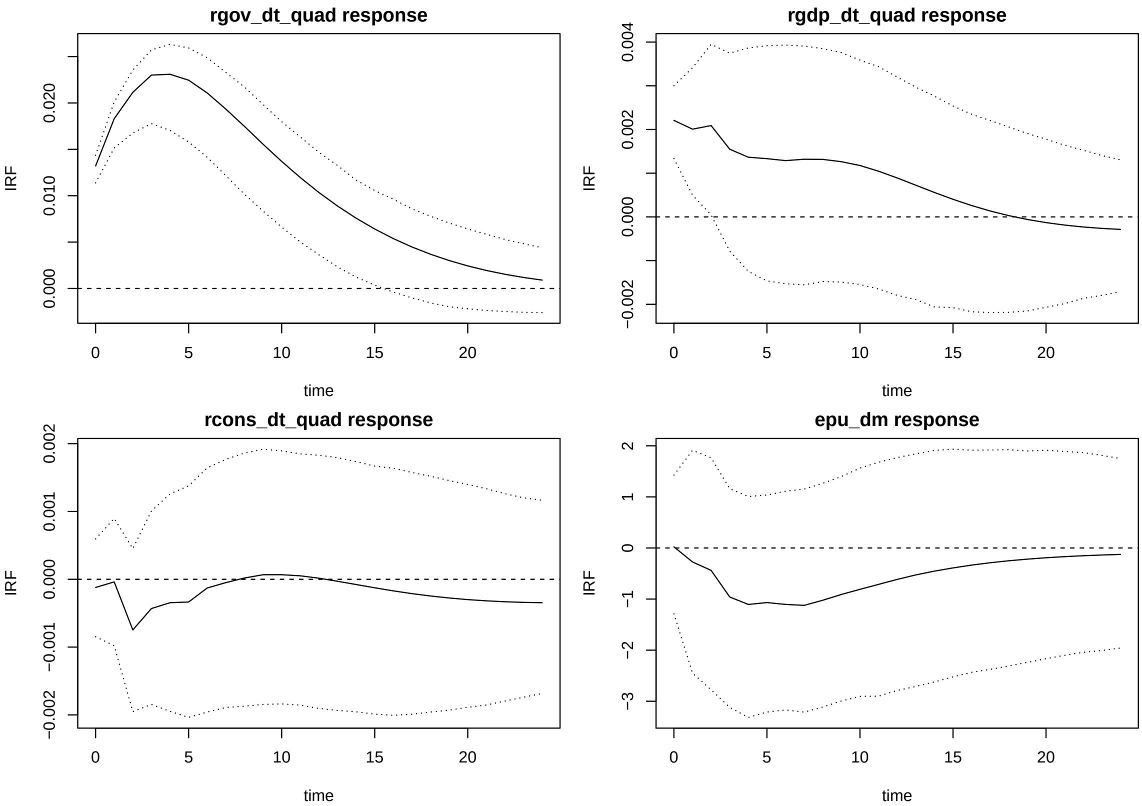

Figure 5: impulse responses to a government spending shock (90% CI).

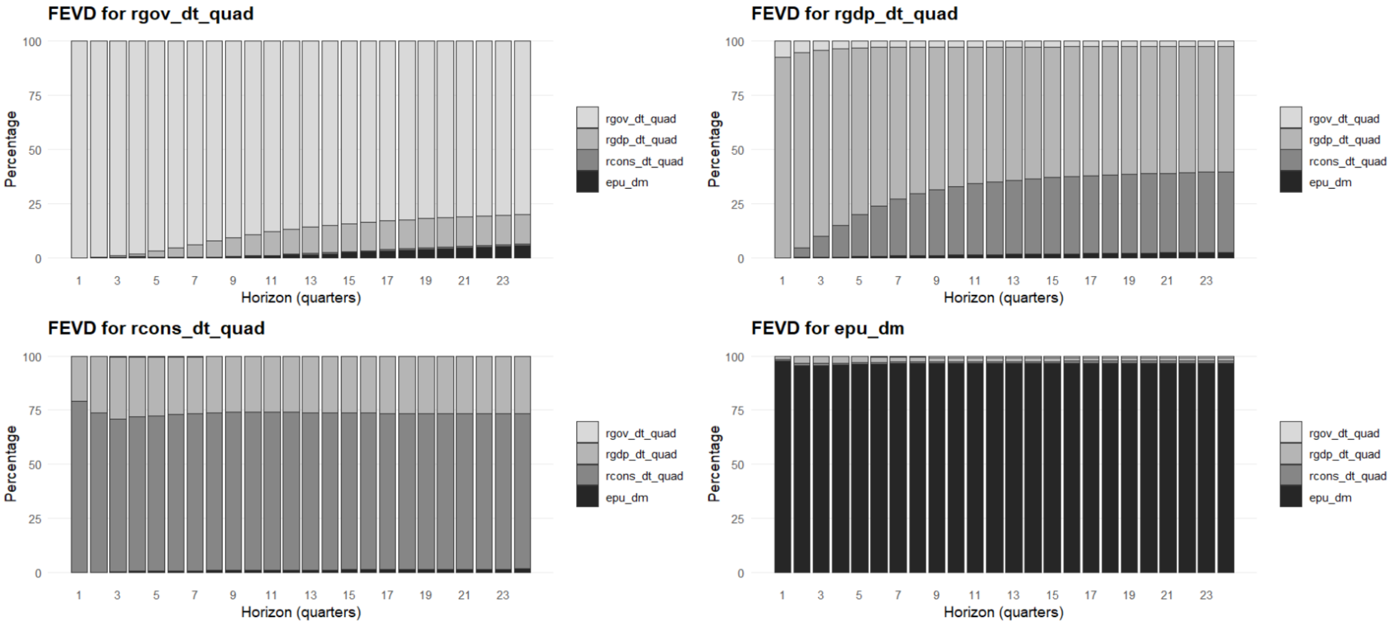

Figure 6: Forecast Error Variance Decomposition

References

Baker, S. R., Bloom, N., and Davis, S. J. (2016). Measuring economic policy uncertainty. *The Quarterly Journal of Economics*, 131(4):1593–1636.

Belke, A. and Goemans, P. (2019). Uncertainty and non-linear macroeconomic effects of fiscal policy in the us: A seivar-based analysis. In *Beiträge zur Jahrestagung des Vereins für Socialpolitik 2019: 30 Jahre Mauerfall – Demokratie und Marktwirtschaft*, number D20-V2 in Session: Macroeconomics III. Verein für Socialpolitik / German Economic Association.

Bernanke, B. S. (1986). Alternative explanations of the money-income correlation. *Carnegie-Rochester Conference Series on Public Policy*, 25:49–100.

Blanchard, O. and Perotti, R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *The Quarterly Journal of Economics*, 117(4):1329–1368.

Blanchard, O. J. and Watson, M. W. (1986). Are business cycles all alike? In Gordon, R. J., editor, *The American Business Cycle: Continuity and Change*, pages 123–180. University of Chicago Press.

Caldara, D. and Kamps, C. (2008). What are the effects of fiscal policy shocks? a var-based comparative analysis. ECB Working Paper 877, European Central Bank.

Engle, R. F. and Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55(2):251–276.

Fatás, A. and Mihov, I. (2001). The effects of fiscal policy on consumption and employment: theory and evidence. *Available at SSRN 267281*.

Friedman, M. (1957). *A Theory of the Consumption Function*. Princeton University Press, Princeton, NJ.

Galí, J., López-Salido, J. D., and Vallés, J. (2007). Understanding the effects of government spending on consumption. *Journal of the European Economic Association*, 5(1):227–270.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2–3):231–254.

Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. Macmillan.

Othman, S. A. (2025). Multivariate time series analysis of the usd/iqd exchange rate using var, svar, and svecm models. *Statistics, Optimization & Information Computing*. Full-text available online.

Pfaff, B. (2013). *Vars: VAR Modelling*. R package version.

Ramey, V. A. (2011). Identifying government spending shocks: It's all in the timing. *The quarterly journal of economics*, 126(1):1–50.

Ramey, V. A. (2016). Macroeconomic shocks and their propagation. NBER Working Paper 21978, National Bureau of Economic Research, Cambridge, MA.

Ramey, V. A. and Shapiro, M. D. (1998). Costly capital reallocation and the effects of government spending. *Carnegie-Rochester Conference Series on Public Policy*, 48(1):145–194.

Ravn, M. O., Schmitt-Grohé, S., and Uribe, M. (2007). Explaining the effects of government spending shocks on consumption and the real exchange rate. NBER Working Paper 13328, National Bureau of Economic Research, Cambridge, MA.

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica*, 48(1):1–48.

Tenhofen, J. (2010). Does anticipation of government spending matter? the role of (non-)defense spending. Working paper, RWI / Econstor.