GOVERNMENT SPENDING AND CONSUMPTION DYNAMICS

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ABSTRACT

The effects of fiscal policy on the economy is increasingly popular in the literature of empirical macroeconomics and factor-augmented vector autoregressive (FAVAR) models have become a popular tool in explaining how economic variables interact over time.This paper focused on the effect of fiscal policy on aggregate and disaggregated consumption by applying the factor-augmented vector autoregression (FAVAR) model. The study specifically estimated the FAVAR model using the computationally simpler principal component method. The result shows that consumption increases after government spending shock. Also, there is heterogeneous effects within disaggregated consumption variables resulting from government spending shock.

Keywords: Government Spending, FAVAR model, Fiscal Policy, Impulse Response Functions, Aggregate Consumption

JEL Codes: C32,C11, E62, E21

1 INTRODUCTION

A large number of macroeconomic research is focused on the effects of government policies on economic activity. The effects of fiscal policy on aggregate consumption is of great interest to researchers and policy makers because it is important in influencing economic activity. Specifically of interest is the effect of government spending on aggregate consumption because competing macroeconomic theories make different predictions about the effects of government spending on consumption. Theoretically, the Neoclassical model predicts a decrease in aggregate consumption in response to a rising government purchases. In contrast, the new Keynesian model predicts an increase in aggregate consumption as a result of expansion in government spending. This point to the fact that the sign of the consumption response depends on the theoretical model used.

Several empirical studies tried to disentangle the discrepancies in the theoretical model prediction of the effects of government spending on aggregate consumption, but there is no consensus in the empirical literature. A study by Blanchard and Perotti (2002) used recursive identification approach and found positive consumption responses. This approach relies on strong identification assumptions by ordering government spending first and therefore assumes that government spending is not affected by the business cycle. Their result is in line with the study by Fragetta and Gasteiger (2014) and Ben Zeev and Pappa (2017), which lends supports to the New Keynesian model. Alternatively, Ramey (2011b) found that consumption decreases in response to a increase in government spending, which supports the neoclassical model. Ramey's approach followed the narrative identification method. Ramey's approach relies on defense news in the narrative time series as a measure of the latent shock series.

Current and past studies showed that structural VAR models to analyze the effects of government spending on aggregate consumption. One limitation of the VAR model is that it uses few variables in its analysis and adding extra variables is usually limited by degrees of freedom problems. Another criticism of the VAR approach to fiscal policy involves the use of a small amount of information (low-dimensional) to prevent the issue of degrees of freedom. The use of few variables causes the VAR model to suffer from fiscal foresight problem, which is a limited information problem because it misaligns information sets between economic agents and the econometrician. This happens since economic agents have more information than the econometrician and the econometrician cannot observe agent's expectations about future spending decisions by government.

This study tries to address the fiscal foresight problem by using the Factor Augmented VAR (FAVAR) model, which is a high-dimensional model with large information sets. The main assumption of this model is that small number of factors captures the dynamics of the large information set. Large data set contains information about agents' expectations which can be captured by the factors in the FAVAR model. This overcomes the fiscal foresight problem by breaking the misalignment between the information sets of economic agents and the econometrician. (Forni Gambetti, 2010; Bernanke et al., 2005). Studies such as Stock and Watson (2002), Bernanke et al., (2005) suggests that factors perform better than the small vector autoregressions, and leading indicator models in simulated forecasting exercises. Since traditional VAR models suffer from fiscal foresight problem, an alternative approach to consider in the case of high-dimensional models with contains large information sets, which includes more variables than the Standard VAR models. Hence, this study aims to analyse the effect government spending on aggregate consumption. Also, to investigate the response of disaggregated consumption variables to government spending shocks.

The rest of the paper is as follows: I introduce the FAVAR model in section 2, section 3 discussed the estimation method and identification. Section 4 describes the data. Section 5 presents the results and section 6 presents the conclusion.

2 Model

This section introduces the FAVAR model and presents details of factor estimation and normalization.

2.1 FAVAR Model

Following Bernanke et.al.(2005), we have the following equations representing the FAVAR model.

$$\begin{pmatrix} F_t \\ Y_t \end{pmatrix} = \beta(L) \begin{pmatrix} F_{t-1} \\ Y_{t-1} \end{pmatrix} + v_t, \tag{1}$$

where Y_t is an M x 1 vector of observable economic variables and contains the policy variable, F_t is a Kx1 vector of unobservable factors which represents the additional economic information which is not fully captured by Y_t, $v_t \sim N(0, \Sigma)$, $\beta(L)$ is a lag polynomial in the KxK coefficient matrices β, where K represents the total number of factors in the model. The observation equation is specified as:

$$X_t = \lambda^f F_t + \lambda^y Y_t + \epsilon_t, \tag{2}$$

where X_t contains information on the current state of the economy, F_t represents a matrix of K factors, Λ^f is an NxK matrix of factor loadings, λ^y is NxM matrix of factor loadings of the policy variables with $\epsilon_t \sim N(0, R)$. Equation (2) shows that Y_t and F_t represent common forces that drive the dynamics of X_t. The factors are extracted through principal components.

2.2 Factor Estimation and Normalization

To estimate the unobservable factors, Bernanke et al., (2005) stated that the computationally complex likelihood-based Gibbs-sampling technique does not necessarily produce better results as compared to the two-step Principal Component (PC) approach. Therefore, I will adopt the two-step PC estimation which is popularised by Stock and Watson (2002b). To perform the two-step PC estimation, the variables in X_t are grouped into two sets of categories; a "slow-moving" (unaffected by government spending shock) and "fast-moving" (instantly affected by government spending shock). In the two-step PC estimation, the first step is to identify common factors extracted from Y_t and X_t variables. In the second step, the extracted factors are then augmented into a VAR model for estimation.

Following the two-step principal component approach, the common components C_t are estimated using the first $K+M$ principal components of X_t, and this estimation includes the observed variable Y_t. In the second step, the FAVAR equation (1) is estimated with F_t being replaced by $\hat{F}_t$. The two-step approach is computationally simple and easy to implement. I perform a bootstrap procedure to obtain confidence intervals on the impulse response functions. I impose a normalization restrictions on the observation equation (2), which is required to estimate the model. These restrictions are imposed on equation (1) and (2) to uniquely identify the factors and the factor loadings. In this paper, I restrict the factor loadings, i.e. $\Lambda^{f'}\Lambda^f/N = I$. Following Bernanke et.al., (2005), I impose the factor restriction, obtaining $\hat{F}_t =$

$\sqrt{T\hat{Z}_t}$ where $\hat{Z}_t$ are the eigenvectors corresponding to the K largest eigenvalues of $X_t X_t'$ arranged in ascending order. One advantage of this approach is that, it identifies the factors against any rotations.

The identification of the structural shocks in the transition equation requires further restrictions. The study will assume a recursive structure where all the factors entering (1) respond with a lag to change in the fiscal policy instrument, ordered last in Y_t. In that case, we do not need to identify the factors separately, but only the space spanned by the latent factors F_t.

3 DATA

The dataset contains quarterly series on 150 macroeconomic and financial time series on the U.S economy from 1960Q1 to 2019Q4, and information on real activity and income, employment, asset prices, interest rates, exchange rates, price indices and money aggregates. All the dataset were obtained from the Bureau of Economic Analysis (BEA) and the FRED database. The variables have been transformed to become stationary and they have been demeaned and standardized. The study also included spread of municipal and Treasury bond data with 1-year, 5-year and 10-year maturity length. Data on municipal bond yields were obtained from 1954M1 to 1994M12 from Salomon Brothers' Analytical Records. Yields on (AAA) municipal bonds are obtained from Bloomberg's Municipal Fair Market from 1995M1-2020M12. Market yields on U.S. Treasury from 1954M1-2020M12 were obtained from the FRED website.

4 RESULTS

In this section I present my findings. Results from Figure 1 shows that government spending had a positive effect on aggregate consumption as displayed by impulse response functions in figure 1. The impulse response functions are as a result of government spending shock. We also observed that real GDP, employment, government deficits and hourly earnings all have positive response to government spending shock. I include federal funds rate to control for the effect of monetary policy. The federal funds rate shows a negative response on impact but it turned unresponsive in the long term. So, the main result implies that, an expansionary government spending shock, leads to positive effect on aggregate consumption. This result is in line with the findings in Fisher and Peters (2010), Blanchard and Perotti (2002) and Ben Zeev and Pappa (2017) but contradicts the findings of Ramey (2011) who found negative consumption response to government spending shock. The findings in this paper followed the Keynesian predictions.

The result of this paper also shows heterogeneous responses of government spending to disaggregated consumption variables. There is mixed results in the literature with regards to the responses of durable goods, non-durable goods and service consumption. A study by Forni and Gambetti (2010) shows that all components have a positive response in the short-run, but the study by Fragetta and Gasteiger (2014) showed that durable consumption responds positively.

4.1 Response of Government Spending shock

Figure 1: Impulse Response to a Government Spending shock on selected variables

4.2 Response of Government Spending shock with yield spreads

In Figure 2, I included yield spread in the impulse response analysis. The yield spread includes 1-year spread, 5-year spread and 10-year spread of government bond yields. These spread were calculated using municipal bonds from Bloomberg. The impulse response of 5-year spread and 10-year spread have positive reaction to government spending shock on impact but we observed a negative response from the 1-year spread. Comparing Figure 1 and 2, I observe that the inclusion of the yield spread does not change the impulse response of the other selected variables in Figure 1. The selected variables shows same response to a government policy shock on impact and have the same pattern of movement even with the introduction of the yield spreads.

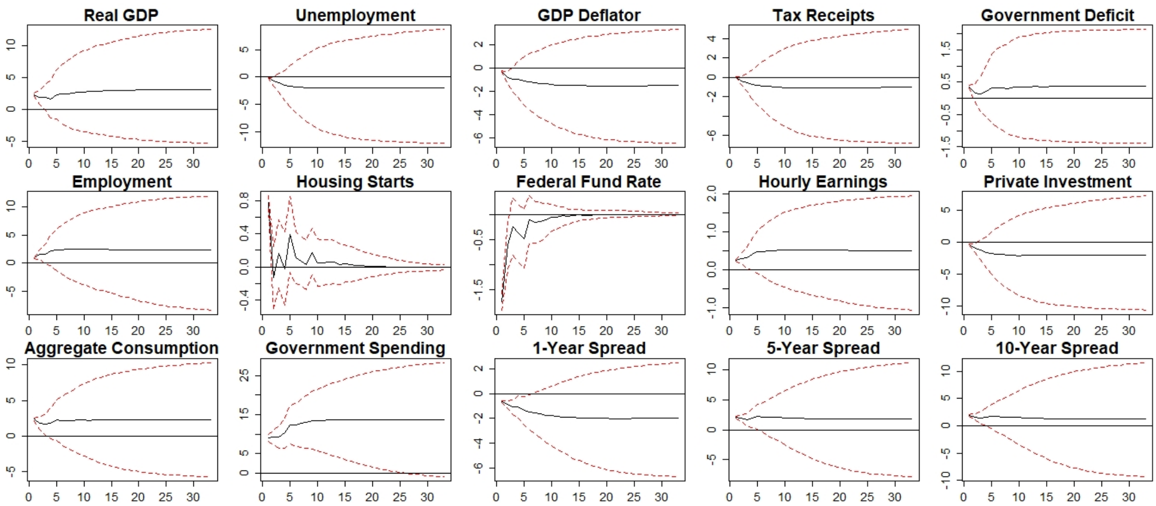

Figure 2: Impulse Response to a Government Spending shock including yield spread

4.3 Disaggregated Consumption Response

This section presents the estimation of disaggregated consumption response to government spending shock. This is done by replacing the replacing aggregate consumption by 9 disaggregated consumption variables in the FAVAR model. Figure 3 displays the results of the impulse response functions. The results shows heterogeneous effects on the disaggregated consumption variables. We observed that after government spending shock, consumers increase their spending on motor vehicles, healthcare, clothing and transportation services but reduces purchases of food and accommodations,housing and utilities, and recreational services. The IRFs also shows that households increase purchases of transportation services in response to government spending shock.

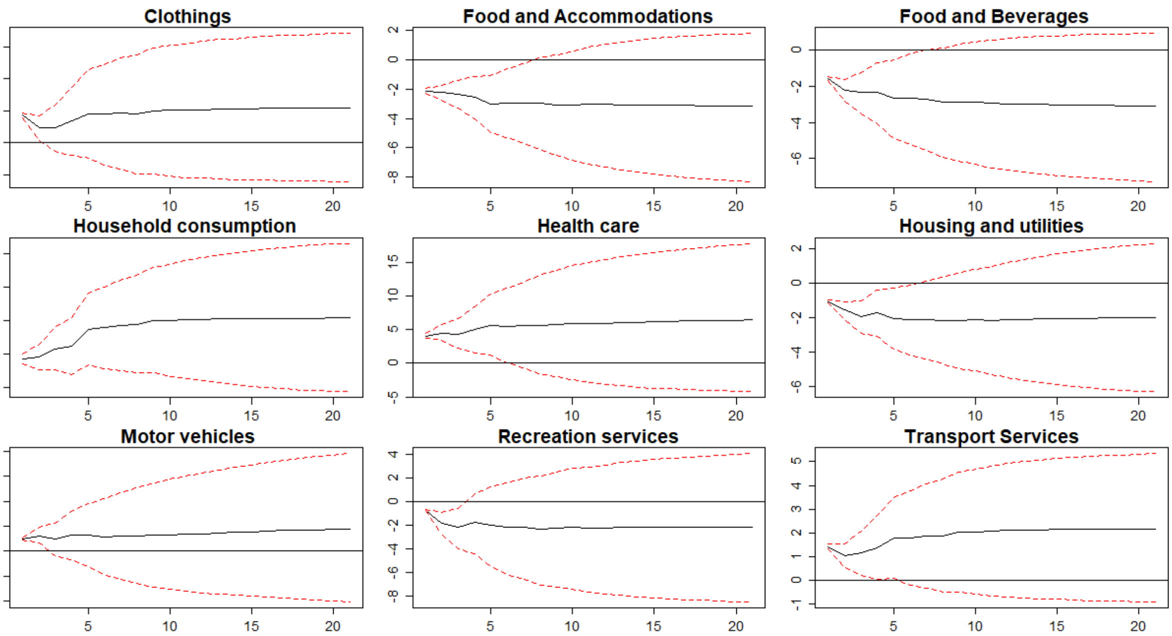

Figure 3: Response of disaggregated consumption to government policy shock

4.4 Variance Decomposition Analysis

Apart from impulse response functions estimation, I performed the variance decomposition on the selected variables of interest which is usually typically performed in standard VAR model. This involves determining the proportion of the forecasting error of a variable,which is attributed to a particular shock at a given horizon.
The results in Table I shows the impulse response for the selected macroeconomic variables analyzed in the previous figures. The tables shows the contribution of government spending shock to the forecast error variance in a 20-quarter horizon. The second column shows the R^2 of the common component. The contribution of the policy variable, government spending is 0.62 which is quiet high but very low for real GDP, aggregate consumption and the remaining variables in the model.

In addition, the factors explain a large proportion of the variables, especially real GDP (73.4%) and private investment (67.8%). The factors explain 39.2% of Aggregate consumption.

Forecast Error Variance Decomposition of selected variables

Variables	Contribution	R^2
Government Spending	0.62	1
Real GDP	0.058	0.734
GDP Deflator	0.005	0.226
Tax Receipts	0.001	0.28
Government Deficit	0.002	0.045
Hourly Earnings	0.01	0.018
Private Investment	0.02	0.678
Aggregate Consumption	0.056	0.392

Table 1: Contribution of government Spending shock

5 CONCLUSION

The goal of this paper is to investigate the impact of government spending shocks on aggregate and disaggregate consumption using the FAVAR model. This model address the fiscal foresight problem inherent in the traditional SVAR model.

This study uses large datasets that contains information sets of economic agents in the economy and applied Two-Step Principal Component Approach to summarize the number of factors and augment them in a standard VAR model. This approach has the advantage of obtaining the responses of a large set of variables to fiscal policy shocks.

The results from the analysis showed that expansionary government spending shock have positive impact on aggregate consumption. Also, I found that the effect of government spending have heterogeneous response to disaggregated consumption. Specifically, we observed that after an expansionary government spending shock, consumers increase their spending on motor vehicles, healthcare, clothing and transportation services but reduces purchases of food and accommodations,housing and utilities, and recreational services.

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