Three Essays on the Macroeconomic Effect of Fiscal Policy in the U.S.

by

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Abstract

Over the past few years, debates among economists on the magnitude of fiscal expansion effects on the economy have been a resurgence in the economics literature. On the one hand, New Keynesian researchers find positive economic effects of expansionary fiscal policy. On the other hand, authors holding a neoclassical perspective argue that fiscal expansion has very limited or even negative effects on economic activity. In an attempt to reconcile these two perspectives, some economists suggest that the size of fiscal multipliers are highly state-dependent: that is, fiscal multiplier effects vary depending on the overall state of the economy in which expansionary spending was introduced.

Given such ambiguous results, this research pivots to questions around the different kinds transmissions through which fiscal expansion may impact economic activity in the U.S. This research, first, focuses on sentiment channel that through which we could have a better understanding of the limited fiscal expansion effect on the private sector. Secondly, it studies the relationship between fiscal deficits and the U.S. current account balance by shedding an light on the topic in the context of consumer sentiment. We note a phenomenon of "Twin Divergences" rather than the often discussed "Twin Deficits". Thirdly, we attempt to reveal how different categories of government expenditures may be a differentiating factor of fiscal expansion effects

on private activity; we illustrate this by imposing a control for the most recent 2007-2009 economic recession.

With the application of recursive conventional VAR and Expectational VAR (EVAR) models, we find, firstly, very limited stimulating effects of fiscal expansion on the private sector due to a pessimistic sentiment response to government spending shocks. In addition, within a floating exchange rate regime, the current account balance of the U.S. tends to improve in response to expansionary government deficits, which reveals a phenomenon of "Twin Divergence". Finally, different types of government expenditures could differentiate expansionary fiscal effects on key macroeconomic variables, such as output, consumption, and investment.

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This dissertation is not just for me, most importantly, it's for my beloved grandma, without whom I won't be able to reach to where I am now. Meanwhile, it's for my dearest husband, Peter J. Santoro, I would not be determined enough to join a PhD program if we didn't meet 6 years ago. Also, this is for both my parents and my parents-in-law, their unconditional love and encouragements make me enjoyed my PhD life even more.

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Chapter 1

Government Spending Shocks and Private Activity: The Role of Sentiments

1.1 Introduction

Observing the sluggish recovery from the recent Great Recession, the economics profession has revived the debate on the effectiveness of the fiscal policy in stimulating economic activity. Can increases in government spending help promote private sector activity? And if so, will key variables of interest such as consumption, investment, employment, and real wages respond persistently positively to expansionary fiscal policy?

There is a large literature on this issue. One group of researchers reports positive responses of consumption, real wages, and output to expansionary fiscal shocks, which are consistent with the New Keynesian macroeconomic model in general. See, among others, Rotemberg and Woodford (1992), Devereux, Head, and Laphan (1996), Fatas and Mihov (2001), Blanchard and Perotti (2002), Perotti (2005), Galí, López-Salido, and Vallés (2007).

On the contrary, many other research works provide strong evidence of negative responses of consumption and real wages to fiscal spending shocks. See, for example, Aiyagari, Chirstiano, and Eichenbaum (1992), Hall (1986), Ramey and Shapiro (1998), Edelberg, Eichenbaum, and Fisher (1999), Burnside, Eichenbaum, and Fisher

(2004), Cavallo (2005), Mountford and Uhlig (2009), Ramey (2012), and Owyang, Ramey, and Zubairy (2013). As Ramey (2011) explains, these negative responses to an expansionary government spending shock are consistent with a negative wealth effect that often appears in the neoclassical macroeconomic model such as Aiyagari, Christiano, and Eichenbaum(1992) and Baxter and King (1993).[1]

One related literature focuses on the output multiplier of government spending. Empirical evidence is again mixed. For instance, Ramey and Shapiro (1998), Hall (2009), Barro and Redlick (2011), and Ramey (2011) obtained fairly low, say less than one, government spending multiplier estimates, while Hall (2009) and Christiano, Eichenbaum, and Rebelo (2009) show that fiscal multipliers can be high when the nominal interest rate is bounded at zero. Overall, the range of fiscal multiplier estimates in the literature is very wide (Ramey, 2011). Also, fiscal multiplier estimates seem to vary greatly across countries depending on key country characteristics such as the exchange rate regime and public indebtedness. See Corsetti, Meier, and Müller (2012) and Ilzetxki, Mendoza, and Vegh (2013) for details.

Another interesting question is whether the government spending shock is more powerful during times of slack. Again, empirical evidence is mixed. For example, Auerbach and Gorodnichenko (2012), Mittnik and Semmler (2012), and Fazzari, Morley, and Panovska (2013) report much higher fiscal multipliers in a regime of a

[1]Increases in government spending may result in a negative wealth effect because government deficits may have to be financed by tax hikes in the future. Rational consumers reduce consumption and increase labor supply in response to spending shocks, resulting in a decrease in the real wage. Note that such responses would occur even when government raises revenues by non-distortionary lump-sum tax.

low economic activity than those in a high regime activity, whereas Owyang, Ramey, and Zubairy (2013) and Ramey and Zubairy (2014) find no such evidence.

Observing such mixed empirical evidence on the effectiveness of fiscal stimulus, we study how the government spending shock influences private activity in the US. Finding negligibly weak or even negative responses of private activity to the fiscal spending shock, we introduce and highlight the role of consumer *sentiment* in the propagation of expansionary fiscal shocks to promote economic activity.

We are not the first who discussed the interaction between consumer sentiment and economic activity. Hall (1993) and Blanchard (1993), for example, underline the causal effects of *animal spirit* on economic activity in their explanation of the 1990-1991 recession. On the other hand, Cochrane (1994) points out that close relationship between innovations in consumer confidence and subsequent changes in economic activity appear because consumer confidence shocks reflect *news* about future economic productivity. Beaudry and Portier (2004, 2006) also propose a similar model. Barsky and Sims (2012) evaluate empirical relevance of these factors in explaining innovations in consumer confidence. They show that confidence innovations are better characterized by the latter, even though animal spirit also has non-negligible contribution. Using a nonlinear VAR framework, Bachman and Sims (2012) report high fiscal multiplier estimates during periods of economic slack. They put an emphasis on the role of confidence, which embodies information of future productivity improvements in response to fiscal spending shocks during recessions. By the same token, they argue that consumers might become more optimistic in response to the fiscal shock during times of economic slack, which sharply contrasts

with our work that reports solid negative responses of consumer sentiment to the fiscal shock in all phases of business cycle.

We are particularly interested in the role of consumer sentiment in propagation mechanism of the government spending shock to private activity such as consumption and investment, excluding the government sector component from the total GDP. For this purpose, we employ an array of identification methods for the fiscal shock that includes conventional recursively identified structural VAR models and the expectational VAR (EVAR) models of Ramey (2011) for the post war US data.[2] We employ the two EVAR models, one with her news (NEWS) variable and the other one with the survey of professional forecasters (SPF) data. Our major empirical findings are as follows.

First, government spending shocks are not effective in stimulating private activity. Consumption responds positively only for a very short period of time, then rapidly decreases when the conventional VAR models are employed. Furthermore, initial increases in consumption are mainly driven by increases in nondurable good consumption. That is, when fiscal shocks are actually *materialized*, consumers respond to it by buying more nondurable goods instead of durable goods because they view increases in income as windfall. When changes in fiscal spending are anticipated in the expectational VAR framework (Ramey, 2011), fiscal policy shocks become completely ineffective as we observe virtually no positive responses since the impact of the shocks. Similarly, we were unable to find any persistently positive responses of investment to fiscal spending shocks. On the other hand, we observe

[2]Perotti (2011) named these models of Ramey's (2011) the expectational VAR model.

solid positive responses of consumption and investment to the sentiment shock from all models we consider in the present paper.

It should be noted that our results contrast with those of Bachman and Sims (2012) who reported a positive response of consumer sentiment to the fiscal shock in times of slacks. In what follows, however, we demonstrate our results are robust to alternative identification methods.[3]

Second, we observe that consumer sentiment rapidly deteriorates to a negative region since the impact of the fiscal spending shock, leading to subsequent decreases in consumption and investment. That is, unexpected increases in the government spending generate consumer pessimism, which may weaken the fiscal policy effect on the private sector GDP. We show that our empirical findings are consistent with a view that consumer sentiment *leads* private activity rather than it passively *reflects* the current state of the economy, which implies an important role of a sentiment channel in the propagation mechanism of the fiscal spending shock. We provide additional supporting evidence via nonlinear VAR model estimations and counterfactual simulation exercises.

Lastly, the fiscal shock seems to be ineffective in improving the labor market condition either, while the real wage and private sector jobs show solid positive increases when sentiment shocks occur.

We provide further evidence in favor of an important role of the sentiment channel via counterfactual simulation exercises following the framework by Bachman and Sims (2012). Our simulation results sharply contrast with those of Bachman

[3]In a related study, Jia and Kim (2016) report mostly negative sentiment responses from 24 different types of identification methods for fiscal spending shocks.

and Sims (2012) even when we employ the same model as theirs. We also employ a threshold VAR model that allows nonlinear effects of the fiscal policy, which provides very weak evidence of nonlinearity.

The remainder of this paper is organized as follows. Section 1.2 discusses our VAR models with alternative identification methods. We also discuss econometric features of our models as to the robustness of our empirical findings to alternative Wold orderings. In section 1.3, we present a data description and our major empirical findings. We also discuss the existence of a consumer sentiment channel in the fiscal policy propagation mechanism to stimulate private activity. Section 1.4 provides an array of further VAR analyses. Section 1.5 report counterfactual simulation exercises and estimates from nonlinear VAR model specifications. Section 1.6 concludes.

1.2 The Econometric Model

Abstracting from deterministic terms, we employ the following vector autoregressive (VAR) model.

$$\mathbf{x}_t = \sum_{j=1}^{p} \mathbf{A}_j \mathbf{x}_{t-j} + \varepsilon_t, \tag{1.1}$$

where

$$\mathbf{x}_t = [\mathbf{g}_t \;\; \mathbf{y}_t \;\; sent_t \;\; \mathbf{z}_t]'$$

$\mathbf{g}_t$ denotes a vector of (or a scalar) government spending variables, $\mathbf{y}_t$ is a vector (or a scalar) of private activity variables such as consumption ($conm_t$) and investment ($invt_t$), $sent_t$ is a scalar sentiment variable, and $\mathbf{z}_t$ is a vector of control variables that includes tax rate (tr_t), the interest rate (i_t), and the monetary aggregate (m_t). All

variables are demeaned and detrended, up to quadratic trend, prior to estimations. We limit out attention to a closed economy VAR model to make the model as simple as possible.[4]

Motivated by Ramey's (2013) work, we employ an array of VAR models based on alternative identification methods for the government spending shock. Our first model, TGOV, resembles conventional VAR models with the government spending ordered first. Put it differently, we identify the government spending shock by unexpected increases in the total government spending ($tgov_t$), that is, $\mathbf{g}_t = tgov_t$. For similar models, see, among others, Blanchard and Perotti (2002), Perotti (2005, 2008), and Galí, López-Salido, and Vallés (2007).

We also employ VAR models which is dubbed the EVAR (expectational VAR) approach by utilizing her "news" variable as well as the survey of professional forecasters data. That is, $\mathbf{g}_t = news_t$ (NEWS) and $\mathbf{g}_t = spf_t$ (SPF), respectively. Ramey (2011) points out that government spending shocks, when identified with standard Choleski decomposition (recursively identified) VAR models, might not be appropriate because planned changes in fiscal variables such as military spending are likely to be anticipated by market participants before the government actually implements it. In order to deal with this timing issue, she constructed a "news" variable by estimating changes in the expected present value of government spending, utilizing information from Business Week and several other mass media sources. She also constructed an alternative news variable via the one-quarter ahead forecast error of

[4]That is, we do not pay much attention to the fiscal policy effect on the net exports. For an open economy model, additional variables such as the exchange rate, foreign incomes, and the domestic and foreign prices should be added to the system.

fiscal spending growth rates, using the Survey of Professional Forecasters from the Philadelphia Fed.

Perotti (2011), however, argues that Ramey's EVAR is equivalent to a model with $\mathbf{g}_t = [fgov_t,\ tgov_t]'$, where $fgov_t$ denotes the federal government (or military) spending. We also employ such a model and denote it FGOV model. Following Perotti (2011) and Ramey (2012), we also put $tgov_t$ next to $news_t$ for the EVAR models. Our empirical models are summarized as follows.[5]

$$\begin{aligned}
\text{TGOV} &: \mathbf{x}_t = [tgov_t \ \ invt_t \ \ conm_t \ \ sent_t \ \ tr_t \ \ i_t \ \ m_t]' \\
\text{FGOV} &: \mathbf{x}_t = [fgov_t \ \ tgov_t \ \ invt_t \ \ conm_t \ \ sent_t \ \ tr_t \ \ i_t \ \ m_t]' \\
\text{NEWS} &: \mathbf{x}_t = [news_t \ \ tgov_t \ \ invt_t \ \ conm_t \ \ sent_t \ \ tr_t \ \ i_t \ \ m_t]' \\
\text{SPF} &: \mathbf{x}_t = [spf_t \quad tgov_t \ \ invt_t \ \ conm_t \ \ sent_t \ \ tr_t \ \ i_t \ \ m_t]'
\end{aligned} \tag{1.2}$$

For visual inspection of the data, we plot estimated fiscal spending shocks (residuals) as well as original spending variables from these alternative VAR models in Figure 1. Ramey's (2011) (raw) news and SPF variables look quite different from other two variables that are trending upward. However, residuals of these variables, that is, the estimated government spending shock identified from each model, look similar each other. That is, all these four measures of fiscal shocks seem fairly consistent with each other. We also present scatter plot diagrams of cyclical components of

[5]We also implemented estimations without the total government spending for FGOV, NEWS, and SPF models. We obtained qualitatively very similar results. See non-for-publication appendix for all results, which is available from authors upon request.

these four key variables in Figure 2.[6] We note that $fgov_t$, $tgov_t$, and spf_t are closely positively correlated, whereas the volatility of $news_t$ is higher than other three variables due to several outliers. Figures 1 and 2 jointly provide strong support of the consistency of our 4 policy variables.

Figures 1 and 2 around here

It is well-known that econometric inferences from recursively identified VAR models might not be robust to alternative VAR orderings. Fiscal spending effects under our framework do not suffer from this ordering problem. For example, consider a VAR with $\mathbf{x}_t = [\mathbf{x}_{1,t},\ \mathbf{x}_{2,t}]$, where $\mathbf{x}_{1,t}$ is a vector of variables with a known ordering, while the ordering of $\mathbf{x}_{2,t}$ is completely unknown. Kim, Kim, and Stern (2015) demonstrate that all impulse-response functions of the entire variables in $\mathbf{x}_t$ to the shock to one of the variables in $\mathbf{x}_{1,t}$ are unaffected by arbitrary reshuffling of the $\mathbf{x}_{2,t}$ variables.

Note that $\mathbf{g}_t$ is ordered first in all models with an assumption that these spending variables are not contemporaneously influenced by innovations in other variables within one quarter.[7] Therefore, the impulse-response functions to the government spending shock under the present framework are invariant to all alternative orderings of the remaining variables in the system. That is, all response functions to the fiscal

[6] We use the Hodrick-Prescott filter with a 1600 of smoothing parameter to separate cyclical components from the trend components of the series.

[7] Unlike the monetary policy, fiscal policy actions may not be implemented immediately, because in most cases, congress and the goverment work together to determine the government budget prior to the fiscal year.

spending shock are "identical" even if we randomly shuffle the variables next to $\mathbf{g}_t$ in the system as long as $\mathbf{g}_t$ is ordered first.

However, response functions to the sentiment shock are not invariant to the ordering of the VAR, because s_t is ordered in the middle of the system. We implemented an array of robustness check analyses putting the sentiment variables in different locations from the first to the last. We obtained qualitatively very similar results, thus we maintain the ordering described in (3.1) throughout the paper.

1.3 Empirical Findings

1.3.1 Data Descriptions

We use quarterly frequency data from 1960:I to 2013:II. We obtained most of our data from the FRED with a few exceptions. The news series ($news_t$) is obtained from Valerie Ramey's website.[8] We obtained the consumer sentiment index ($sent_t$) data from the University of Michigan's Survey of Consumers database. The consumer sentiment index comes with two sub-indices, the current economic conditions index (ICC) and the index of consumer expectations (ICE). That is, $sent_t$ is a combination of consumers' perception on the current economic conditions as well as economic conditions in the near future. As can be seen in Figure 3, they are highly correlated each other, thus we report empirical findings mostly with the consumer sentiment index.

[8]For detailed explanations on how to construct her news variable, see the following webpage. http://econweb.ucsd.edu/~vramey/research.html#data

We use "total" government expenditures for government spending variables that include transfer payments and interest payments as well as capital transfer payments.[9] All public and private spending variables ($tgov_t, fgov_t, conm_t, invt_t$) are divided by the GDP deflator and population, then log-transformed. $sent_t$ is expressed in natural logarithm. tr_t denotes the government tax receipts divided by the total GDP. As to the money market control variables, i_t denotes the three month Treasury Bills yield and m_t is the nominal M2, expressed in natural logarithm.

Figure 3 around here

The Survey of Professional Forecasters data were obtained from the Philadelphia Fed. Starting from 1968:IV, forecasters were asked to predict *nominal* defense spending until 1981:II, whereas they were asked to predict *real* federal spending since then. We used the forecasts of the GDP deflator to convert the nominal defense spending data to real spending data.[10] We also noticed 9 changes of base year in the national income and product account (NIPA) during our full sample period. Since the SPF forecast does not reflect such changes, we rescaled all relevant forecast data with 2009 as the common base year.[11] Following Ramey (2011), we use the actual government spending growth minus the forecast of it made one quarter earlier, that is,

[9]Total government expenditures is a broader measure than "government consumption expenditures and gross investment," which is a government component of the total GDP. It is even greater than "government current expenditures" because it includes items that affect government activities in the future such as capital transfer payments and net purchases of nonproduced assets.

[10]Nominal defense spending data from 1968:IV to 1981:II are obtained from Tom Stark at the Philadelphia Fed.

[11]Ramey (2011) and Forni and Gambetti (2014) used growth rates of government spending forecasts without adjusting for changes in base year. This is not ideal because their estimations can be influenced by suddent big changes in their fiscal spending variable up to 9 times.

$g_t - E(g_t|\Omega_{t-1})$ where Ω_{t-1} is the forecasters' information set at time $t-1$, as the fiscal spending shock.

One caveat is that, following Ramey (2011), we combine forecast errors of defense spending growth with those of federal spending growth rates in order to get the data with reasonably long sample period. As she discussed, however, this news variable explains substantial portion of changes in the federal spending growth. Further, we use forecast errors instead of forecasts, which will minimize the cost of combining those two data series. We report a scatter plot diagram of the business cycle components of these two series in Figure 4. Clearly, these two series are highly positively correlated. More detailed information on data is provided in Table 1.

Figure 4 and Table 1 around here

1.3.2 Fiscal Spending Shocks and Private activity

As a preliminary exercise, we estimated fiscal spending effects on the private GDP that excludes the government spending component from the total GDP. Figure 5 reports the response function estimates of the private GDP to the fiscal spending shock and to the sentiment shock using 4 alternative identification methods discussed in the previous section. We also report the 95% confidence bands obtained from 500 nonparametric bootstrap simulations.

It should be noted that the fiscal shock has negligible or even negative effects on the private GDP in all models we consider, which is consistent with the findings reported by Ramey (2012). This implies that any evidence of positive responses

of the total GDP to the fiscal shock might be mainly due to an expansion of the public sector. Contrary to the fiscal shock, the sentiment shock yields a persistently positive effect on the private GDP over 2 years, which is significant at the 5%. We note that this finding is consistent with the work by Hall (1993), Blanchard (1993), Cochrane (1994), and Bachman and Sims (2012), for example, in the sense that we also find close relationship between consumer sentiment and economic activity. However, our findings contrast sharply with those of Bachman and Sims (2012) qualitatively, because they argue that the government spending shock has a positive effect on consumer confidence during times of slack.[12] In what follows, we show that the government spending shock generates consumer *pessimism* rather than optimism, which then weakens private activity.

Figure 5 around here

Next, we report impulse-response function estimates of private consumption and investment to the fiscal spending shock in Figure 6.[13] Consumption responds significantly positively only in the short-run (less than a year) under TGOV and FGOV identification schemes, while no meaningful or even significantly negative responses are observed when the EVAR models are employed. Investment responses to the fiscal shock turn out to be mostly negligible and insignificant with an exception of those from SPF model, where we obtained a significantly negative harmful effect of the fiscal shock on investment. These responses of consumption and investment

[12]It should be noted, however, that our models do not allow such nonlinearity in the impulse-response function estimations.

[13]Complete response function estimates are reported in the non-for-publication appendix.

would be consistent with negligible responses of the private GDP to the fiscal shock reported earlier.

Figure 6 around here

One of our major objectives is to identify propagation channels through which fiscal spending shocks possibly affect private activity. We view the consumer sentiment as a potential candidate. For this purpose, we report the impulse-response functions of $sent_t$ to the fiscal spending shock in Figure 7. Note that under the TGOV, FGOV, ana SPF schemes, consumer sentiment rapidly falls below zero immediately after the impact of the fiscal spending shock, which might play a key role in explaining why initially positive responses of consumption quickly deteriorate to negative ones. That is, positive fiscal spending shocks may be interpreted as a sign of weak economy, which might make consumers more pessimistic, resulting in decreases in private spending. Naturally, such changes in consumer sentiment may weaken the effectiveness of the expansionary fiscal policy as consumption and investment fall in response to the fiscal shock. Under the NEWS VAR, we observe no meaningful responses of the sentiment, which is consistent with virtually zero-responses of consumption to the fiscal shock under the same model.

In what follows, we also show that "total" consumption responses shown in Figure 6 are more closely related with those of nondurable goods and services consumption rather than durable goods consumption. That is, consumption responses to the fiscal shock seem to be mainly driven by temporary changes in nondurable goods consumption. One way to interpret Figures 6 and 7 together would be the

following. When fiscal shocks are anticipated as assumed in the EVAR models, fiscal shocks tend to generate consumer pessimism, resulting in decreases or no meaningful changes in consumption. When fiscal shocks are actually materialized, that is, when identified fiscal shocks are the same as the actual increases in fiscal spending as in TGOV and FGOV models, consumers respond to it by increasing nondurable goods consumption because they view increases in income as windfall. In other words, they may do so because they believe fiscal shocks are not going to permanently change the direction of the economy towards booms.

Overall, fiscal policy effects on private activity seem to be weak and short-lived if any. Further, the fiscal spending shock seems to fail to improve, even decrease, consumer sentiment, which may cause decreases in consumption and investment. To investigate such possibility, we report and discuss our impulse-response function estimates of private activity to the sentiment shock in next section.

Figure 7 around here

1.3.3 Consumer Sentiment Shocks and Private activity

Responses of private activity to the sentiment shock sharply contrast with those to the fiscal shock. As can be seen in Figure 8, both investment and consumption respond positively for a prolonged period of time in response to the sentiment shock in all four models. That is, we obtained robust evidence of persistently positive effects of the sentiment shock on private activity. Especially, consumption responses are highly significant at the 5% level for over three years. Even though investment

responses are not significant at the 5% level, its point estimates are substantially skewed to the positive area.

Responses of the government spending to the sentiment shock are overall negative, reported in not-for-publication appendix, though either insignificant or marginally significant. This is not surprising because fiscal spending tends to be counter-cyclical. That is, government spending normally falls below the trend when the private GDP (consumption and investment) rises during economic booms.

In contrast to the responses to the fiscal shock, the impulse-response function estimates to the sentiment shock are not invariant to alternative orderings since $sent_t$ is put after the fiscal variable and private spending variables. For robustness check, we implemented the same analysis with the sentiment variable ordered next to $\mathbf{g}_t$. We also experimented with the sentiment variable ordered last. All results were qualitatively very similar. That is, our findings on the sentiment effect are quite robust to alternative orderings.[14]

Figure 8 around here

1.3.4 Fiscal Shock and the Role of a Sentiment Channel

We observe that all four models including the two EVAR models imply solid positive effects of the sentiment shock on private spending. We note that these findings may provide some useful insights on the ineffectiveness of the fiscal policy in promoting private activity as reported in the previous section. That is, the fiscal

[14] All results are available upon request.

spending shock may not be able to stimulate consumption and investment if it fails to generate consumer (or entrepreneur) optimism as can be seen in Figure 7. In other words, the effectiveness of the fiscal spending shock may critically hinge upon a sentiment channel.

Observing sudden increases in the government deficit, consumers may revise down their economic growth forecasts in the future, interpreting such policy actions as a clear sign of serious economic downturns, which may persist for a while. In this sense, our conjecture is consistent with the "news" effect discussed in Cochrane (1994) and Bachman and Sims (2012), even though Bachman and Sims (2012) are more optimistic on the role of the expansionary fiscal policy.

One may argue against this conjecture by the following logic. Consumption and investment may fall after the spending shock occurs for some unknown reason, and the sentiment passively reflect such decreases in private GDP. We are skeptical to such a possibility for the following reasons.

As we can see in Figure 6, consumption tends to rise for a short period of time in response to the fiscal shock when TGOV and the FGOV models are employed, whereas consumer sentiment falls almost immediately after the impact under these models. These responses are inconsistent with a view that consumer sentiment passively reflects changes in the current private GDP. If that is the case, the sentiment response should have resembled initially positive responses of consumption for about a year since the impact of the fiscal shock. Furthermore, it should be noted that the consumer sentiment is constructed to measure consumers' perception on the future economic conditions as well as the current conditions. Therefore, immediate declines

of the sentiment which contrast to short-run increases in consumption imply that consumer sentiment does not passively reflect changes in private activity. Put it differently, our response function estimates overall imply the existence of a sentiment channel where the sentiment plays a leading role in determining private activity.

1.4 Further VAR Evidence

1.4.1 Responses of Durable and Nondurable Goods Consumption

This subsection estimates the effects of the fiscal and the sentiment shocks on two sub-components of private consumption: consumption of durable goods ($cond_t$) and consumption of non-durable goods and services ($conn_t$). One motivation of this exercise is that consumers tend to adjust consumption pattern for durable goods such as automobiles and houses when they expect persistent changes in economic conditions, while non-durable goods consumption might be also influenced by temporary changes in incomes. For this purpose, we replace $conm_t$ with $cond_t$ or $conn_t$ in (3.2), then re-estimate the VAR models. Impulse-response function estimates are reported in Figures 9 and 10.

Overall, durable good consumption does not respond significantly to the fiscal shock with an exception of SPF model which shows significantly *negative* responses. Nondurable good consumption exhibit significantly positive responses for a short period of time under the TGOV and FGOV schemes. We note that nondurable good consumption shows significantly positive responses for a while under the SPF identification scheme. Note also that durable good consumption responses under the same scheme exhibit much stronger decreases that dominate the positive responses

of nondurable good consumption, which is consistent with decreases in the total consumption reported earlier.

Response function estimates of total consumption to the fiscal shock shown in Figure 6 resemble those of nondurable goods consumption in Figure 10 more than durable goods consumption responses in Figure 9. Put it differently, fiscal shock effects on total consumption are overall driven by responses of $conn_t$ instead of those of $cond_t$. Since consumers tend to buy more durable goods such as automobiles and home appliances when they are confident that the economy would continue to expand, these findings imply fiscal shocks fail to generate consumer optimism on economic conditions in the near future, which seems consistent with insignificant and negligible responses of durable goods consumption to the fiscal shock.

In contrast, total consumption responses to the sentiment shock are somewhat in between those of durables and nondurables consumption responses. That is, in response to a positive sentiment shock, durable goods consumption also rises significantly and persistently no matter what identification methods are employed.

Figures 9 and 10 around here

1.4.2 Effects on Private Employment

As Ramey (2012) points out, fiscal spending effects on private jobs may differ depending on the nature of government spending. If fiscal spending occurs mainly

through government purchases of private sector goods and services, the fiscal spending shock may increase private employment. On the contrary, increases in government value added that include mainly compensation of public employees may decrease private sector jobs as the public sector employment rises given the labor force, eroding the private sector jobs.

We estimate and report private sector labor market effects of the fiscal shock as well as those of the sentiment shock. For this purpose, we replace $invt_t$ and $conm_t$ in (3.2) with private jobs ($pjob_t$). Results are reported in Figure 11. We observe that fiscal shocks again fail to increase private employment when TGOV, FGOV, and SPF models are employed, while it temporarily increases private jobs in the short-run when NEWS model is used. Overall, responses of the private sector jobs are either insignificant or even negative. On the contrary, the sentiment shock has a solid positive effect on private employment that lasts several years since the shock occurs no matter what identification methods are employed.

In a nutshell, private labor market effects of the fiscal spending shock are weak and mostly insignificant, which contrast sharply with the sentiment effect that results in persistently positive increases in private sector jobs. These findings might explain why recent increases in fiscal spending fail to reduce unemployment for a prolonged period of time after the Great Recession. That is, falling private spending may weaken job creation effects of the government spending shock as it creates consumer pessimism in the economy, which in turn reduces private spending.

Figure 11 around here

1.4.3 Effects on Private Wages

Private wages may rise in response to the fiscal shock in either cases of government purchases of private sector goods or increases in government value added. On the other hand, private sector wages may fall if rational consumers, expecting a tax hike in the near future, increase the labor supply sufficiently. If fiscal shocks result in decreases in private activity, as implied by our estimation results, there will be negative effects on private wages due to decreases in consumption and investment.

We empirically appraise the effects of the fiscal shock on private wages by replacing $invt_t$ and $conm_t$ in (3.2) with private wages ($pwag_t$). As can be seen in Figure 12, we observe slightly positive effects of the fiscal shock on private wages that are mostly insignificant from three VAR specifications with an exception of SPF model. That is, potentially positive effects of fiscal spending shocks are likely to be muted by negative responses of private spending, which result in decreases in demand for private sector goods and services. On the contrary, private wages respond persistently and positively to the sentiment shock for over three years that are significant at the 5% levels. Solid increases in private wages seem to be caused by increases in the demand for labor, because sentiment shocks promote private activity persistently.

Figure 12 around here

1.4.4 Current or Forward Looking Sentiment?

We further experiment our analyses with two sub-indices of the consumer sentiment index: the index of current economic conditions (ICC) and the index of

consumer expectations (ICE). For example, Bachman and Sims (2012) use ICE instead of the combined sentiment index used in the present paper. Even though their approach has some merits, the forward-looking sentiment data (ICE), behaves very similarly to the current economic conditions index (ICC) as we saw in Figure 3.

Nonetheless, we estimate VAR models after replacing the consumer sentiment index ($sent_t$) with these two sub-indices. Results are reported in Figures 13 and 14. We obtain very similar impulse-response functions as the ones reported in Figure 6. We also estimate and report the responses of these sentiment sub-indices to the fiscal shock in Figure 15, which again resemble those in Figure 7 with the combined sentiment data. Therefore, our results are robust to the choice of alternative sentiment variables.

Figures 13, 14, and 15 around here

1.4.5 Sub-Sample Analysis

We also investigate the consequences of combining forecast errors for the real defense spending growth rate with those for the real federal spending growth rate via the SPF data. Following Ramey (2011), we combined these two series in order to obtain long-horizon data. Key results from a shorter sample period from 1981:III to 2013:II, the period with the real federal spending growth rate forecast errors, are reported in Figure 16.[15]

[15]All results are reported in the not-for-publication appendix and are available from authors.

In a nutshell, we obtain very similar impulse-response functions as the ones reported previously. Consumption and investment respond significantly negatively to the fiscal shock, while they rise persistently when the sentiment shock occurs.

Figure 16 around here

1.5 Further Analysis

This section provides robustness check analysis by implementing counterfactual simulation exercises following the framework proposed by Bachman and Sims (2012). Our results contrast sharply with those of Bachman and Sims (2012). We also employ a nonlinear model. Our results imply very weak evidence of nonlinearity, which is consistent with findings by Owyang et al. (2013) and Ramey and Zubairy (2014).

1.5.1 Counterfactual Simulation Results

This section implements counterfactual simulation exercises that isolate the direct effects of the fiscal expansion shock on private activity from its indirect effects via the sentiment channel. Following Bachman and Sims (2012), we generate a hypothetical sequence of sentiment shocks that holds sentiment unchanged at all forecast horizons since the impact of the fiscal shock, which then can be used to eliminate the indirect effects of the fiscal shock so that one can obtain the hypothetical direct fiscal shock effects on private activity.

Consider the following simple tri-variate VAR model.

$$\mathbf{x}_t = \sum_{j=1}^{p} \mathbf{A}_j \mathbf{x}_{t-j} + \mathbf{A}_0^{-1} \mathbf{u}_t, \tag{1.3}$$

where $\mathbf{x}_t = [g_t \quad sent_t \quad y_t]'$, $\mathbf{A}_0^{-1}$ is the Choleski factor, and $\mathbf{u}_t$ is the vector of the orthonormal structural shocks, that is, $E\mathbf{u}_t\mathbf{u}_t^{'} = \mathbf{I}$. Let $\tilde{\mathbf{F}}$ denotes the top-left 3 by 3 sub-matrix of the $3p$ by $3p$ companion matrix for the state-space representation.[16] The h-period ahead impulse-response function of the i^{th} variable to the structural shock to the j^{th} variable is given by the following.

$$\psi_{i,j}(h) = s_i^{'} \tilde{\mathbf{F}}^{h-1} \mathbf{A}_0^{-1} s_j, \tag{1.4}$$

where s_i is a 3 by 1 selection vector with a one in the i^{th} place and zeros elsewhere.

Note that the contemporaneous sentiment response to a 1% fiscal spending shock ($u_1^g = 1$) is given by $s_2^{'} \mathbf{A}_0^{-1} s_1$. To zero out this response, we need to generate the following size hypothetical sentiment shock,

$$u_1^{sent} = -\frac{s_2^{'} \mathbf{A}_0^{-1} s_1}{s_2^{'} \mathbf{A}_0^{-1} s_2} \tag{1.5}$$

The sequence of sentiment shocks for the remaining period can be recursively calculated as follows.

$$u_h^{sent} = -\frac{s_2^{'} \tilde{\mathbf{F}}^{h-1} \mathbf{A}_0^{-1} s_1 + \sum_{r=1}^{h-1} \left(s_2^{'} \tilde{\mathbf{F}}^{h-r} \mathbf{A}_0^{-1} s_2 \right) u_r^{sent}}{s_2^{'} \mathbf{A}_0^{-1} s_2}, \; h = 2, 3, \ldots \tag{1.6}$$

[16] See any time series econometrics textbook for details on the state-space representation.

Finally, the counterfactual impulse-response function of the i^{th} variable to the 1% fiscal spending shock can be calculated as follows.

$$\hat{\psi}_{i,1}(h) = \psi_{i,1}(h) + \sum_{r=1}^{h} \left(s_i' \tilde{\mathbf{F}}^{h-r} \mathbf{A}_0^{-1} s_2 \right) u_r^{sent} \tag{1.7}$$

Our simulation exercise results are consistent with empirical findings reported earlier. We first implemented the exercises with the federal spending per capita ($fgov_t$) and the per capita private GDP.[17] Solid lines are point estimates for the impulse-response function from the benchmark tri-variate VAR model, $\psi_{i,1}(h)$, whereas dashed lines are hypothetical response functions, $\hat{\psi}_{i,1}(h)$. 95% confidence bands (dotted lines) for the benchmark VAR model are obtained from 500 nonparametric bootstrap simulations.

As we can see in Figure 17, hypothetical sentiment shocks ,$\{u_h^{sent}\}_{h=1}^{\infty}$, are mostly *positive* because sentiment overall *negatively* responds to the fiscal shock, $\psi_{2,1}(h) < 0$. Since the government spending responds negatively to the sentiment shock, this implies that $\hat{\psi}_{1,1}(h)$ tends to be weaker than $\psi_{1,1}(h)$. It should be noted that hypothetical output responses, $\hat{\psi}_{3,1}(h)$, would be overall greater than $\psi_{3,1}(h)$, because hypothetical consumer optimism shocks, $u_h^{sent} > 0$, continue to boost output. Note also that fiscal shocks might be able to stimulate private activity if consumer pessimism can be muted.

Figure 17 around here

[17]The private GDP is the total GDP minus the government spending.

The negative response of consumer sentiment we report here is at odds with that of Bachman and Sims (2012). In order to investigate the robustness of our results, we estimate the impulse-response functions from (3.4) using an array of popularly used identification methods. Figure 18 reports the response function estimates of consumer sentiment to fiscal spending shocks that are identified with 4 different measures of real government spending per capita: the real government consumption expenditures and gross investment; the real federal government consumption expenditures and gross investment; real state and local government consumption expenditures and gross investment; real federal government defense consumption expenditures. In all cases, we obtain either negative or negligibly positive responses. More detailed exercises are available in Jia and Kim (2016).

Figure 18 around here

We also implemented a similar exercise with the total GDP instead of the private GDP. Results in Figure 19 provide similar findings. We note that Bachman and Sims (2012) obtained small but positive responses of consumer sentiment to the fiscal expansion shock, though insignificant. Their model uses the log government spending (consumption and investment) and the forward looking sentiment index (ICE). Employing the same model specification, we obtained very similar results as ours in Figure 18 including negative responses of sentiment to the fiscal spending shocks.[18]

[18]We obtained the Real Government Consumption Expenditures and Gross Investment data (GCEC1) from the FRED. We log transformed the series for our VAR models. We also used per

Figure 19 around here

1.5.2 Nonlinear Model Estimates

Lastly, we study the possibility of nonlinear responses of the sentiment to the fiscal shock. For this purpose, we employ the following two-regime threshold VAR (TVAR) model. Abstracting from deterministic terms, we use,

$$\mathbf{x}_t = \left(\sum_{j=1}^{p} \mathbf{A}_j^R \mathbf{x}_{t-j} \right) I(\tau_{t-d} < \tau^*) + \left(\sum_{j=1}^{p} \mathbf{A}_j^B \mathbf{x}_{t-j} \right) I(\tau_{t-d} > \tau^*) + \varepsilon_t, \qquad (1.8)$$

where I is the indicator function and τ_{t-d} is a d-period lagged threshold variable that represents the present state of the economy. We use the (total) GDP growth rate for this threshold variable in order to investigate nonlinear responses of the sentiment to the fiscal shock during different phases of the business cycle. $\mathbf{A}_j^R(L)$ and $\mathbf{A}_j^B(L)$ are lag polynomial matrices during economic recessions ($\tau_{t-d} < \tau^*$) and booms ($\tau_{t-d} > \tau^*$), respectively. We use a one-dimensional grid search method to identify τ^* by minimizing $\ln \left\| \hat{\Sigma} \right\|$, where $\hat{\Sigma}$ is the variance-covariance matrix given a fine grid point $\tau_{t-d} \in \{\tau_{0.15}, ..., \tau_{0.85}\}$. We trimmed 15% of the data from each side to make sure we use enough number of observations in each regime. Conventional delay parameter $d = 1$ was employed.

It should be noted that we need to reduce the dimension of our VAR system substantially for proper estimations of this type of TVAR models. For example, our FGOV model with three lags requires estimations of $8^2 \times 3$ reduced-form coefficients

capita real government spending data. Whichever specifications are used, our VAR models always yielded negative dynamic responses of sentiment to the fiscal shock.

for each regime, which may not be feasible with a small grid point such as $\tau_{0.15}$, because not enough number of observations may be used to estimate coefficients with such specifications. Since we are mainly interested in nonlinear responses of the sentiment to the fiscal spending shock, we employ a simple tri-variate TVAR model with $\mathbf{x}_t = [g_t \;\; priy_t \;\; sent_t]'$, where $g_t = tgov_t,\; fgov_t,\; ramy_t,\; spf_t$. Regime-specific impulse-response function estimates of the sentiment to the fiscal shock are reported in Figure 20.[19]

From all 4 VAR models, we obtain solid negative responses of the sentiment to the fiscal shock in both regimes, which sharply contrasts to the work of Bachman and Sims (2012). Instead of finding positive (optimism) responses, we observed that the fiscal spending shock during recessions generates consumer pessimism as in our previous results from the linear model. We also obtain solid negative responses of $sent_t$ to the fiscal shock during economic booms as well. Put it differently, our evidence of consumer pessimism in response to the fiscal shock seems to be robust to different states of the economy, which is consistent with the work of Owyang, Ramey, and Zubairy (2013) and Ramey and Zubairy (2014). We also note that consumer sentiment shows improvement for a while since the occurrence of the fiscal shock during economic booms especially in SPF model. However, $sent_t$ rapidly falls and enters a negative region, showing no persistent improvement in the sentiment.

[19]We report regime-specific impulse-response function estimates based on the point estimates, since the main objective of this exercise is to see whether there's evidence of quaitatively different responses of $sent_t$ in different phases of business cycle. For more rigorous analysis, we need to estimate the generalized impulse-response functions for nonlinear models (Koop, Pesaran, and Potter, 1996).

Figure 20 around here

1.6 Conclusion

The recent Great Recession accompanied by the slow recovery triggered an active debate on the effectiveness of the fiscal policy in stimulating economic growth. Empirical evidence is at best mixed and the economics profession has failed to reach a consensus.

This paper takes a different road and attempts to understand what influences the effects of the fiscal policy on the private sector economy. For this purpose, we introduce the role of consumer sentiment in a propagation mechanism for government spending shocks towards economic activity in the private sector. As Ramey (2011) points out, statistical inferences may be influenced by alternative identification methods for the spending shock. Thus, we employ an array of recursively identified VAR models as well as the two expectational VAR models. We obtain solid evidence of the existence of a consumer sentiment channel that is robust to alternative identification methods.

Our major findings are as follows. First, our empirical results imply a very weak, even negative effect of the government spending shock on private sector spending such as consumption and investment, which confirms the conclusion by Ramey (2012). On the contrary, innovations in the consumer sentiment generate solid positive responses of consumption and investment for a prolonged period of time. Third, consumer sentiment negatively responds to the government spending shock since the

impact, while under the conventional VAR schemes, consumption shows positive responses, mainly from nondurable good consumption, for a brief period of time, then quickly deteriorates to a negative region. This implies that the fiscal policy may become ineffective in stimulating economic activity because it generates consumer pessimism that results in subsequent decreases in consumption and investment. That is, consumer sentiment channel may be a key in understanding the propagation mechanism of fiscal policy shocks. Similar evidence are also obtained from private sector labor market variables. Employment and real wages in the private sector respond significantly positively only to the sentiment shock. Our nonlinear VAR models and counterfactual simulation exercises also provide strong supports for an important role of the consumer sentiment channel in the propagation mechanism of the fiscal shock.

Chapter 2

Fiscal Expansions and the Current Account in the U.S.: The Role of Sentiments

2.1 Introduction

Over the last several years, the discussion about the effect of government budget deficits on current account balance in open economies is still holding a widespread disagreement among economists. According to the conventional claims, government budget deficits tend to lead a deterioration of current account balance and it is in line with the theoretical "Twin Deficits" hypothesis. Most of the studies who follow New Keynesian theorem tend to observe the deterioration of current account in response to the expansionary fiscal deficits shock, while real exchange rate is appreciating, e.g. Baxter (1995), Bluedorn and Leigh (2011), Kumhof and Laxton (2013), Makin and Narayan (2013), Auerbach and Gorodnichenko (2015). In contrast, studies like Corsetti and Müller (2006), Olivier Blanchard (2007), Kim and Roubini (2008), Müller (2008), and Kim (2015) surprisingly reveal a salient positive effect of fiscal deficits on the current account balance, which is the so-called "Twin Divergence". However, neither of these strands have reached a conclusive agreement about the fiscal deficits effect on the current account balance.

Given this paradoxical statement about the fiscal deficits effect on the external balance, some other economists try to explore the reconciliations between

"Twin Deficits" and "Twin Divergence", e.g. Corsetti and Müller (2008), Nickel and Vansteenkiste (2008), Backus et al (2009), Cavallo (2005), Erceg, Guerrieri and Gust (2005), Nickel and Tudyka (2013), Forni and Gambetti (2016). Most of these reconciliation studies tend to find intensively conditional, weak or non-existent correlations between fiscal deficits and the current account deficits. They also claim that there are other important factors rather than government budget deficits are switching the sign of the link between fiscal deficits and current account deficits, the anticipation of government spending changes is one of the highly controversial factors.

The purposes of this paper is to, firstly, revisit those mixed statements. In fact, according to the empirical results in this paper, government spending shock tends to consistently depreciate the real exchange rate and improve the current account balance, which is in line with the "Twin Divergence" hypothesis. Secondly, since the understanding of the propagation of fiscal deficits effect on the current account balance has still been elusive as mentioned in Auerbach and Gorodnichenko (2014), we try to shed a light on the sentiment channel that through which the presence of "Twin Divergence" would be interpreted.

Although some studies have already talked about a few threshold variables[1] that would alter the effect of fiscal deficits on current account balance, ultimately, those threshold variables are highly affected by the presence of home bias in private spending according to Müller (2008). One important interpretation for the presence of

[1]For example, anticipation of government spending, the ratio of debt-to-GDP, degree of trade openness, consumers' Ricardians behavior, decisions of saving and investment, shocks of productivity and technology, price elasticity of exports and imports demand, the persistence of government spending shock, government purchase distribution on durable goods and non-durable goods, etc.

"Twin Divergence" in this paper is that private spending consistently has a negative response to the fiscal spending shock, and this finding is in line with the work of Hall (1986), Aiyagari, Chirstiano, and Eichenbaum (1992), Ramey and Shapiro (1998), Edelberg, Eichenbaum, and Fisher (1999), Burnside, Eichenbaum, and Fisher (2004), Cavallo (2005), Mountford and Uhlig (2009), Ramey (2011, 2012), Owyang, Ramey, and Zubairy (2013), and Jia and Kim (2016). According to Cavallo (2005), private spending deterioration induces an offsetting effect of the private saving on the decreased public saving, which means once the increased private saving is higher than the decreased public saving due to the deficits shock, the current account balance will be improved, since both the real interest rate and real exchange rate will be declining at this scenario.

Furthermore, we draw a special attention to the consumer sentiment channel that through which we could interpret the presence of "Twin Divergence". Many previous studies have found salient interactions between consumer sentiment and economy activities, e.g. Hall (1993) and Blanchard (1993), Cochrane (1994), Beaudry and Portier (2004, 2006), Barsky and Sims (2012), Bachman and Sims (2012), and Jia and Kim (2016). The pessimistic consumer sentiment in response to the fiscal expansion is revealing that an expansionary fiscal policy tends to make consumers feel more pessimistic and it's leading to the deterioration of private spending. Especially when the increase of private saving is more than enough to offset the expansionary fiscal deficits, the current account balance will be improved due to the depreciated real exchange rate. So, it's not hard for us to tell the fundamental propagation of the

effect of fiscal deficits on the external balance is the pessimistic sentiment response. This finding is also one of the most important contributions in this paper.

As to the methodology, firstly, we set up a conventional VAR model to capture how the actual amount of government spending changes will lead the response of the current account balance. This identification scheme is in line with the empirical models proposed in Fatas and Mihov (2001), Blanchard and Perotti (2002), Perotti (2004), Galí, López-Salido, and Vallés (2007), Kim and Roubini (2008), Ramey (2011), Ramey (2013), etc. Secondly, since the anticipation of fiscal spending is critical to analyze the effect of government spending shock on economy (Ramey (2011), Jia and Kim (2016), and Forni and Gambetti (2016)), we apply an Expectational VAR (EVAR) model which is initially proposed by Perotti (2011). With EVAR model, we could observe how the current account balance is affected by the forward-looking changes of government spending. Thirdly, we compare the impulse response results of conventional VAR with those of EVAR. We want to see if impulse responses of interested variables to the shock of fiscal spending are consistent or disparate due to the fact of spending anticipation. Last but not the least, we apply a few alternative types of fiscal spending under both conventional VAR and EVAR models to discuss the results robustness. We also impose fiscal shock on variables of both private activates and consumer sentiment to detect the sentiment channel that through which we could interpret the presence of "Twin Divergence".

The calibration of our models is neither based on a finite-horizon setup nor the assumption of non-Ricardian consumers as in Kumhof and Laxton (2013). We allow both Ricardian and non-Ricardian households exist in the model. Moreover, in

order to detect the consistency of government deficits effect on the current account balance, we allow the application of alternative types of government spending, such as total government spending, federal government spending, and defense spending. We don't use state and local government spending individually, since it has already been included in the total government spending. Also, the state and local government spending is more about stimulating the local infrastructure and employment, it has a comparatively much tenuous influence on the external balance as a whole.

All in all, the remaining part of this paper is organized as follow: in section 2.2, we introduce the benchmark empirical models along with the identifications of fiscal spending shocks; section 2.3 is about the data description, analysis for empirical results and extensive discussion; eventually, we reach to the conclusion in section 2.4.

2.2 The Empirical Model

Abstracting from deterministic terms, we employ the following p^{th} order vector autoregressive model for an open macroeconomy.

$$\mathbf{x}_t = \mathbf{\Phi}_1 \mathbf{x}_{t-1} + \mathbf{\Phi}_2 \mathbf{x}_{t-2} + ... + \mathbf{\Phi}_p \mathbf{x}_{t-p} + \mathbf{C}\mathbf{u}_t, \tag{2.1}$$

where

$$\mathbf{x}_t = [g_t \quad y_t \quad sent_t \quad nx_t \quad rir_t \quad rer_t]'$$

$\mathbf{C}$ is a lower-triangular matrix and $\mathbf{u}_t$ is mutually orthogonal vector of normalized structural shocks, that is, $E\mathbf{u}_t\mathbf{u}_t' = \mathbf{I}$. g_t denotes the government spending, y_t is a vector (or a scalar) of private GDP variables such as consumption (con_t), investment (ivt_t), or overall private spending (pry_t). $sent_t$ denotes a scalar consumer sentiment variable, nx_t is the trade account balance as a share of GDP, rir_t is the real interest rate, and rer_t is the real exchange rate. We demean and detrend $\mathbf{x}_t$ prior to estimations.

We employ the following two benchmark VAR(p) models in the present paper. First, motivated by the work of Kim and Roubini (2008), we employ a recursively identified conventional VAR model that employs the fiscal deficit ($g_t = govd_t$) to identify the fiscal expansion shock. $govd_t$ is the government spending minus the tax revenue as a share of GDP.[2]

Our second model is the so-called expectational VAR (EVAR) model that incorporates market partcipants' expectation on changes in the stance of fiscal policy. Ramey (2011) points out that fiscal variables such as military spending are likely to be anticipated. That is, market participants may react to anticipated changes in fiscal policy well before the government actually implements it. Following Ramey (2011), we identify the fiscal shock via the one-quarter ahead forecast error of the government spending growth ($g_t = spf_t$), utilizing the Survey of Professional Forecasters (SPF) data from the Philadelphia Fed.

Note that g_t is ordered first in all models, meaning that the fiscal variable is not contemporaneously influenced by the other variables within one quarter. This

[2]Kim and Roubini (2008) also employed a non-recursive VAR model to check robustness of their findings.

seems to be an innocuous assumption that is often employed in the current literature (e.g., Ramey, 2011), because implementations of fiscal policies in general require congressional approval prior to the fiscal year.[3]

It is well documented that econometric inferences based on recursively identified VAR models might not be robust to alternative VAR orderings. Our major findings, however, are not subject to this problem. To see this, consider a VAR with $\mathbf{x}_t = [\mathbf{x}_{1,t},\ \mathbf{x}_{2,t}]$, where $\mathbf{x}_{1,t}$ is a vector of variables with a known ordering, while the ordering of $\mathbf{x}_{2,t}$ is unknown. Kim et al. (2015) analytically demonstrate that response functions to the shock to the $\mathbf{x}_{1,t}$ variables are unaffected by arbitrary reshuffling of the $\mathbf{x}_{2,t}$ variables. Since g_t is ordered first ($g_t = \mathbf{x}_{1,t}$), Kim et al.'s (2015) work implies that all response functions to the fiscal shock are numerically *identical* even when one randomly rearrange the other variables next to g_t.

2.3 Empirical Results

2.3.1 Data Description

We obtained most of our data from the FRED with a few exceptions. Observations are quarterly and span from 1973:I to 2015:IV for the current floating exchange rate regime. We obtained the monthly frequency consumer sentiment index ($sent_t$)

[3]Kim and Roubini (2008) put $govd_t$ second next to the total GDP to control for business cycle effects on $govd_t$, because the government tax receipt in $govd_t$ is contemporaneously influenced by GDP. That is, the tax receipt falls (rises) during economic recessions (booms). We implemented VAR analysis that is similar to this specification, and obtained virtually the same results. All results are available in the not-for-publication appendix.

data from the University of Michigan's Survey of Consumers database, and transformed it to quarterly data by taking the end of period values. $sent_t$ is expressed in natural logarithm.

All public and private spending variables such as the total government spending (gov_t), consumption (con_t), and investment (ivt_t) are divided by the GDP deflator, then log-transformed. The total private spending (pry_t) is defined as the sum of private consumption and private investment, divided by the GDP deflator, then log-transformed. The real exchange rate (rer_t) is the natural logarithm of the real trade weighted US dollar index (major currencies). The real interest rate (rir_t) is the second market three-month Treasury Bill yield adjusted for GDP deflator-based inflation.

Under the conventional VAR model framework, we use the government budget deficit ($govd_t$) to identify the fiscal expansion shock (Kim and Roubini, 2008). $govd_t$ is defined as gov_t minus the total tax receipt (tax_t) as a share of GDP. The current account (cur_t) and/or the net exports (nx_t) are also represented as a share of GDP.

For the expectational VAR scheme (Ramey, 2011), we use the Survey of Professional Forecasters (SPF) data, obtained from the Philadelphia Fed. Following Ramey (2011), we use the actual (log) federal government spending ($fgov_t$) growth rate ($\Delta fgov_t$) minus its one quarter ahead forecast, that is, $\Delta fgov_t - E(\Delta fgov_t|\Omega_{t-1})$ where Ω_{t-1} is the forecasters' information set at time $t-1$, as the fiscal spending variable (spf_t). One caveat is that we combine forecast errors of the defense spending growth rate (1973:I to 1981:II) with those of the federal government spending growth

rate (1981:III to 2015:IV) to get the data with reasonably long sample period.[4] As Ramey (2011) discussed, however, using forecast errors instead of forecasts reduces the cost of combining those two data series.

One issue is that forecasters were asked to predict *nominal* defense spending until 1981:II, whereas they were asked to predict *real* federal spending since then. So we deflate the earlier period data using the SPF forecasts of the GDP deflator. One other issue is that there were overall 9 changes of base year in the national income and product account (NIPA) during our full sample period. Since the SPF forecast does not reflect such changes, we re-scaled all relevant forecast data with 2009 as the common base year.

In Figure 21, we report graphs of $govd_t$ and spf_t. Once filtered through VAR models, residuals of these variables show quite similar dynamics. In what follows, we show both identification schemes provide similar empirical evidence in favor of the "Twin Divergence". More detailed information on data is provided in Table 2.

Figure 21 and Table 2 around here

2.3.2 Fiscal Expansions and the Current Account

This section reports impulse response function estimates over 5 years to the fiscal spending shock from the conventional VAR model (Figure 22) and from the EVAR model (Figure 23).[5]

[4]We obtained the earier data set from Tom Stark at the Philadelphia Fed.

[5]We report response function estimates from VAR(3). Resuts with alternative choices of lag length, up to 4 lags, yielded qualitatively similar results and are available upon requests.

Our empirical findings from both the VAR and the EVAR frameworks are consistent with the so-called "Twin Divergence" (Kim and Roubini, 2008) rather than the twin deficit hypothesis. The current account increases persistently in response to the fiscal deficit ($govd_t$) shock. The real exchange rate depreciates over time which explains the observed improvement in the current/trade account balance.[6] Similar evidence in favor of the "Twin Divergence" was also observed from the EVAR framework that identifies the fiscal spending shock via the SPF forecast error (spf_t).

It should be noted that the real interest rate *declines* when the fiscal spending shock occurs, it is an exactly opposite prediction compare to what is proposed by "Twin Deficits" hypothesis. If fiscal expansions decrease national savings as explained in the standard textbook (e.g., Mankiw, 2010), the real interest rate must rise and it will be resulting in a real appreciation, which then leads to a current account deterioration. We also note that the interest rate rises in response to the fiscal shock in Kim and Roubini (2008), which is consistent with a decrease in investment and thus an improvement of the current account. However, their model predicts a real depreciation that is at odds with the increase in the real interest rate.

Figures 22 and 23 around here

Our estimates suggest a different story. The real interest rate (rir_t) decreases in response to the fiscal spending shock due to a decrease in private spending (pry_t), which is more than enough to offset the decrease in government saving. As the real

[6]We obtain qualitatively very similar results from VAR estimations with the net exports instead of the current account. Response function estimates are available upon requests.

interest rate falls, the real exchange rate declines leading to a real depreciation instead of a real appreciation of the U.S. dollar, which is consistent with an improvement of the current/trade account balance.

A conventional Ricardian consumer argument and the theory of negative wealth effect would explain why private spending declines when the fiscal expansion shock occurs.[7] We offer an alternative explanation based on the sentiment channel introduced by Jia and Kim (2016).

As can be seen in Figures 22 and 23, $sent_t$ declines significantly when the fiscal expansion shock occurs. That is, the fiscal shock triggers consumer pessimism by confirming the expectation of declining productivity in the near future. Decreases in consumption and investment, therefore, contribute to increases in savings, which result in a decrease in the real interest rate as seen above. To investigate this conjecture in more details, we estimate the impulse-response functions after replacing pry_t with consumption (con_t) and investment (ivt_t). Results reported in Figures 24 and 25 strongly support this view as both con_t and ivt_t persistently and significantly decline when the fiscal shock occurs. Since both rir_t and ivt_t fall in response to the fiscal shock, the decrease in ivt_t is caused by a shift factor such as changes in $sent_t$ rather than by endogenous adjustments.

Figures 24 and 25 around here

We further investigate the importance of the role of consumer sentiment by estimating the impulse-response functions to the sentiment ($sent_t$) shock. Results

[7] In response to an increase in the budget deficit, rational consumers increase saving as they anticipate a tax hike in the future.

are reported in Figures 26 (VAR) and 27 (EVAR). We first note that consumption and investment exhibit highly significant positive responses to the sentiment shock, which imply an important role of $sent_t$ in determining private spending. The real interest rate rises as private savings fall, and the real exchange increases, though insignificant, which is consistent with increases in the real interest rate. The current/trade account, therefore, decreases as private spending increases and a real appreciation occurs. Fiscal expansions variables, $govd_t$ and spf_t, decline in response to the $sent_t$ shock, which is consistent with counter-cyclical nature of fiscal spending.

Figures 26 and 27 around here

In a nutshell, our empirical findings provide solid evidence in favor of the "Twin Divergence" whether fiscal expansions are anticipated (EVAR) or come to a surprise realization (conventional VAR). It should be noted that the consumer sentiment channel (Jia and Kim, 2016) plays a key role in generating the "Twin Divergence" instead of the "Twin Deficit". Fiscal expansions (fiscal deficits) generate consumer pessimism, which is accompanied by decreases in consumer spending and the real interest rate. Consequently, the real exchange rate falls and the trade account improves.

We then study the dynamic adjustments of the current/trade account to the fiscal shock in more details by estimating responses of imports (imp_t) and exports (ext_t) separately. For this purpose, we replaced the current account with imports (or exports) in each of our VAR models. As we can see in Figure 28, imports

fall immediately then converge to the long-run equilibrium in about three years, while exports increase after about a two-year delay. It should be noted that delayed responses of exports seem to be caused by delayed real appreciations we observe in the graph. That is, initial improvements in the current account seem to be driven by decreases in imports as private spending fall in response to the fiscal expansion shock. It also reveals that expansionary fiscal stimulus not only lacks of effectiveness on private sector but also on the external balance, since in short-run the trade surplus is more due to the decreases in imports rather than the boosts in exports.

Figure 28 around here

2.3.3 Alternative Identification Methods

This section implements an array of VAR models with alternative identification schemes. We first employ a conventional VAR model that is similar as the ones adopted by Blanchard and Perotti (2002), Perotti (2004, 2011), and Galí, López-Salido, and Vallés (2007), which identify the fiscal shock with the federal government spending ($fgov_t$) variable instead of the government deficit variable ($govd_t$). For this purpose, we replaced $govd_t$ with $fgov_t$ and use the federal tax receipt variable (tax_t) as a control variable.

We report impulse-response function estimates in Figure 29. We obtain very similar empirical findings as those from our two benchmark models reported earlier. In response to the fiscal spending shock, $sent_t$ and pry_t fall, resulting in a decrease in the real interest rate, though marginally significantly. Again, we observe a persistent

real depreciation and an improvement in the current/trade account. Overall, we obtained strong evidence of the "Twin Divergence".

Figure 29 around here

We also employ an EVAR model using Ramey's (2011) news variable (rnw_t) replacing spf_t with it. Main results are reported in Figure 30. In contrast with previous results, the current account decreases in response to the fiscal expansion shock identified by rnw_t.

Figure 30 around here

To understand why the EVAR model with rnw_t fails to yield sharp estimates, we note the following statement by Ramey (2011). She points out that her news variable (rnw_t) lacks explanatory power for fiscal expansions if both WWII and the Korean War are excluded from the sample.[8] This is exactly the case in the present paper, because we use the sample period that begins in 1973:I as we focus on the current floating exchange rate regime in the U.S., this time period is excluding both WWII and Korean War. That is, poor estimates with the rnw_t model seem to be due to poor identification scheme for the sample period used in the present paper. To further investigate this issue, we report scatter plot diagrams for rnw_t, spf_t, and $govd_t$ in Figure 31. These scatter-plot diagrams imply strong positive correlation

[8]See the second paragraph on page 4 in Ramey (2011).

between spf_t and $govd_t$, while very weak correlation between rnw_t and the other two variables.[9] That is, rnw_t may not be an ideal variable for the current floating exchange rate regime.

Figure 31 around here

2.4 Conclusion

This paper explores the resolutions for two major questions: in floating exchange rate regime in the U.S., the relationship between fiscal deficits and current account deficits is more consistent with "Twin Deficits" or "Twin Divergence"? Through which channel, the effect of fiscal deficits on the current account would be interpreted appropriately?

First, we revisit those mixed statements about "Twin Deficits" and "Twin Divergence" by implying both conventional VAR and *Expectational VAR (EVAR)* models, and then we compare the impulse response results of conventional VAR with those of EVAR. We find that the impulse responses of current account balance to the shock of fiscal spending/deficits are consistently positive regardless of the spending anticipation. Moreover, we apply a few alternative types of fiscal spending under both

[9]Forni and Gambetti (2016) recently claim that their EVAR models that utilize SPF data generate empirical evidence in favor of the twin deficit. Their identification schemes, however, are different from the one in Ramey's (and our) SPF model (2011). For example, they use forecast revisions, $E(\Delta fgov_t|\Omega_t) - E(\Delta fgov_t|\Omega_{t-1})$, instead of $\Delta fgov_t - E(\Delta fgov_t|\Omega_{t-1})$ as in the present paper. We noticed that these two variables are *negatively* correlated each other, which explains why their model provides evidence of the twin deficit. We are not sure whether their method is useful in identifying the fiscal shock because their variable reflects revisions of forecasts only and does not utilize actual fiscal variables.

conventional VAR and EVAR models to test the fiscal effect consistency. In general, the main findings of "Twin Divergence" prove to be robust across alternative VAR identifications during the floating exchange rateregime in the U.S.

Secondly, we shed a light on the propagation of fiscal deficits effect on the current account balance via the channel of consumer sentiment. One important interpretation for the presence of "Twin Divergence" in this paper is that the private spending consistently has a negative response to the fiscal deficits shock, which is subsequently lead by a pessimistic response of consumer sentiment to the fiscal expansion. That is, expansionary fiscal policy tends to make consumers feel more pessimistic and it's leading to a deterioration of private spending, which subsequently induces the increase of private saving to exceed expansionary fiscal deficits, all those are contributing to the improvement of current account balance. Thus, the presence of "Twin Divergence" is observed.

Chapter 3

Estimates of Fiscal Expansion Effects: The Role of Government Expenditures Variations

3.1 Introduction

The magnitude of expansionary fiscal effects on the economy has long been a heated debate in macroeconomics, especially after the implementation of the American Recovery and Reinvestment Act (ARRA) in 2009, and extensive literature has grappled with this debate. For those studies which are mainly the echoes of the new Keynesian approaches, the gist of their arguments are about the positive stimulating effect of fiscal expansion. Yet works such as Rotemberg and Woodford (1992), Devereux, Head, and Laphan (1996), Fatás and Mihov (2001), Blanchard and Perotti (2002), Perotti (2005), Galí, López-Salido, and Vallés (2007) are advocating the positive view of fiscal expansion effect, the findings of other studies tend to reveal either limited or negative influences of expansionary fiscal policy to economic activities. This includes Aiyagari, Chirstiano, and Eichenbaum (1992), Hall (1986), Ramey and Shapiro (1998), Edelberg, Eichenbaum, and Fisher (1999), Burnside, Eichenbaum, and Fisher (2004), Cavallo (2005), Mountford and Uhlig (2009), Ramey (2012), and Owyang, Ramey, and Zubairy (2013), Jia and Kim (2016). In general, the estimates of a fiscal expansion effect are various across studies, and a definitive consensus has not reached thus far.

Given such mixed conclusions about the fiscal expansion effects, the major purpose of this paper is to address whether the variation of fiscal expansion effects is subsequently due to the variations of the government spending variables, such as government expenditures, government purchase[1], federal government expenditures, state and local government expenditures, transfer payments, etc. In addition, this paper is investigating if during different sample periods the fiscal expansion effects are working diversely in terms of stimulation. For contrastable purpose, two different sample periods have been implemented in the empirical work: sub-sample period (pre-2008) and full-sample period (1960-2015). Within this setting, we could compare the expansionary fiscal policy effect with and without the impact of the Great Recession[2].

In view of previous literature, most of studies are focusing on the expanded government purchases in terms of the sum of government consumption and gross investment, this includes Blanchard and Perotti (2002), Pappa (2009), Ramey (2012), Owyang, Ramey and Zubairy (2013), Leeper, Traum and Walker (2015), Bachmann and Sims (2012), Perotti (2004), Fatás and Mihov (2001), Galí, López-Salido and Vallés (2007), Mountford and Uhlig (2009), Corsetti, Meier and Müller (2012a), Fazzari, Morley and Panovaska (2015), Ilzetzki, Mendaza and Vegh (2013), Corsetti, Meier and Müller (2012b), Leeper, Walker and Yang(2010), McGrattan and Ohanian (2008), Monacelli, Perotti and Trigari (2010), Finn (1998), Auerbach and Gorodnichenko (2012), Hall (2009), Mittnik and Semmler (2012). This massive study on

[1]It primarily includes government consumption expenditures and gross investment.

[2]It denotes the global economic recession started in late 2000s and ended around 2010s. Different countries experience different length of the recession period. According to NBER's Business Cycle Dating Committee, the Great Recession lasted from 2007q4 to 2009q2 in the U.S.

expanded government purchases effect usually ends up with the claim that expansionary fiscal policy has a positive influence over economic activities, such as output, consumption and real wage. However, this conclusion suffers two major cursoriness: first, it omits the influence of expanded transfer payment, which is generating negative impact on interested economic activities; second, total government purchases also includes the state and local government spending, which shouldn't be counted as part of fiscal stimulation package due to the fact that the state and local governments are not making decisions about the national fiscal policies in the U.S.

Notwithstanding the popularity of government purchases, other literature have applied expanded government expenditures as the proxy of fiscal expansion, for example, Perotti (2014), Ramey (2011), Natvik (2012), Jia and Kim (2016). Oppositely, those studies tend to find either very limited or even negative fiscal expansion effects on economic activity, especially in the private sector. To disentangle the mixed findings regard to the effectiveness of expansionary fiscal shock, Natvik (2012) reveals that in order to generate a positive response from consumption to fiscal expansion, intensive constraints need to be injected. For example, we need to assume that only a small number of consumers are holding Ricardian equivalence, while other consumers are spending their entire income for each period. Besides, it also requires the restrictions about wage rigidity and imperfect substitutability between the optimizing and rule-of-thumb households. Moreover, according to the work of Jia and Kim (2016), even during economic recessions when the fiscal crowding out effects are comparatively low, government expenditures are not significantly generating positive responses from the private sector. Similar results are also found in those

works who are using federal-level expenditures, such as Ramey (2011), Fishback and Kachanovskaya (2010), Mertens and Ravn (2012).

Except for the variation of fiscal spending variables, one other important challenge in estimating the fiscal expansion effect is that, over time, the factors that are shifting the aggregate demand and short-run aggregate supply curves are different if government implements dissimilar fiscal policies (Hubbard and O'brien (2015)). Thus, dissimilar sample periods could be another important reason why the size of fiscal multipliers is a mixture across studies.

As to methodology, alternative identifications of a fiscal expansion shock have been identified based on a standard VAR model. The impulse responses of disaggregated expenditures variables are captured by the recursive cholesky decomposition, within two dissimilar sample periods respectively. Intuitively, the interested macroeconomic variables in this paper are including output (total GDP, private GDP), private activities (consumption and investment respectively), and consumer sentiment. It's worth noting how those major macroeconomic variables are responding to different fiscal expansion shocks before we reach to a generalized conclusion about the fiscal expansion effects.

The major contributions of this paper are four-fold. First, in contrast to government expenditures, government purchases tend to have stronger stimulating effect on economic activity. Second, compare to the full-sample period, the stimulating effects of fiscal expansions are more positive during the sub-sample period without the intervention of the Great Recession. Third, consumer sentiment constantly falls in response to fiscal expansion shocks, especially to the shock of transfer payment.

This finding of a pessimistic sentiment under the influence of fiscal expansion is in line with Jia and Kim (2016). Fourth, this paper provide an insight that the effect gap of total government purchases and federal government purchases is mainly built up by the interference of state and local government spending.

The remainder of this paper is organized as follows. Detailed information of the empirical model is provided in section 3.2. Data description and the preliminary findings are discussed in section 3.3. In order to compare the findings in this paper with previous papers, a comparable discussion is assigned to section 3.4. Section 3.5 consists of the concluding remark.

3.2 Empirical Model

In order to capture the fiscal expansion shock, a standard Vector Auto-Regressive (VAR) model has been implied. The basic setting of this model is:

$$\mathbf{x}_t = \mathbf{\Phi}(\mathbf{L})\mathbf{x}_{t-1} + \omega_t, \tag{3.1}$$

where $\mathbf{x}_t$ is an (n·1) vector containing $\mathbf{n}$ variables in the VAR; $\mathbf{\Phi}(\mathbf{L})$ is the vector of lag operator polynomials, see equation 3.2, which includes up to p lags in the system. ω_t is the vector of reduced form error terms. The coefficient matrix of this VAR is identified by $\mathbf{\Phi}$. On the right-hand side of equation 3.1, it only includes the predetermined variables, and the error terms are assumed to be serially uncorrelated.

$$\mathbf{\Phi}(\mathbf{L}) = \sum_{\mathbf{i=1}}^{\mathbf{p}} \mathbf{\Phi_i L^i} \tag{3.2}$$

This paper is particularly interested in variables as it's listed below:

$$\mathbf{x}_t = [g_t \quad y_t \quad snt_t \quad taxr_t \quad ints_t \quad mony_t]' \tag{3.3}$$

$\mathbf{g}_t$ denotes different types of government expenditures, it contains both aggregated government expenditures and disaggregated expenditures. y_t is a scalar (or vector) of output variables, such as total GDP ($rgdp_t$), private GDP ($priy_t$), consumption (con_t) and investment (ivt_t). snt_t denotes a scalar of consumer sentiment index, $taxr_t$ is the Federal government current tax receipts as a share of nominal GDP. $ints_t$ is the secondary market 3-month treasury bill yield, and $mony_t$ is the M2 money stock. By assuming that all variables in the system are stationary, all the data is demeaned and detrended prior to the estimation[3].

In order to detect the variations of the fiscal expansion effect, three alternative VAR(p) identification schemes have been employed in this paper. First identification scheme (**TGDP** model) is motivated by the work of Fatás and Mihov (2001), Blanchard and Perotti (2002), Bachmann and Sims (2012), Corsetti, Meier and Müller (2012a), a recursively identified VAR model has been employed when the y_t is defined as total GDP. Under this calibration, the fiscal expansion effect on total output could be estimated. The second (**PGDP** model) and third (**CI** model) frameworks of the VAR model focus primarily on the fiscal expansion effect on private sector, such as works of Galí, López-Salido and Vallés (2007), Fishback and Kachanovskaya (2010),

[3]According to Sims, Stock and Watson (1990), it argues that the data in VAR system do not need to be detrended since it might remove important information of the comovements among endogenous variables. However, follow the majority view, Enders (2004) points out that the data in VAR should mimic the true data generating, especially if the major purpose is to estimate a structure VAR model.

Ramey (2011, 2012), Perotti (2014). Private GDP ($priy_t$) has been used as y_t in the second identification scheme of VAR. Alternatively, private consumption (con_t) and private investment (ivt_t) take the place of private GDP ($priy_t$), which form the third identification. The empirical models are summarized as follows.

$$\begin{aligned} TGDP &: \mathbf{x}_t = [g_t \;\; rgdp_t \;\; snt_t \;\; taxr_t \;\; ints_t \;\; mony_t]' \\ PGDP &: \mathbf{x}_t = [g_t \;\; priy_t \;\; snt_t \;\; taxr_t \;\; ints_t \;\; mony_t]' \\ CI &: \mathbf{x}_t = [g_t \;\; con_t \;\; ivt_t \;\; snt_t \;\; taxr_t \;\; ints_t \;\; mony_t]' \end{aligned} \tag{3.4}$$

Within these alternative VAR models in group 3.4, g_t is always ordered first to shield against the contemporaneous influence by the other variables. This assumption is also applied by some previous literatures, such as Ramey(2011), Corsetti, Meier and Müller (2012a), Ilzetzki, Mendoza and Végh (2013). Since the wheels of fiscal policy often spin slowly and deliberately due to the implementation lag[4], so it's realistic that changes of government expenditures could barely have any instantaneous adjustment in response to the changes of other variables within one quarter.

As to the ordering issue of VAR model along with a recursive cholesky decomposition, according to what haven been detected in Kim, Kim and Stern (2015), all the impulse responses are numerically identical even for randomly rearranging the other variables next to the top-variable. For example, assuming we have a VAR with $\mathbf{x}_t = [\mathbf{x}_{1,t},\ \mathbf{x}_{2,t}]$, where $\mathbf{x}_{1,t}$ is a vector of variables with a known ordering, while the

[4]The time lag between when government decides to implement new fiscal policy and when it's actually enacted through the market.

ordering of $\mathbf{x}_{2,t}$ is unknown. The impulse response from $\mathbf{x}_{2,t}$ to the shock of $\mathbf{x}_{1,t}$ won't be affected, even if we randomly shuffle the ordering of variables in $\mathbf{x}_{2,t}$. Thus, the robustness of empirical results in this paper do not suffer from a ordering problem.

3.3 Empirical Findings

3.3.1 Data Description

All the data used in this paper are quarterly basis, and most of them are collected from the FRED online database with one exception: consumer sentiment index ($sent_t$). The quarterly consumer sentiment index is collected from the Survey of Consumers, which is constructed by University of Michigan. Additionally, a natural logarithm has been implied to this index.

The entire sample period in this paper is stretching from 1960q1 to 2015q4, which includes the most recent great recession. All public and private spending variables such as the multiple government expenditures variables, total GDP ($tgdp_t$), private spending (pry_t), private consumption (con_t), and private investment (ivt_t) are in terms of real value per capita, since they are divided by both the GDP deflator and total population. Also, they are all log-transformed. The private spending variable (pry_t) is defined as the sum of private consumption (con_t), private investment (ivt_t), and net exports.[5]

Under the VAR model, multiple types of government expenditures variables have been retrieved. This includes not only the aggregated government expenditures, but

[5]The computation is to subtract the government purchases, which does not include current transfer payment, from total GDP.

also all these important disaggregated expenditures, as they are the major components of aggregated expenditures, for example, government consumption expenditures and gross investment, current transfer payment, and state & local government expenditures. For more detailed description about the government expenditures variables, see Table 3; for the major interested macroeconomics variables, see Table 4.

Table 3 and Table 4 around here

3.3.2 Variations of Government Expenditures

Bureau of Economic Analysis (BEA) usually lists government expenditures in three different categories: Total Government Expenditures, Government Current Expenditures, and Government Purchases. Government Expenditures usually includes both government purchases and transfer payments; while Government Purchases denotes only the government consumption expenditures and gross investment.

Total government expenditures could be decomposed in two ways: on one hand, it's virtually the sum of current expenditures ($gov\_current$) and gross government investment (gov_inv), see the Type.1 in Figure 32; alternatively, total government expenditures consist of federal government expenditures and state & local government expenditures, see the Type.2 in Figure 32.

Figure 32 around here

In contrast with other spending variables, government current expenditures take up the largest weight of total expenditures, followed by gross investment and other capital-type expenditures that affect future-period activities [6]. Furthermore, government current expenditures primarily consist of government consumption expenditures, current transfer payments, interest payments on debts, and subsidies; see Figure 33. According to the left panel in Figure 33, current transfer payments account for almost one third of total current government expenditures; while on the right panel in Figure 33, current transfer payments account for approximately half weight of federal current expenditures.

Figure 33 around here

3.3.3 Fiscal Expansion and Sample Period

Since fiscal expansion effect is a well-known debate among economists, especially for the size of fiscal multipliers, most of the previous studies focus on the calibration of either the spending multiplier or tax multiplier on the potential GDP equilibrium. However, estimated results are different across studies, such as what have been discussed in Ramey (2011), Leeper, Traum and Walker (2015), Hubbard and O'brien (2015). One important challenge in estimating the fiscal expansion effect is that, over time, the factors which shift the aggregate demand and short-run aggregate supply curves are different if government injects dissimilar fiscal policies

[6]Such as capital transfer payments and net purchases of nonproduced assets (for example, land).

(Hubbard and O'brien (2015)). Thus, besides the dissimilar identifications, different sample periods could be another important reason why the size of fiscal multipliers are various across studies.

Most previous studies are focusing on the Post-WWII period and end in no later than the year of 2008. This often omits the completed period of the recent great recession from 2007 to 2009, and subsequently ignores the influence of American Recovery and Reinvestment Act (ARRA) of 2009. Those omitted factors could have a significant impact on estimating the fiscal policy outcome, such as the findings in Feyrer and Sacerdote (2011), Chodorow-Reich et al.(2011), and Wilson (2012). Table 5 briefly summarizes different sample periods across studies.

Table 5 around here

In this paper, two sample periods have been studied alternatively. The full sample period includes from 1960q1 to 2015q4, during which the completed period of the Great Recession is covered. In contrast, in order to nail out the impact of the Great Recession, a sub-sample period is constructed as 1960q1 to 2007q4, which is also called the pre-crisis period through this paper. Under such a setting, it will be interesting to see if a fiscal expansion effect is not only affected by the disaggregated types of government expenditures, but also the sample period. A brief discussion of the impulse response results is stated in the following section.

3.3.4 Primary Results

3.3.4.1 Fiscal Expansion on Total GDP

In order to compare different fiscal expansions' effect on total output, see Figure 34. In contrast with the full-sample period (1960q1-2015q4), total government expenditures induce an insignificant but more positive response from total output during the sub-sample period (1960q1-2007q4). This implies that the enactment of ARRA doesn't impose a significant enhancement in fiscal stimulation effect on the real GDP, instead, the stimulating effect becomes more negligible compare to what happens before the Great Recession.

Figure 34 around here

On the contrary, if we estimate the fiscal expansion effect that is solely depending on government purchases and gross investment, in the middle panel of Figure 34, we could observe significant positive responses from total output to the shock of government purchases and gross investment in both the full-sample and sub-sample period. This reveals a persistent stimulating effect of government consumption and gross investment, regardless of the intervention of the Great Recession. However, according to the right panel in Figure 34, the current transfer payments haven't contributed much to the positive influence in this scenario, oppositely, transfer payments are consistently depressing total output. As what discussed in previous section, transfer payments account for about half weight of total government expenditures, so its

negative effect on real GDP cannot be rustily ignored. The negative impact of transfer payments on total output could explain the less stimulating effect of aggregated government expenditures compare to the effect of government purchases and gross investment.

That is, without considering the intervention of the Great Recession and transfer payments, fiscal expansion seems to be more effectively working on its stimulation job, and it's mostly due to the stronger positive influence of government purchase rather than the spending[7]. In a similar vein, expansionary federal government expenditures do not significantly enhance the output level, while the federal consumption and gross investment positively stimulate the real GDP regardless of the time periods. The negative impact of federal transfer payments on total output largely accounts for the attenuated stimulating effect of total federal expenditures, since transfer payments take up about two thirds of federal total expenditures; see Figure 35.

Figure 35 around here

In general, compare to government consumption and investment, aggregated government expenditures including the transfer payments have significantly smaller stimulating effect on total output. This perspective arouses people's attention on

[7]According to Hubbard and O'brien (2015), there is a difference between government purchases and government expenditures. Intuitively, government expenditures include both government purchases and government spending. Government purchases are more about in exchange for goods and service; while government spending is more about transfer payment —such as social security benefits, unemployment insurance benefits, medicare expenses —does not in return for purchased goods and service.

the selection of government expenditures variables and time periods, which could profoundly alter the estimates of a fiscal expansion effect on total output.

3.3.4.2 Fiscal Expansion on Private GDP

Another important gist in this paper is the fiscal expansion effect on private sector. In general, both total expenditures and federal expenditures have a negligible but mostly negative impact on private GDP, and this observation is within the context of both the full-sample period and the sub-sample period.This dampening fiscal expansion effect on private GDP also appears under the shocks of government purchases and transfer payments; see Figure 36 and 37.

Figure 36 and Figure 37 around here

In summary, regardless of the intervention from the Great Recession, both government expenditures and purchases consistently have a very limited or significant negative impact on private GDP. So does transfer payments. In other words, the selection of government expenditures variables and time periods seems to be neutral to estimate the fiscal expansion effect on private output, since it does not change the negative response of private GDP to expansionary fiscal shocks. This finding is also in line with Ramey and Shapiro (1998), Ramey (2011, 2012), Barro and Redlick (2011), and Zeev and Pappa (2015), and Jia and Kim (2016).

3.3.4.3 Fiscal Expansion on Private Consumption and Investment

According to the empirical results, expanded fiscal expenditures have a slightly different effect on private consumption in contrast to private investment. Initially, both total government expenditures and federal expenditures have a very limited or even negative influence on consumption and investment; however, it becomes much more positive when it comes to the shock of government consumption and investment. Although federal government consumption and investment does not have a significant stimulating effect on consumption as much as total government purchases, it is more stimulating than both the aggregated federal expenditures and transfer payments. However, there is one exception: government purchases do not positively stimulate investment, instead, it dampens investment; see Figure 38 and 39.

Figure 38 and Figure 39 around here

Overall, private investment consistently has insignificant and negative response to the shock of government expenditures, regardless of controlling the Great Recession or not. However, consumption responds differently based the types of government expenditures. In general, government consumption and investment has much more positive influence on consumption compare to aggregated government expenditures and transfer payments. In this scenario, the sample difference does not alter much of consumption's response to fiscal expansion shock.

3.3.4.4 Fiscal Expansion on Consumer Sentiment

Under the influence of fiscal expansion, in general, consumer sentiment has a very sluggish positive response across different identification schemes. Most of the time, consumer sentiment has either a negligible or negative response to the shocks of aggregated government expenditures. However, the government consumption and the gross investment has constantly positive influence over consumer sentiment, especially during sub-sample period. See Figure 40 and 41.

Figure 40 and Figure 41 around here

Recalling from what have been discussed in previous sections, results in Figure 40 and 41 confirm that the positive stimulating effect of government purchases on consumption has a close connection with the optimistic sentiment. Such as in Jia and Kim (2016), it reveals a sentiment channel that through which the fiscal expansion effect could be altered: the more optimistic the consumers feel, the more positive the consumption reacts to the fiscal shock. Yet, transfer payments are persistently dampening the sentiment as well as the effect of total and federal expenditures, regardless of the sample periods. This is illustrating the negative impact from both total/federal government expenditures and transfer payments on private GDP and total output in the previous sections.

Overall, sentiments' different responses clarify the major difference between the effect of aggregated fiscal expenditures expansion and fiscal purchases. It reveals that, in contrast to aggregated fiscal expenditures, government purchases variables

tend to be more stimulating to economic activities is primarily resulted from its positive influence on consumer sentiment. However, at private sector, this stimulating effect of government purchases doesn't exist much, it is because that government consumption and investment only works stimulatingly for private consumption due to the optimistic sentiment, but not for the private investment; see Figure 38 and 39.

3.4 Comparative Discussion

As previously mentioned, conclusions are still quite mixed with regards to the fiscal expansion effect. According to the empirical findings in this paper, the selection of distinct types of government expenditures and sample periods may be thwarting a more concrete conclusion with regards to the effect of fiscal expansion.

3.4.1 Government Expenditures vs. Government Purchases

In order to estimate the fiscal stimulus, the majority of previous literatures focus on expansionary government purchases, which are mostly measured by the sum of government consumption expenditures and gross investment; for example, Blanchard and Perotti (2002), Owyang, Ramey and Zubairy (2013), Bachmann and Sims (2012), Perotti (2004), Fatás and Mihov (2001), Galí, López-Salido and Vallés (2007), Mountford and Uhlig (2009), Fazzari, Morley and Panovaska (2015), Ilzetzki, Mendaza and Vegh (2013), Corsetti, Meier and Müller (2012a), McGrattan and Ohanian (2008), Finn (1998), Auerbach and Gorodnichenko (2012), Hall (2009), Mittnik and Semmler (2012). Within those literatures, most of them state a positive influence

from fiscal expansion on output, consumption and employment. This conclusion is in a stark contrast with the effect of expansionary aggregated government expenditures.

Government expenditures [8] have either ignorable or negative impact on economic activities. As might have been expected, in works of Ramey (2011, 2012), Leeper, Walker and Yang (2010), Mertens and Ravn (2012), Natvik (2012), and Jia and Kim (2016), when the more aggregated government expenditures have been taken into consideration, they usually fail to incur a positive influence of fiscal expansion on the economy. Instead, the expansion effect is quite limited or even negative, especially for the private sector. This is also in line with the findings in this paper.

According to what has been stated in Hubbard and O'brein (2015), there is an important difference among government expenditures and government purchases. Government purchases, which primarily consists of government consumption and the gross investment, always require in exchange for goods and services directly from the market. Through this, expansionary purchases would have a straightforward stimulating effect on output, consumption and employment. However, the positive purchases expansion does not have a lasting effect, and would largely disappear when the purchases end. This has been detected in the work of Owyang, Ramey and Zubairy (2013), Perotti (2004)[9],Ilzetzki, Mendaza and Vegh (2013), Corsetti, Meier and Müller (2012b).

[8]This indicates either the government total expenditures which is including state and local government expenditures, or just the federal total expenditures.

[9] In Perotti (2004), he also points out the variation of time periods could be altering the fiscal expansion effect on output, such as, first, fiscal multiplier on output is larger than 1 could be estimated only in the U.S. in pre-1980 period; second, Shocks of spending or tax cuts on GDP and its components have weaker effect over time, in the post-1980 period, those effects are mostly negative, particularly on private investment.

3.4.2 Total Government Purchases vs. Federal Government Purchases

Furthermore, inside the category of government purchases, total government purchases tends to has a more stimulating effect on total output compare to federal purchases, why? Recall of what has been discussed in section 3.2, total government purchases consists of federal purchases and state & local government purchases. So the expansionary effect of total government purchases is incorporating with the influence of state and local government expansion as well; see Figure 42, it depicts the expansion effect of state and local government purchases in contrast to total and federal purchases.

Figure 42 and Figure 43 around here

According to Figure 42 and 43, state and local government purchases account for most positive stimulus of total government purchases. Thus, although previous literatures tend to conclude a positive impact of expansionary total government consumption and investment on output and consumption, as long as it omits the incorporated impact from state and local government purchases, it's imprecise to claim a stimulating effect of fiscal expansion. Because state and local governments do not participate in making decisions about national fiscal policy, accordingly, their expanded purchases cannot be treated as a proxy of expansionary fiscal policy.

Furthermore, if we only focus on the effect of expanded federal purchases, in both Figure 42 and 43, federal spending has much less positive influence on total output and consumption, regardless of the selection of sample period; for example, Ramey

(2011), Barro and Redlick (2011), and Zeev and Pappa (2015). Obviously, this different expansion effect between total government purchases and federal purchases is primarily from the intervention of state and local government spending. Thus, this finding could help to disentangled some conflicted results in previous literatures regard to the fiscal expansion effect.

3.5 Conclusion

Facing the various arguments about the fiscal expansion effect among previous literatures, this paper is especially interested in if the selection of fiscal spending variables and different time periods will alter the estimate of the fiscal expansion effect on the economy.

One important feature of this paper is to point out the different characteristic between government expenditures and government purchases. The former spending stands for an aggregated government spending type, which includes transfer payments; while the latter is the proxy for the government spending that is in exchange for goods and service, i.e. government consumption and the gross investment. Due to the different function of government expenditures and government purchases, their stimulating effects on the economy are dissimilar, this provides an insight of disentangling the conflicted conclusions about fiscal expansion effect in previous studies. Besides, the intervention of the Great Recession has been taken account of altering the the effect of expansionary fiscal policy at different times. The empirical work that has been constructed on top of these features provides us with more rigorous analysis about fiscal expansion effect.

The primary findings in this paper are listed as follow. First, in contrast to government purchases, variables of government expenditures consistently have less stimulating effect on the economy, especially regard to the total output. Due to the fact that government purchases are normally in terms of government consumption and the gross investment, they require in exchange for goods and services directly from the market. Through this, expansionary purchases would have a straightforward stimulating effect on output, consumption and employment. On the contrary, variables of government expenditures, especially the transfer payments, which persistently dampens the real GDP, consumption, and private spending. This accounts for the attenuated stimulating effect of expanded government expenditures.

Second, adding the Great Recession period to the sample period shows a significant intervention to the fiscal stimulus effect. Empirical results in this paper reveal that before the debut of the Great Recession in 2007, the fiscal stimulus package is more effective. As to the story behind this finding, it requires further research work in the future.

Moreover, consumer sentiment has more optimistic responses to the shock of government purchases rather than to government expenditures, which confirms the exhilarated effect of government purchases on private consumption. This finding is in line with the proposal of the sentiment channel in Jia and Kim (2016), that through which the fiscal expansion effect on private sector could be altered.

Last but not the least, within the category of government purchases, usually the estimate of total government purchases expansion is more positive than expanded federal government purchases. This is primarily due to the positive stimulating

effect of state and local government spending, which is included in total government expenditures. However, since state and local governments are not participating in making decisions of national fiscal policy, so we should be more careful to draw a conclusion about fiscal expansion effect if only based on the total government purchases, otherwise, it might overstate the actual stimulating effect of expansionary fiscal policy.

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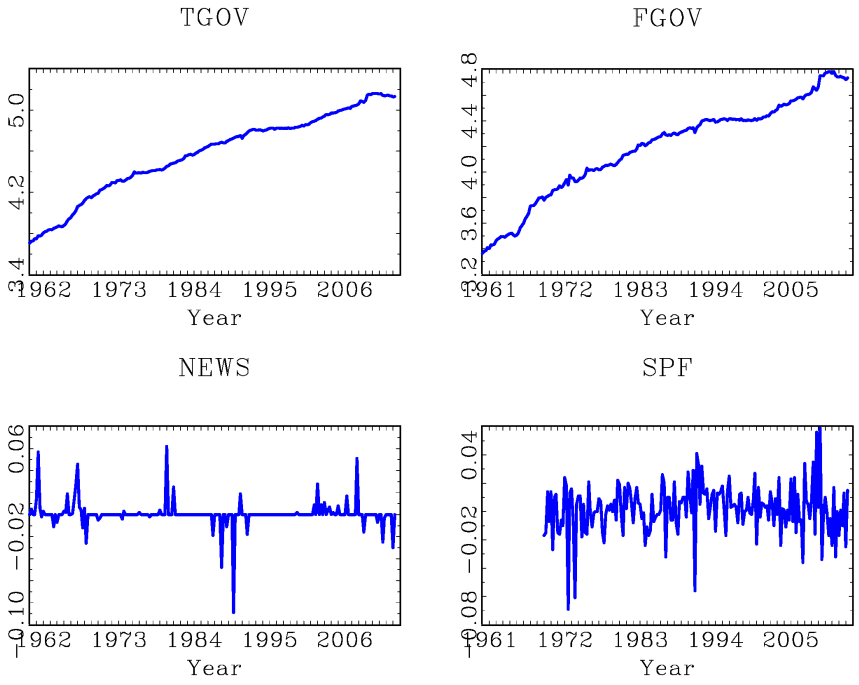
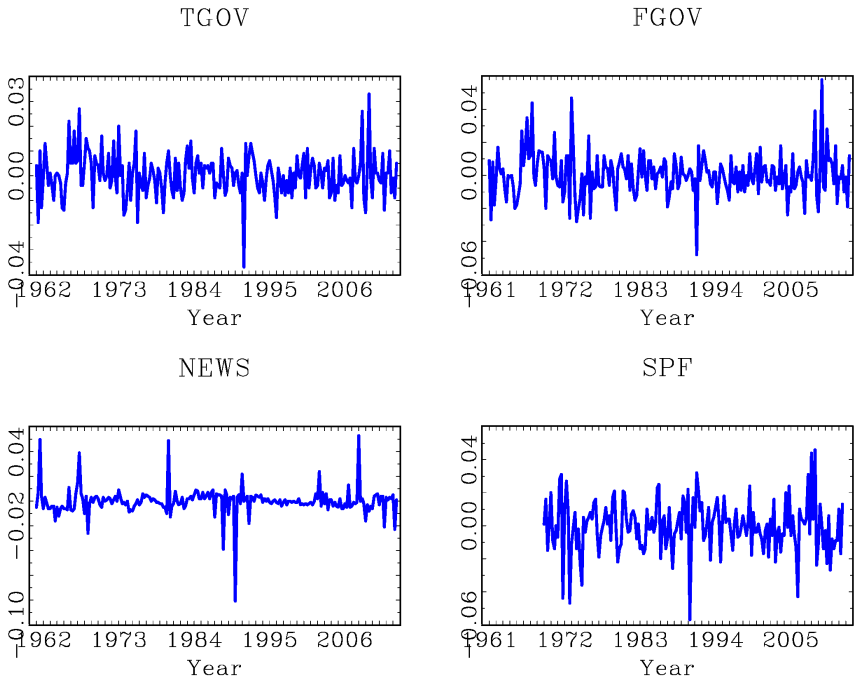
Appendices

Figure 1: **Government Spending Data: Raw Data and Residuals**

Level Variables

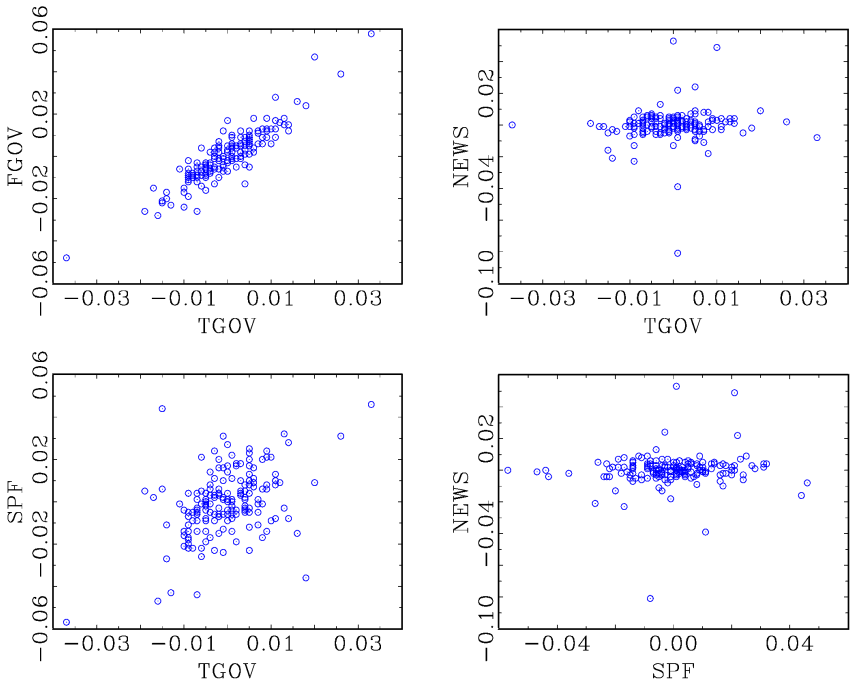


Residuals



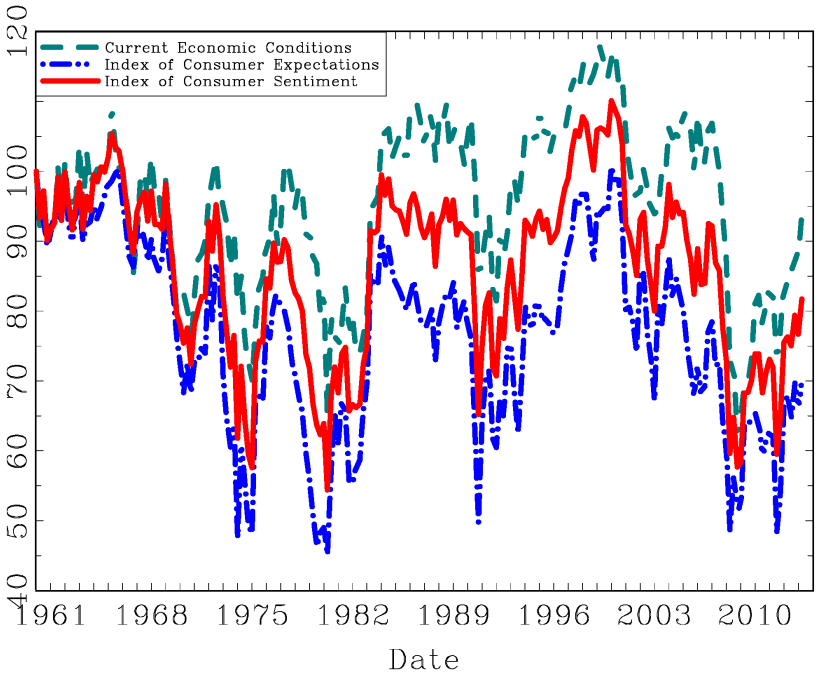
Note: TGOV, FGOV, NEWS, and SPF denote the total government spending, federal government spending, news variable (Ramey, 2011), and SPF variable (Ramey, 2011). Residuals are obtained from VAR regressions.

Figure 2: **Government Spending Data: Cyclical Components**



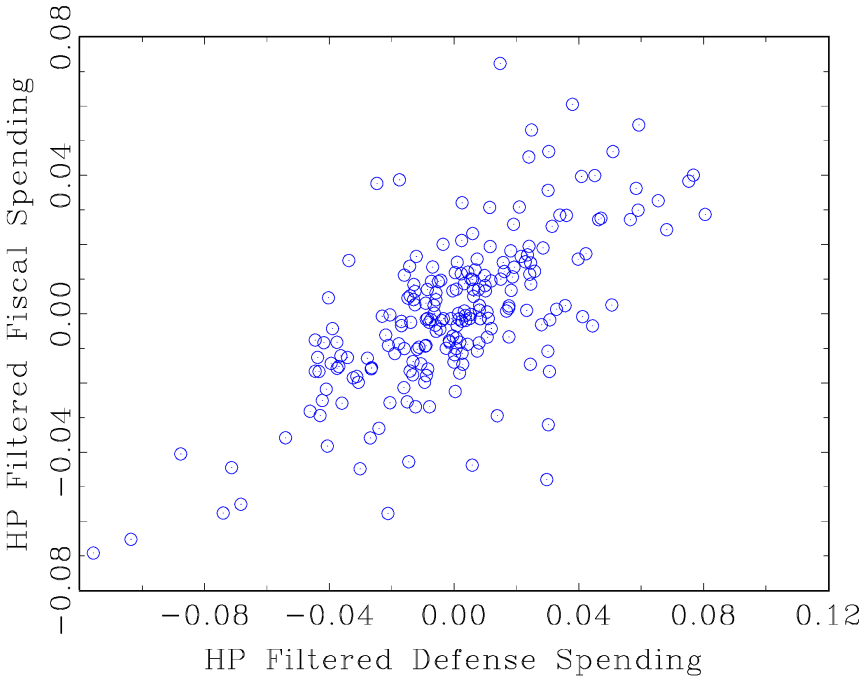
Note: We use the Hodrick-Prescott filter to separate cyclical components of the series from the trend components of the series. We use 1600 of smoothing parameter for quarterly data.

Figure 3: **Consumer Sentiment Index Data**



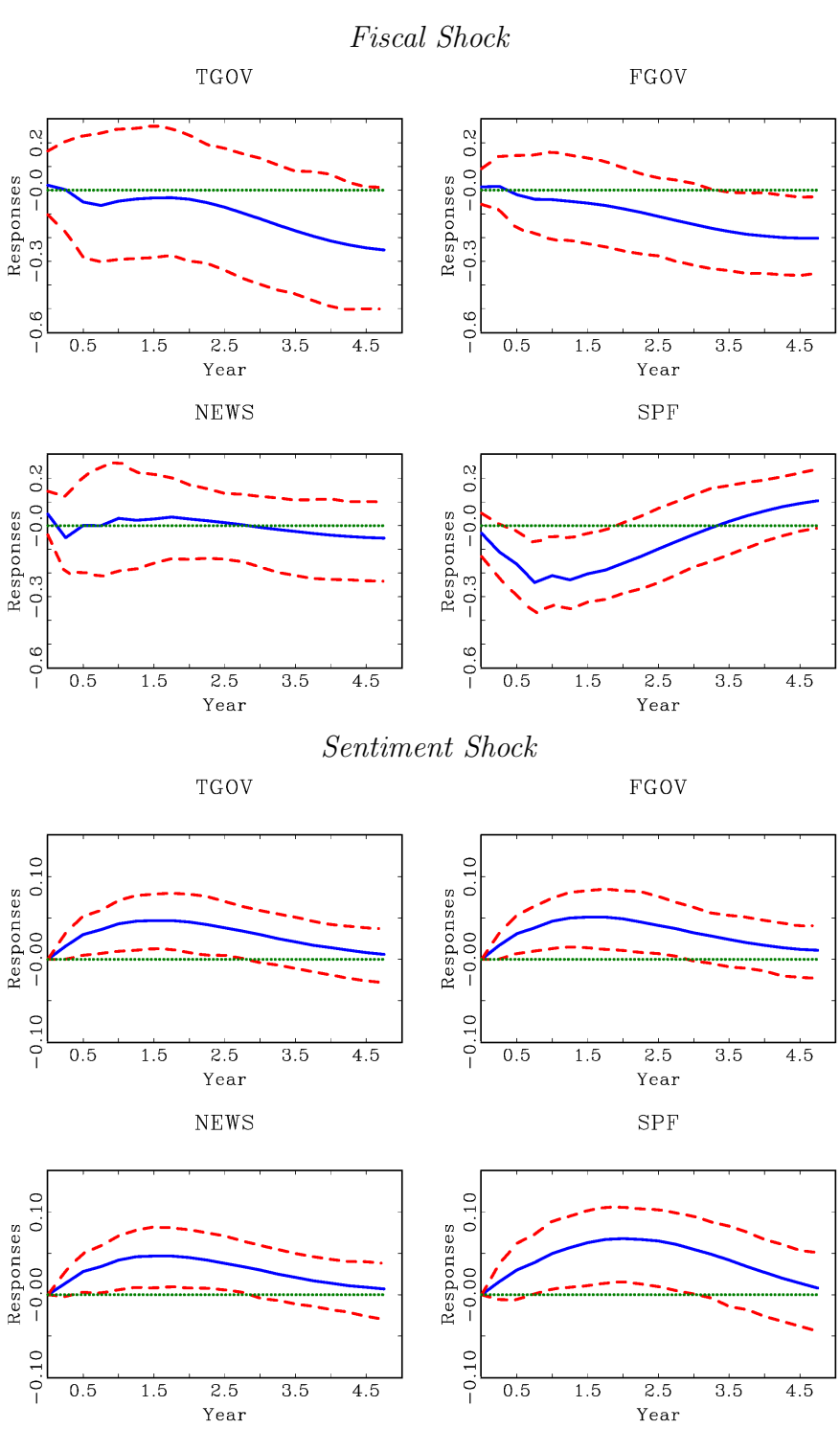
Note: We obtained the data from Surveys of Consumers website at the University of Michigan. All indices are normalized to be 100 in 1960Q1 by authors.

Figure 4: **Defense Spending Growth and Federal Spending Growth**



Note: We use the Hodrick-Prescott filter to separate cyclical components of the series from the raw data. We use 1600 of smoothing parameter for quarterly data.

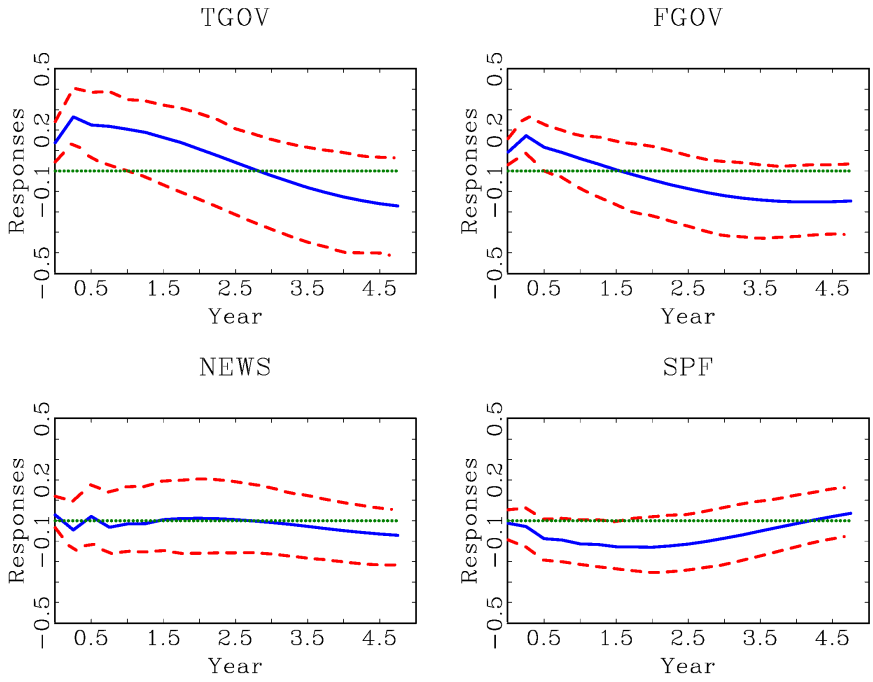
Figure 5: **Private GDP Responses**



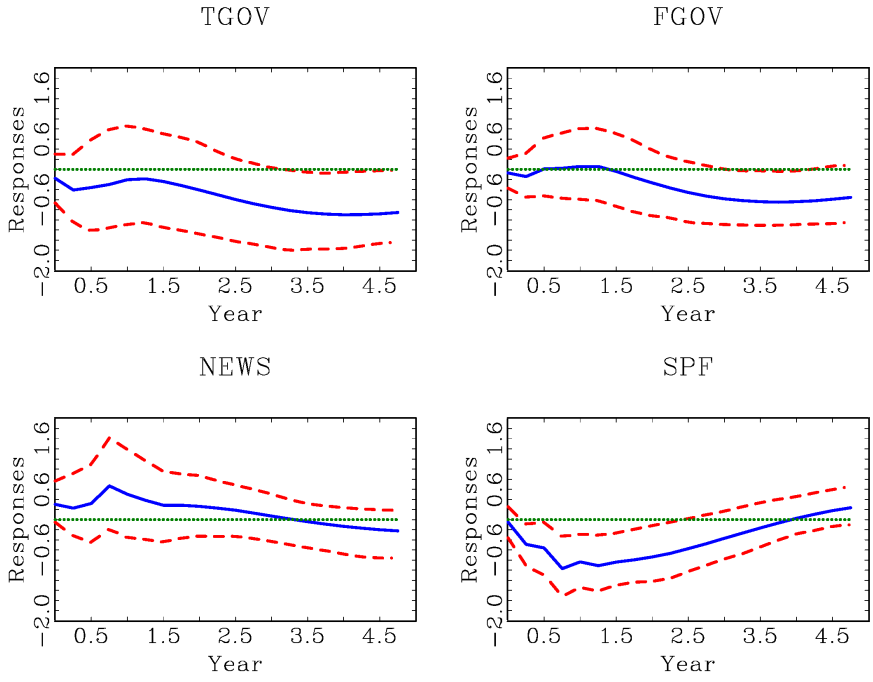
Note: Private GDP is obtained by substracting the government spending from the total GDP. We report responses of the private GDP to the fiscal spending shock from each model. Dashed lines are the 95% confidence band of the response function from 500 nonparametric bootstrap simulations.

Figure 6: **Private Activity Responses to the Fiscal Shock**

Consumption Responses

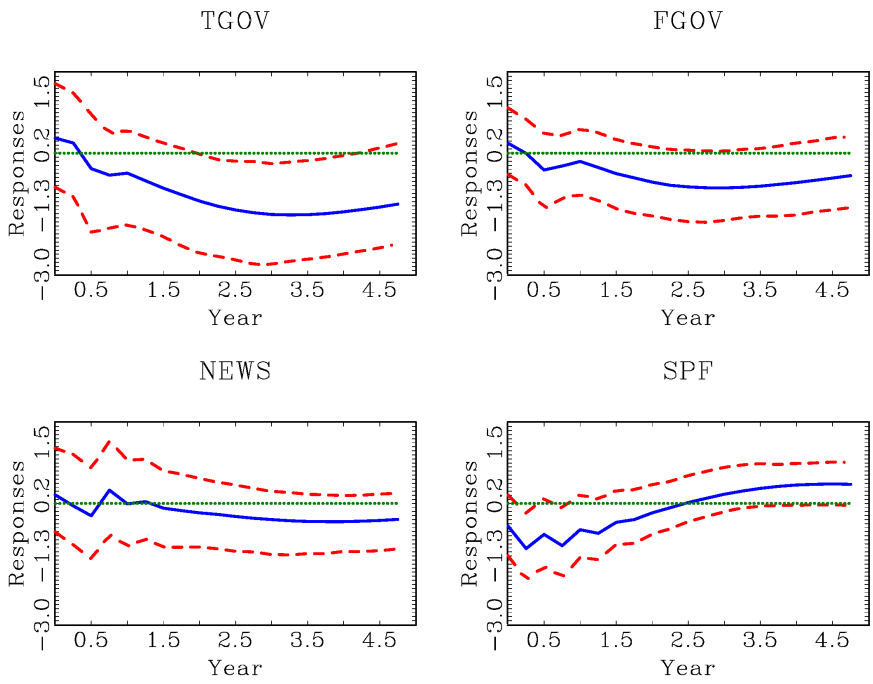


Investment Responses



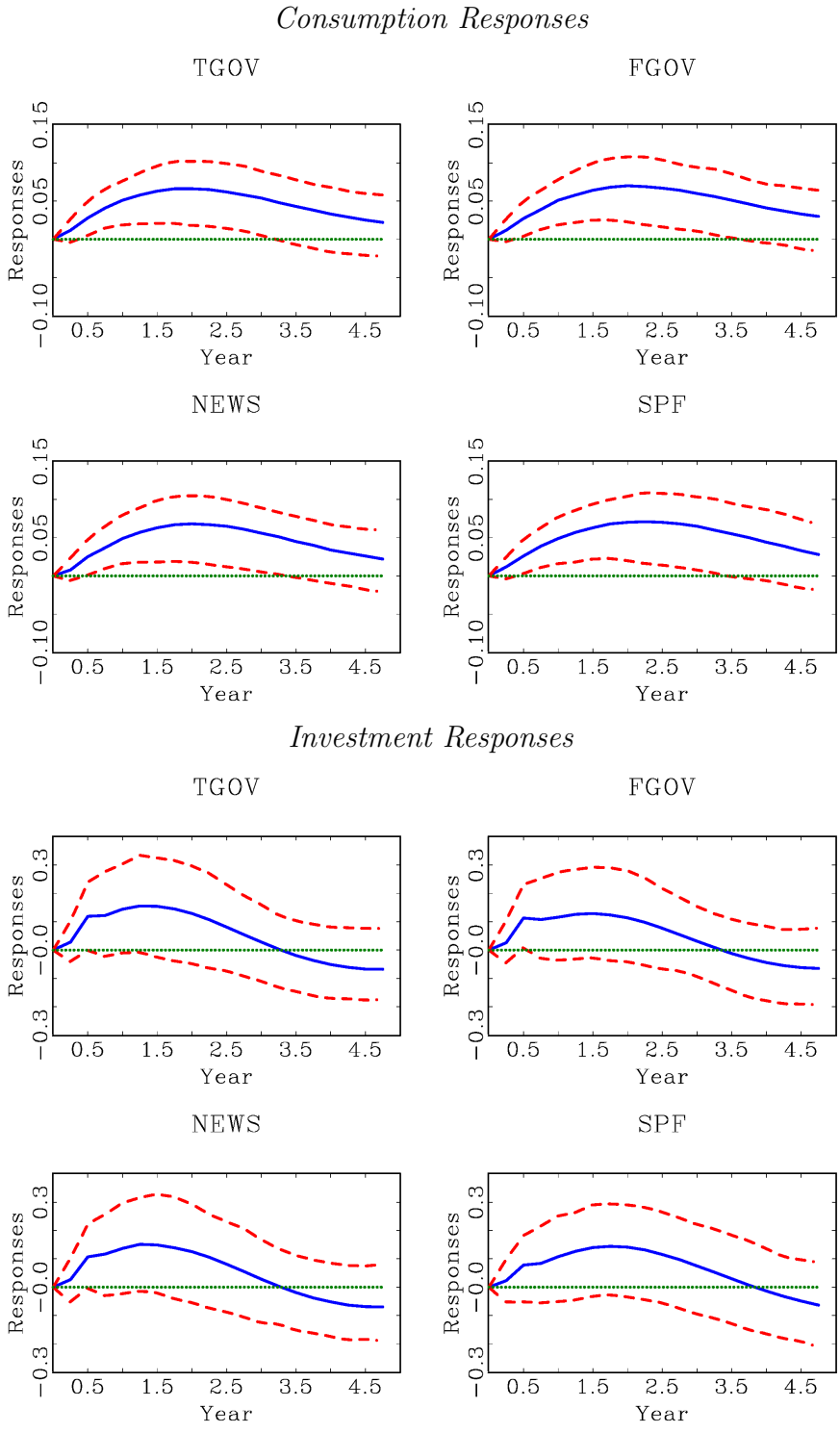
Note: Dashed lines are the 95% confidence band of the response function from 500 nonparametric bootstrap simulations.

Figure 7: **Sentiment Responses to the Fiscal Shock**



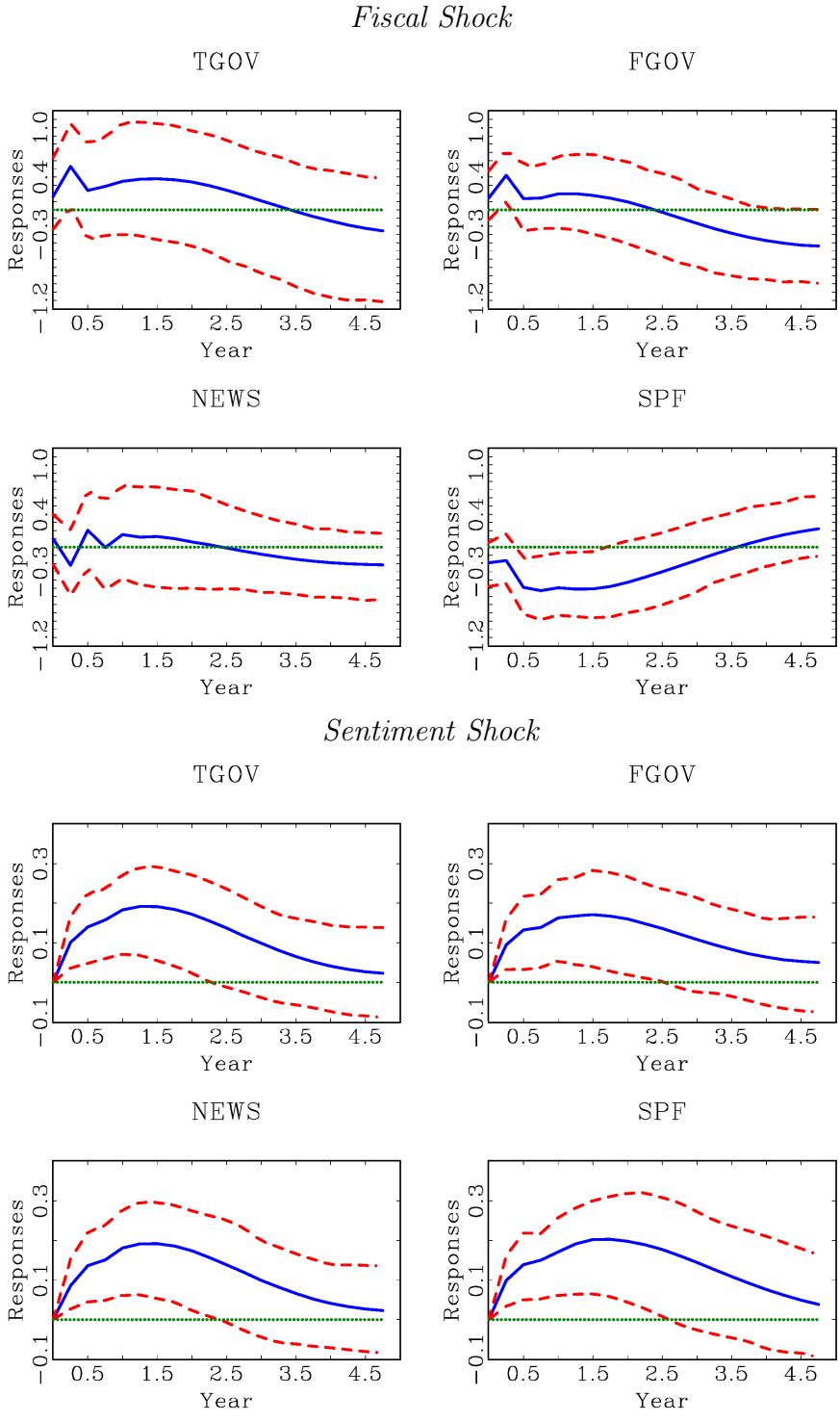
Note: Dashed lines are the 95% confidence band of the response function from 500 nonparametric bootstrap simulations.

Figure 8: **Private Activity Responses to the Sentiment Shock**



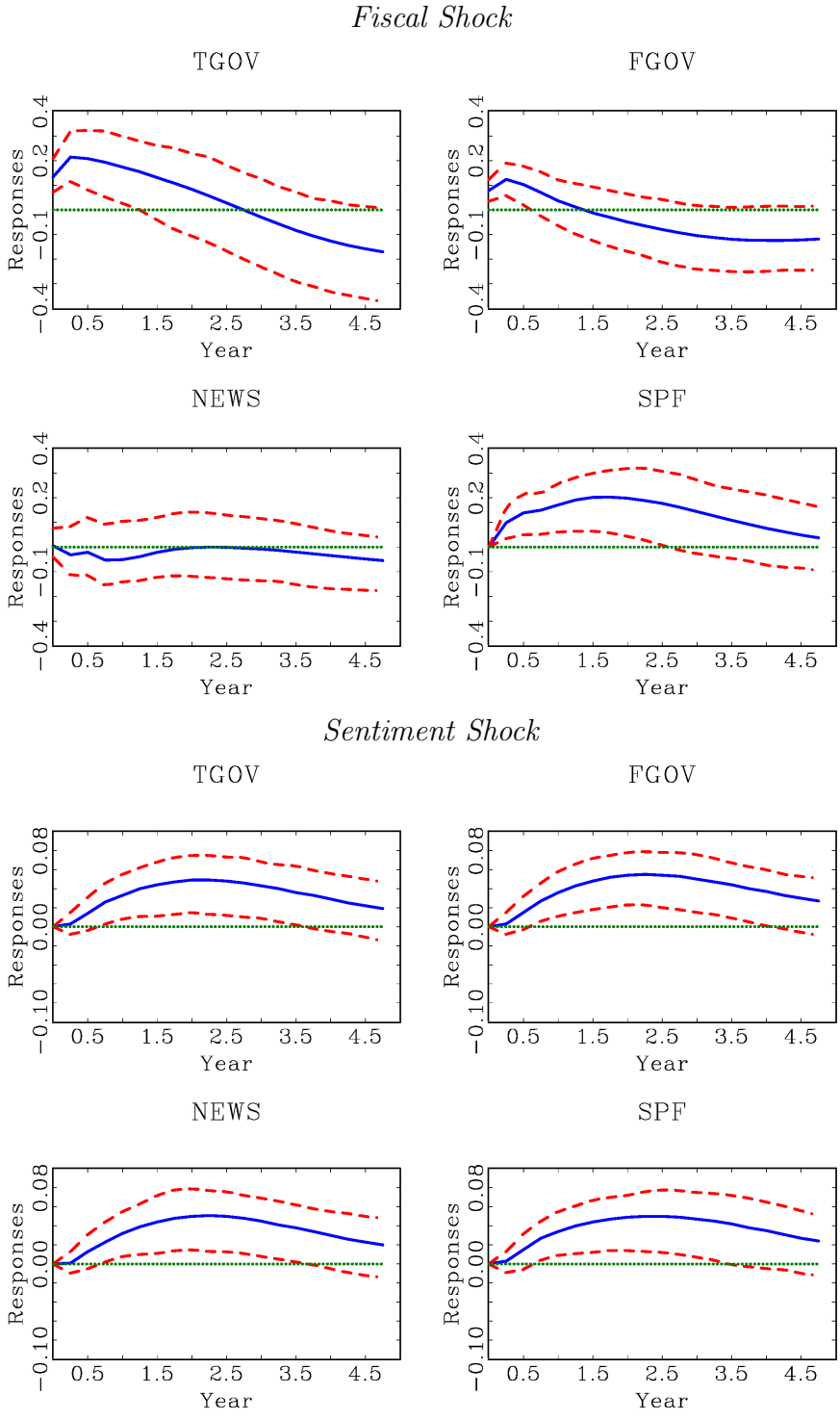
Note: Dashed lines are the 95% confidence band of the response function from 500 nonparametric bootstrap simulations.

Figure 9: **Responses of Durable Goods Consumption to the Fiscal Shock**



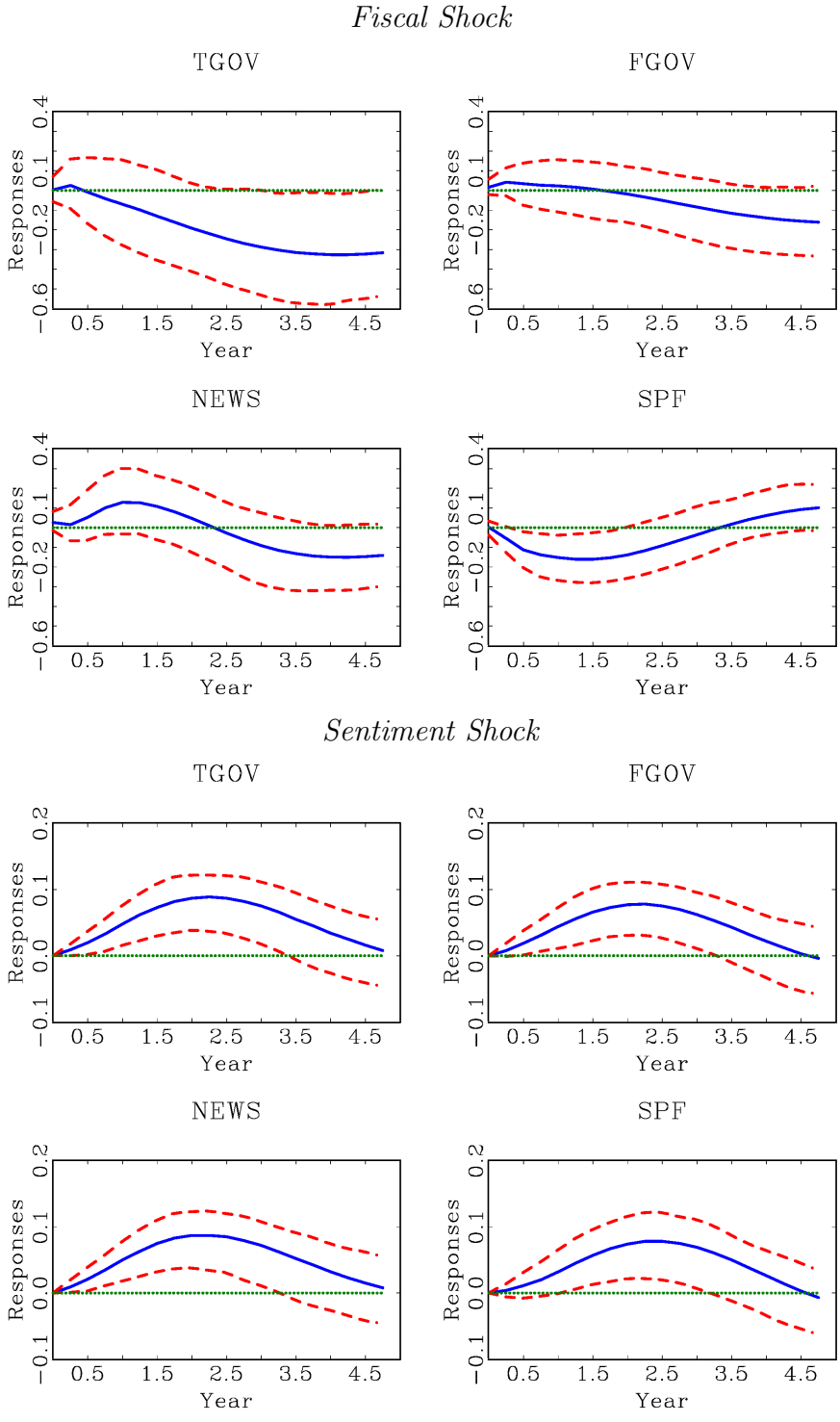
Note: Dashed lines are the 95% confidence band of the response function from 500 nonparametric bootstrap simulations.

Figure 10: **Responses of Nondurables Good and Services Consumption**



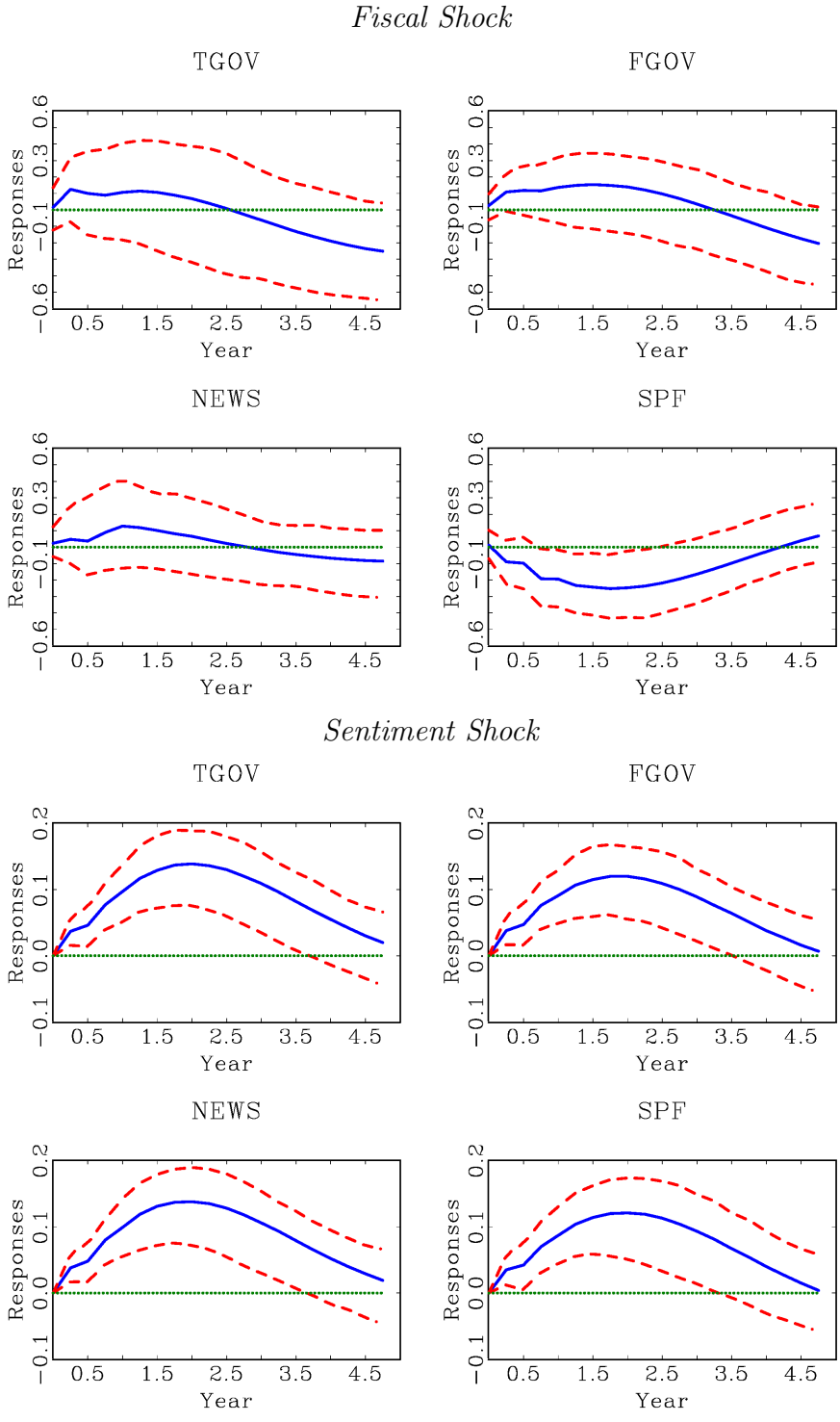
Note: Dashed lines are the 95% confidence band of the response function from 500 nonparametric bootstrap simulations.

Figure 11: **Responses of Private Job**



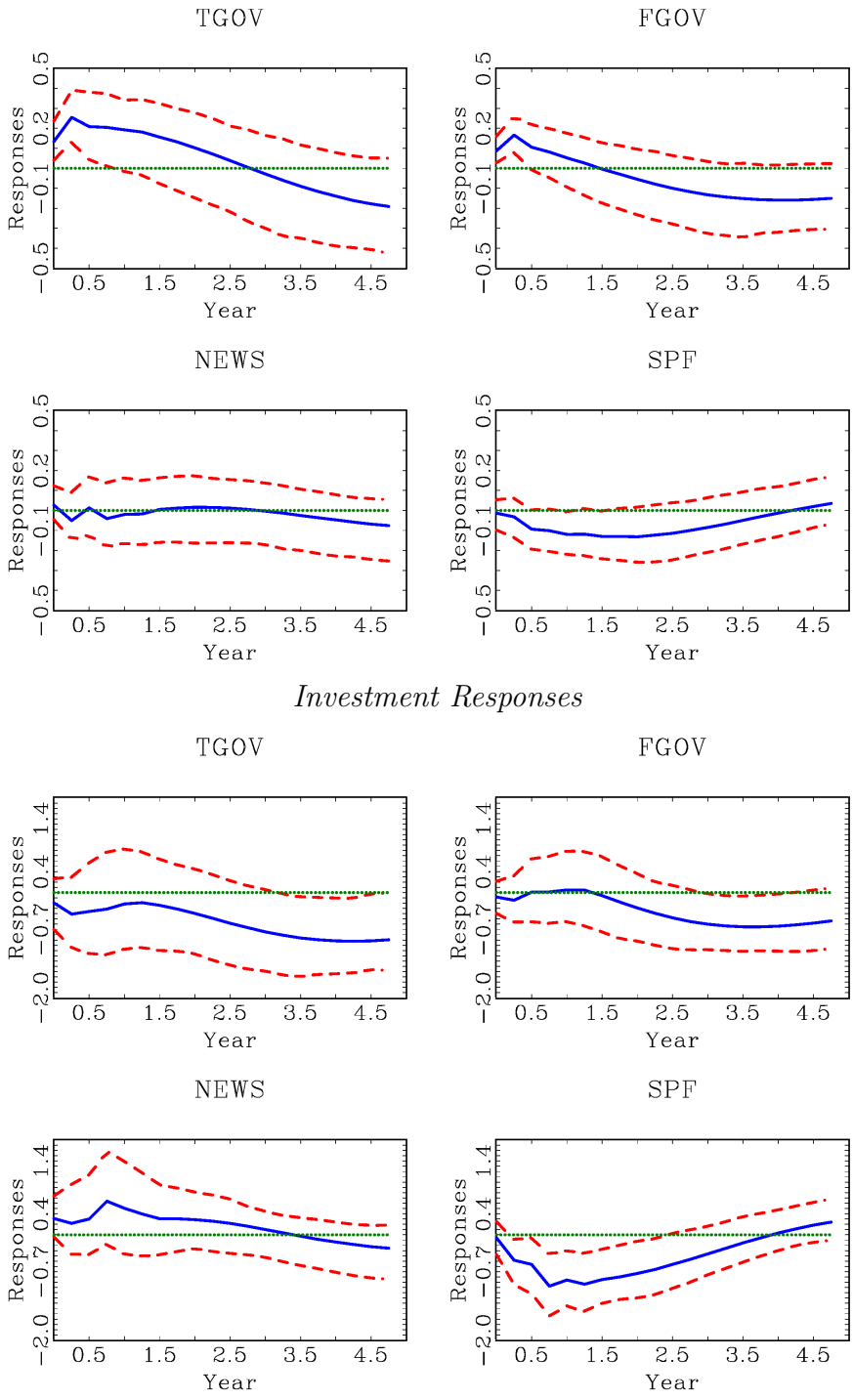
Note: Dashed lines are the 95% confidence band of the response function from 500 nonparametric bootstrap simulations.

Figure 12: **Responses of Private Wage**



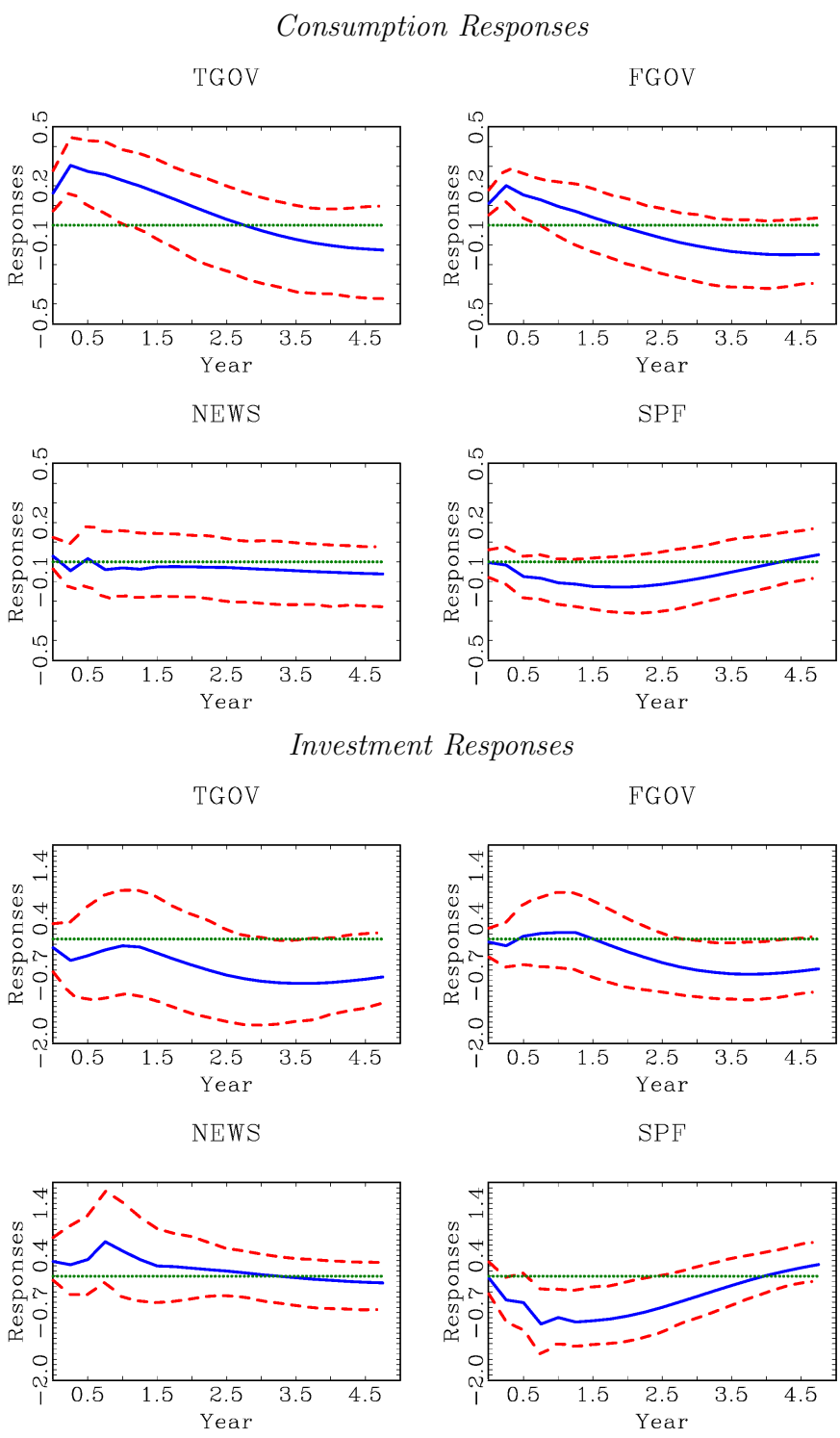
Note: Dashed lines are the 95% confidence band of the response function from 500 nonparametric bootstrap simulations.

Figure 13: **Responses to the Fiscal Shock with ICE**



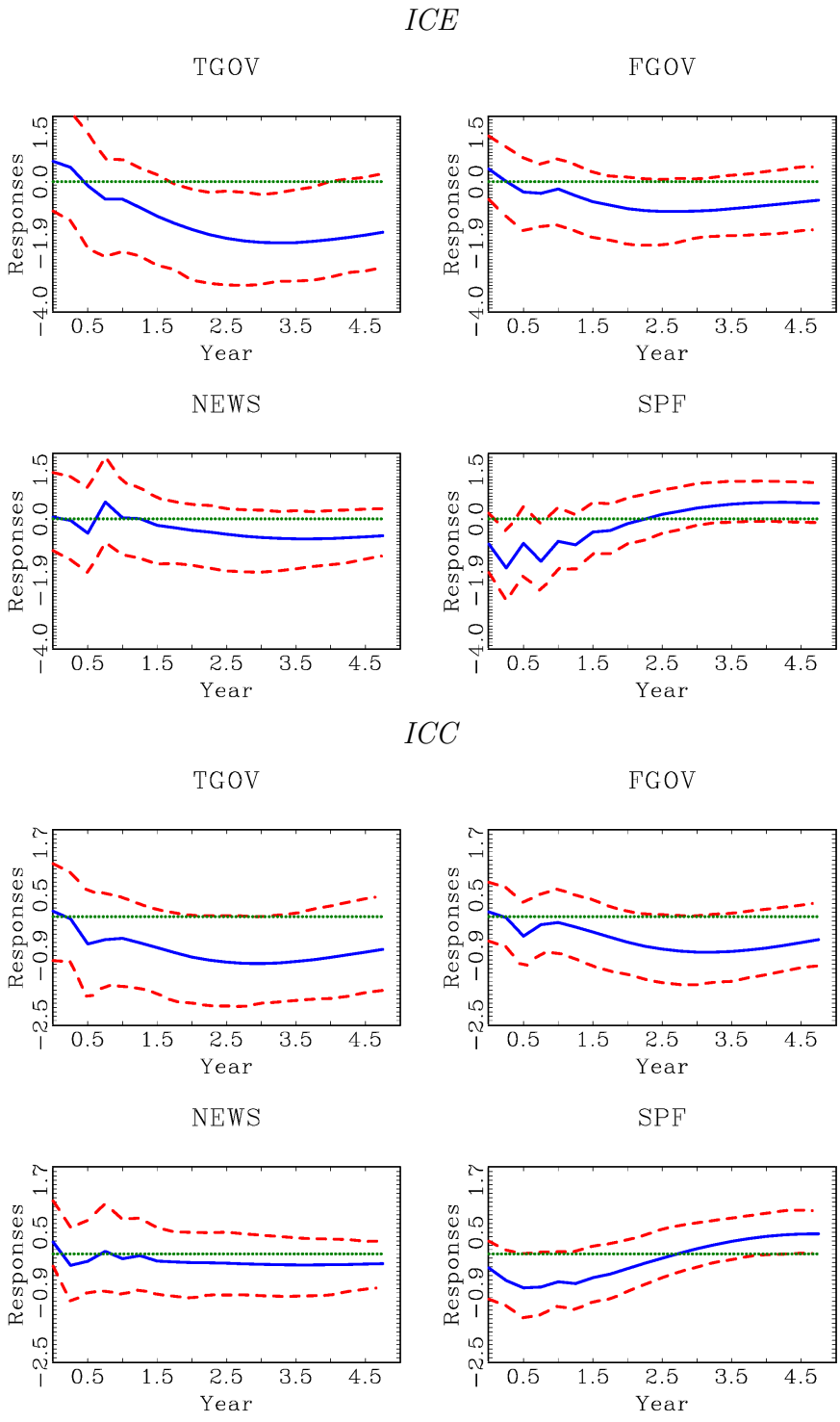
Note: ICE denotes the index of consumer expectations.

Figure 14: **Responses to the Fiscal Shock with ICC**



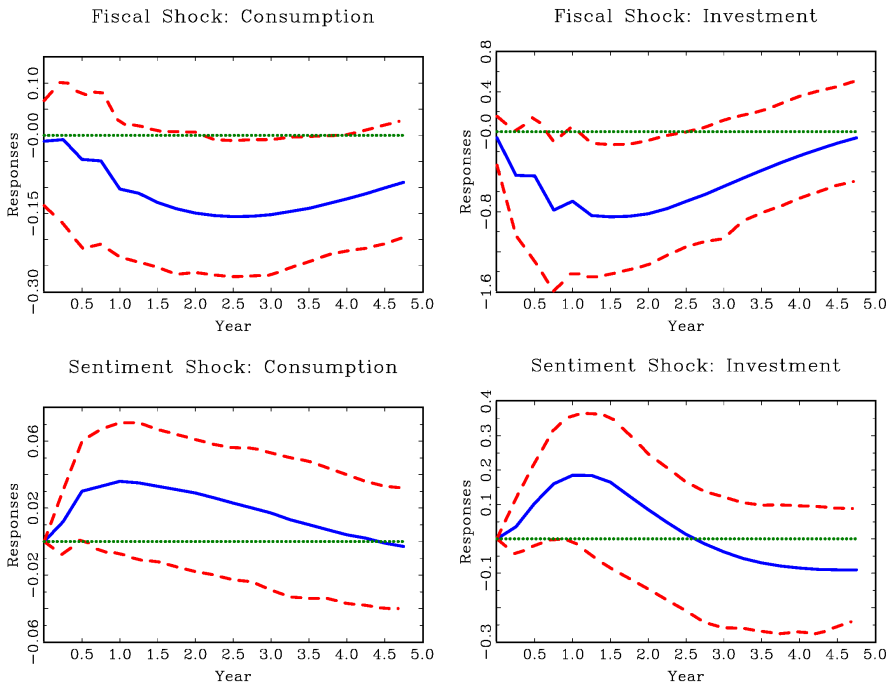
Note: ICC denotes the index of current economic conditions.

Figure 15: **Sentiment Responses to the Fiscal Shock: Sub-Indices**



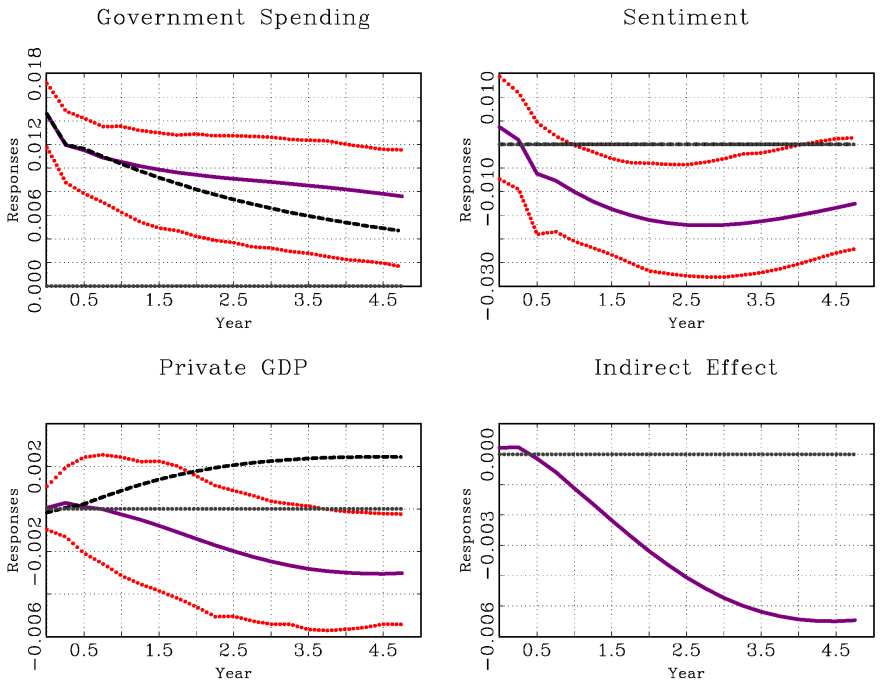
Note: ICE and ICC denote the index of consumer expectations and the index of current economic conditions, respectively.

Figure 16: **Sub-Sample Analysis: 1981:III - 2013:II**



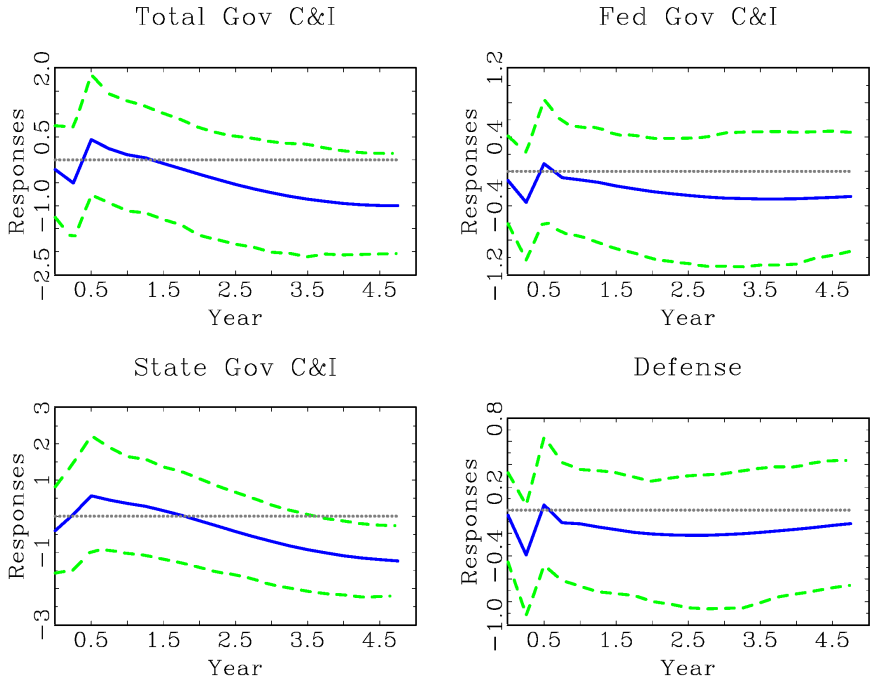
Note: Response function estimates are from *SPF* model with the *SPF* forecast error of the federal spending growth rate excluding the forecast error of the defense spending growth rate.

Figure 17: **Counterfactual Simulation Exercises: Private GDP**



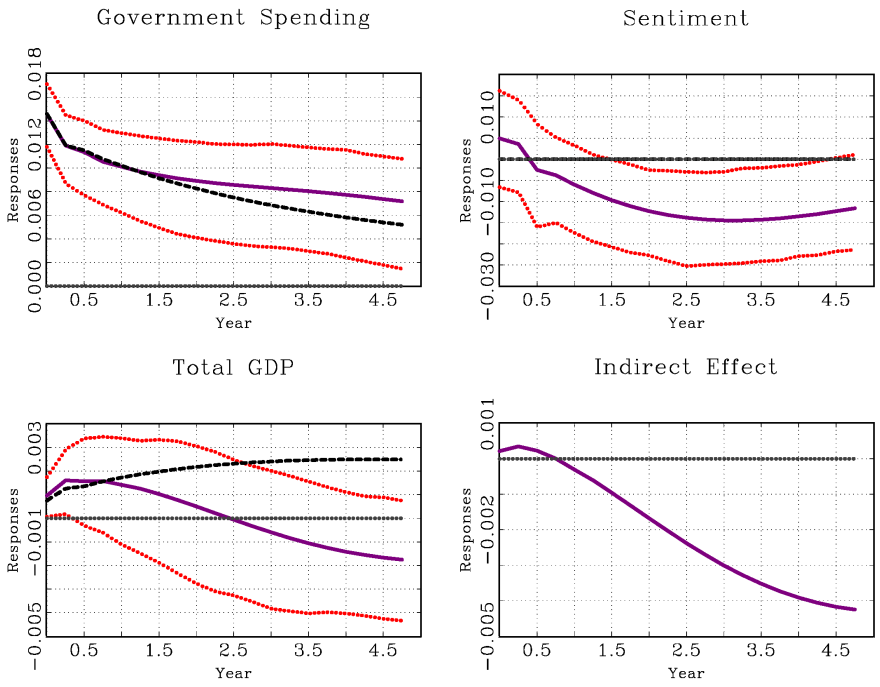
Note: The estimates are from tri-variate VAR models with the fiscal variable, the sentiment variable, and the private GDP. The solid lines are the impulse-response function estimates from unconstrained models. The dashed lines are the hypothetical response functions with additional shocks that hold sentiment unchanged for all forecast horizons. The last figure measures the estimated indirect effect of the sentiment shock on the private GDP.

Figure 18: **Sentiment Responses with Alternative Identification Methods**



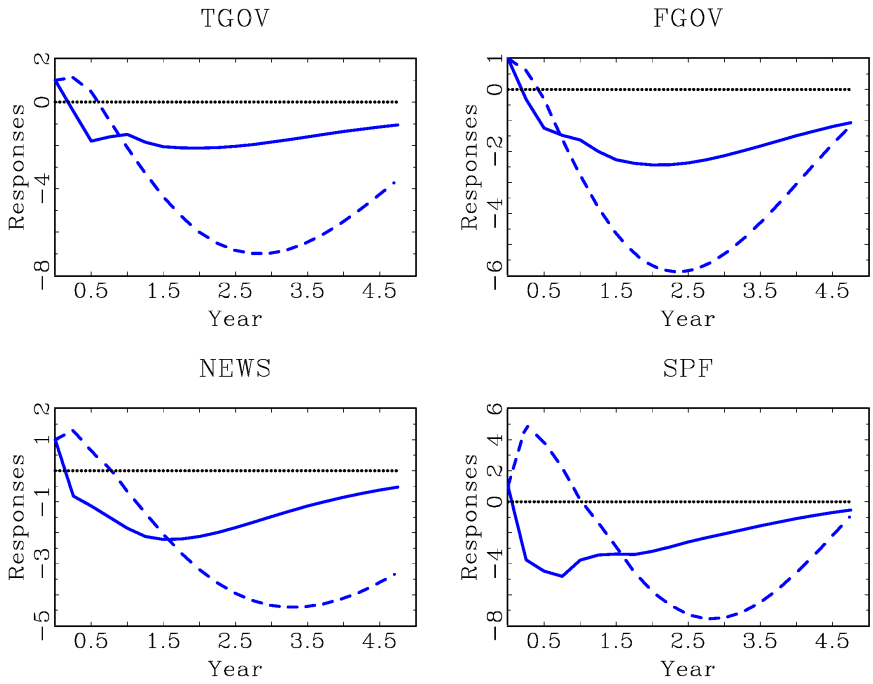
Note: The estimates are from tri-variate VAR models with the fiscal variable, the sentiment variable, and the private GDP. The solid lines are the impulse-response function estimates from unconstrained models. Dashed lines are the 95% confidence band of the response function from 500 nonparametric bootstrap simulations.

Figure 19: **Counterfactual Simulation Exercises: Total GDP Methods**



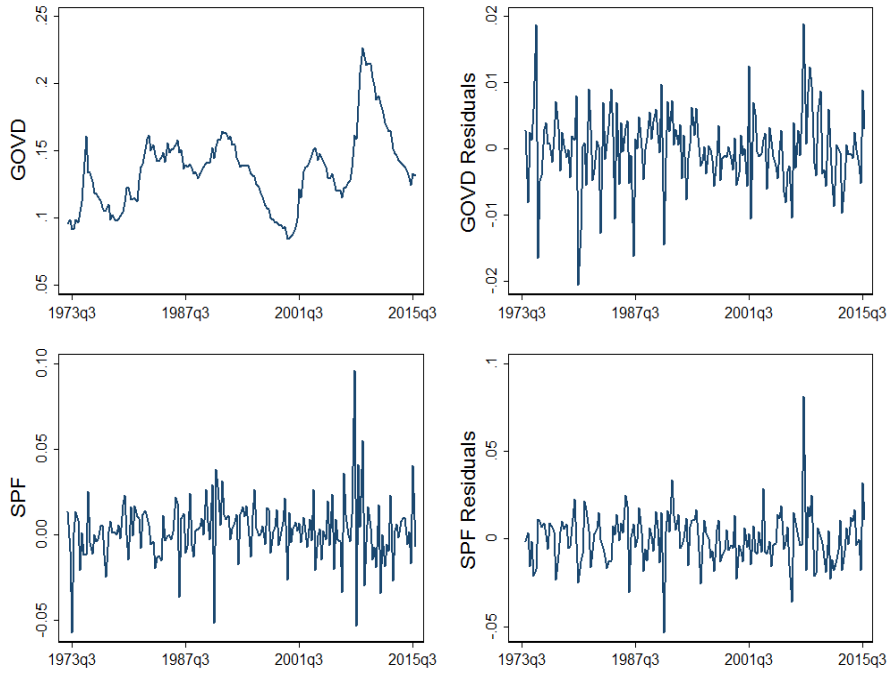
Note: The estimates are from tri-variate VAR models with the fiscal variable, the sentiment variable, and the total GDP. The solid lines are the impulse-response function estimates from unconstrained models. The dashed lines are the hypothetical response functions with additiona shocks that hold sentiment unchanged for all forecast horizons. The last figure measures the estimated indirect effect of the sentiment shock on the GDP.

Figure 20: **Sentiment Responses to the Fiscal Shock: Threshold VAR**



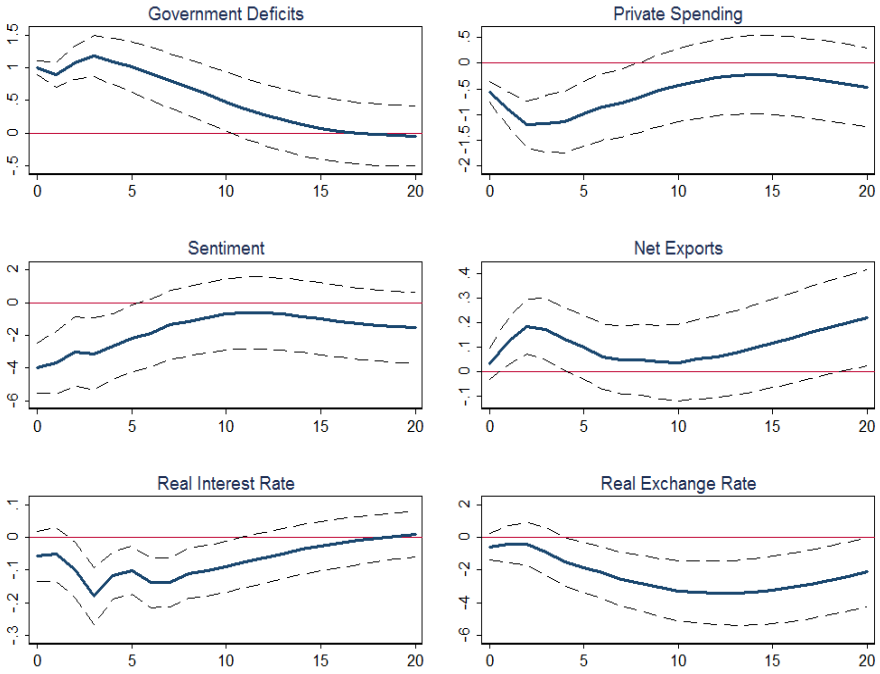
Note: Sentiment responses to the fiscal shock are reported. The threshold variable (τ_{t-1}) is one-period lagged log differenced real (total) GDP. Solid lines are responses during recessions ($\tau_{t-1} < \tau^*$), while dashed lines are those in booms ($\tau_{t-1} > \tau^*$). The estimates are from tri-variate VAR models with the fiscal variable, the private GDP, and the sentiment variable.

Figure 21: **Raw Data & Residuals**



Note: Most quarterly data is from Federal Reserve Economic Database, SPF data is constructed from both Survey of Professional Forecasters and Valerie A. Ramey's research database. "GOVD" denotes for total government spending deficits, it's constructed by subtract total government spending from total government current tax receipts. Time span is 1973Q1-2015Q4. L-R: raw data, residuals.

Figure 22: **Effect of Government Deficits Shock with conventional VAR**

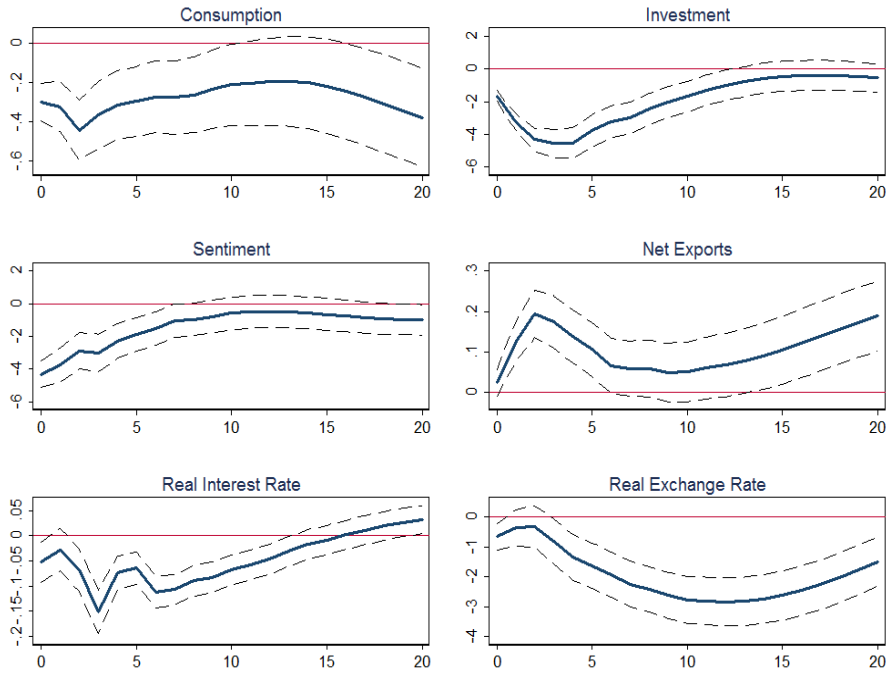


Note: Impulse response to the shock of total government spending deficits. Total government spending deficits are constructed by subtract total government spending from total government current tax receipts. Private spending is the sum of consumption and investment. Net exports are computed as the ratio of GDP. Real interest rate is computed based on the secondary market rate of 3-month treasury bills. Real exchange rate is the real trade weighted U.S. dollar index (major countries). One standard deviation confidence interval (68% CI), nailing out tax interference by subtract total government spending from total government current tax receipts. Time period is 1973Q1-2015Q4.

Figure 23: **Effect of SPF shock with EVAR**

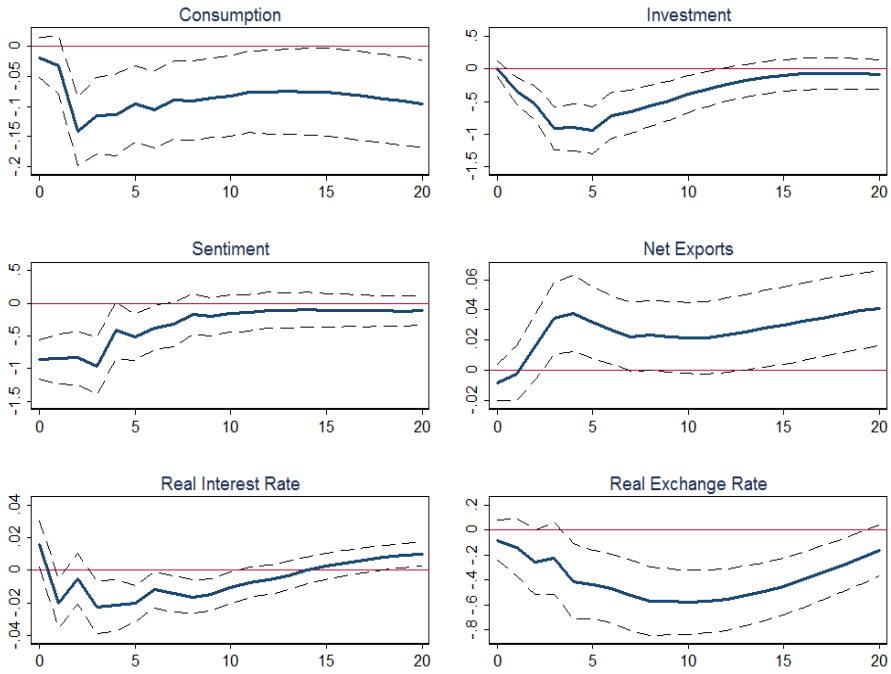
Note: Impulse response to the shock of SPF news variable. "SPF" variable is derived from Valerie Ann Ramey's research database and Survey of Professional Forecasters. Private spending is the sum of consumption and investment. Net exports are computed as the ratio of GDP. Real interest rate is computed based on the secondary market rate of 3-month treasury bills. Real exchange rate is the real trade weighted U.S. dollar index (major countries). One standard deviation confidence interval (68% CI), with control on federal government current tax receipts. Time period is 1973Q1-2015Q4.

Figure 24: **Effect of Government Deficits shock on Private Spending Components**



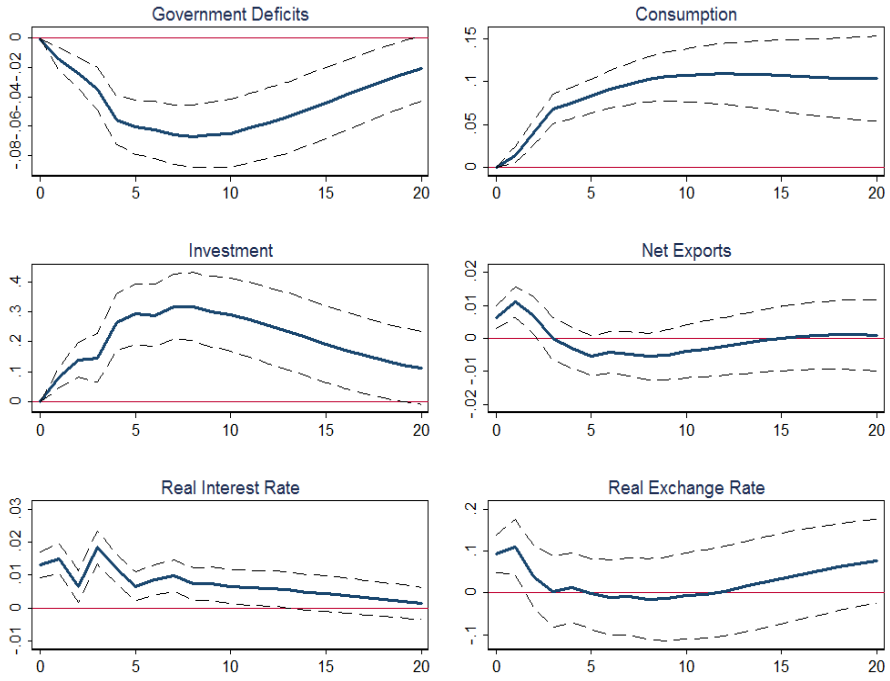
Note: Impulse response to the shock of total government deficits. Total government spending deficits are constructed by subtract total government spending from total government current tax receipts. Net exports are computed as the ratio of GDP. Real interest rate is computed based on the secondary market rate of 3-month treasury bills. Real exchange rate is the real trade weighted U.S. dollar index (major countries). One standard deviation confidence interval (68% CI). Time period is 1973Q1-2015Q4.

Figure 25: **SPF shock on Private Spending Components**



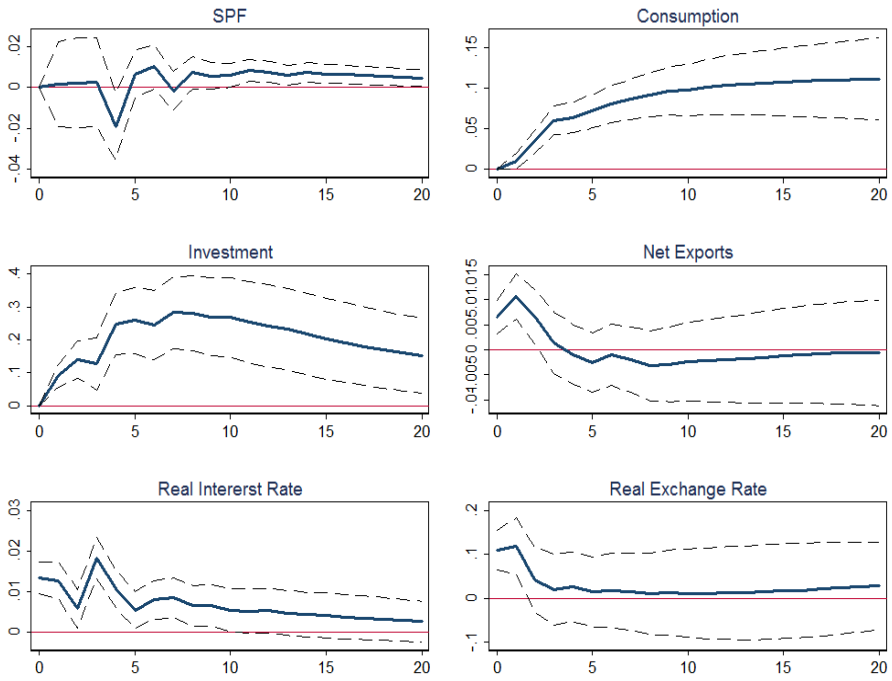
Note: Impulse response to the shock of SFP news series, "SPF" variable is derived from Valerie Ann Ramey's research database and Survey of Professional Forecasters. Real interest rate is computed based on the secondary market rate of 3-month treasury bills. Real exchange rate is the real trade weighted U.S. dollar index (major countries). One standard deviation confidence interval (68% CI), with control on federal government current tax receipts. Time span is 1973Q1-2015Q4.

Figure 26: **Effect of Consumer Sentiment Shock on Private Sector with conventional VAR**



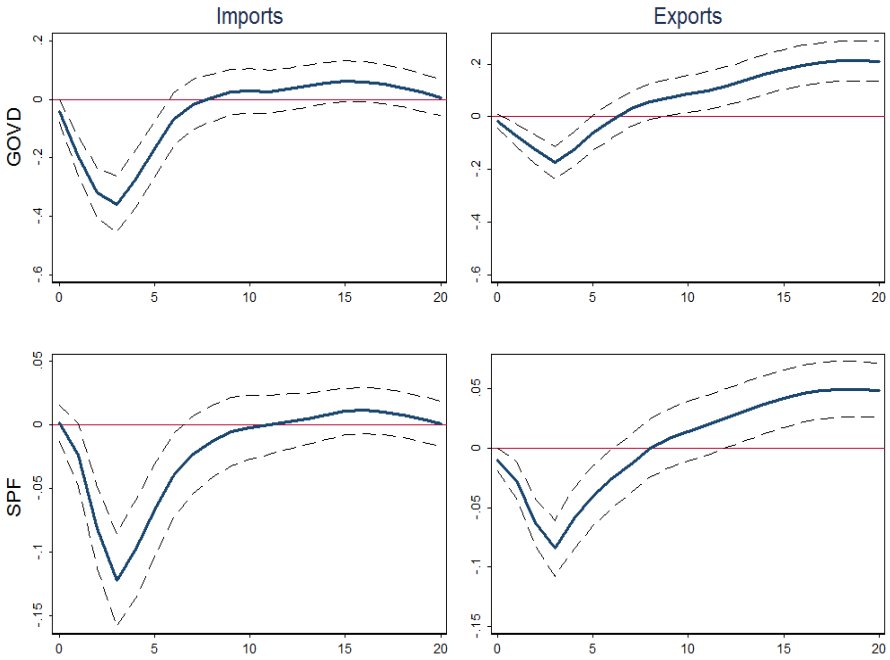
Note: Impulse response to the shock of consumer sentiment. Consumption and investment are all real value. Real interest rate is computed based on the secondary market rate of 3-month treasury bills. Real exchange rate is the real trade weighted U.S. dollar index (major countries). One standard deviation confidence interval (68% CI), nailing out tax interference by subtract total government spending from total government current tax receipts. Time period is 1973Q1-2015Q4.

Figure 27: **Effect of Consumer Sentiment Shock on Private Sector with EVAR**



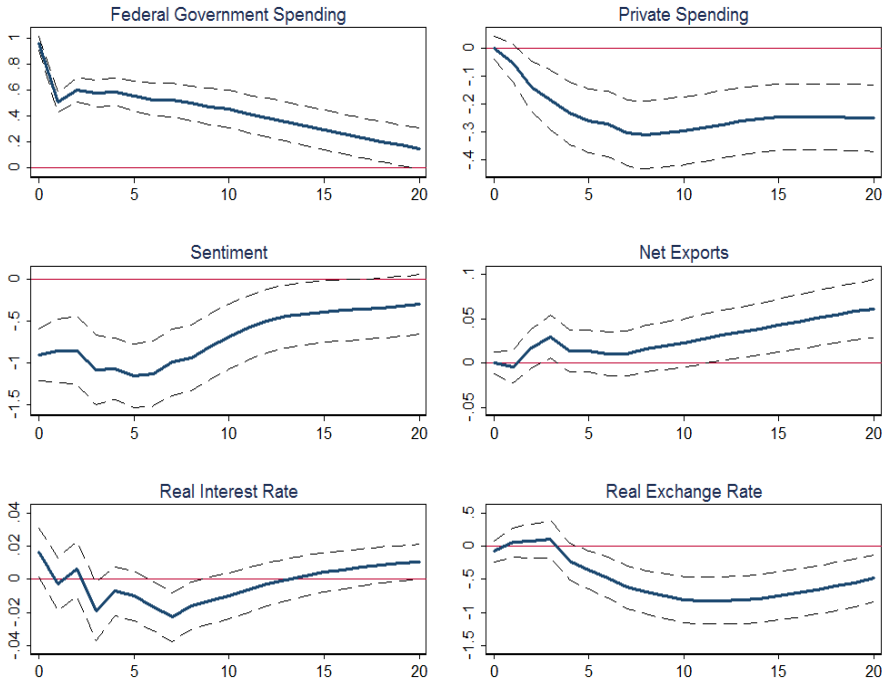
Note: Impulse response to the shock of consumer sentiment. "SPF" variable is derived from Valerie Ann Ramey's research database and Survey of Professional Forecasters. Consumption and investment are all real value. Real interest rate is computed based on the secondary market rate of 3-month treasury bills. Real exchange rate is the real trade weighted U.S. dollar index (major countries). One standard deviation confidence interval (68% CI), with control on federal government current tax receipts. Time period is 1973Q1-2015Q4.

Figure 28: **Effect of Fiscal Spending shocks on Imports and Exports**



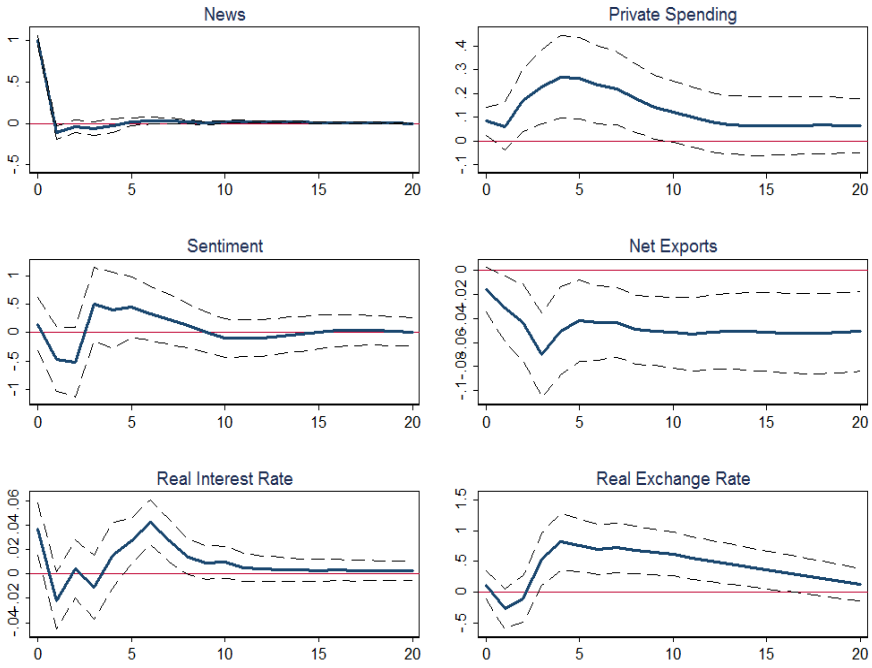
Note: Impulse response to the shock of government deficits and SPF news variable respectively. Both imports and exports are constructed as a ratio of GDP. One standard deviation confidence interval (68% CI). Time period is 1973Q1-2015Q4.

Figure 29: **Effect of Federal Government Spending Shock with conventional VAR**



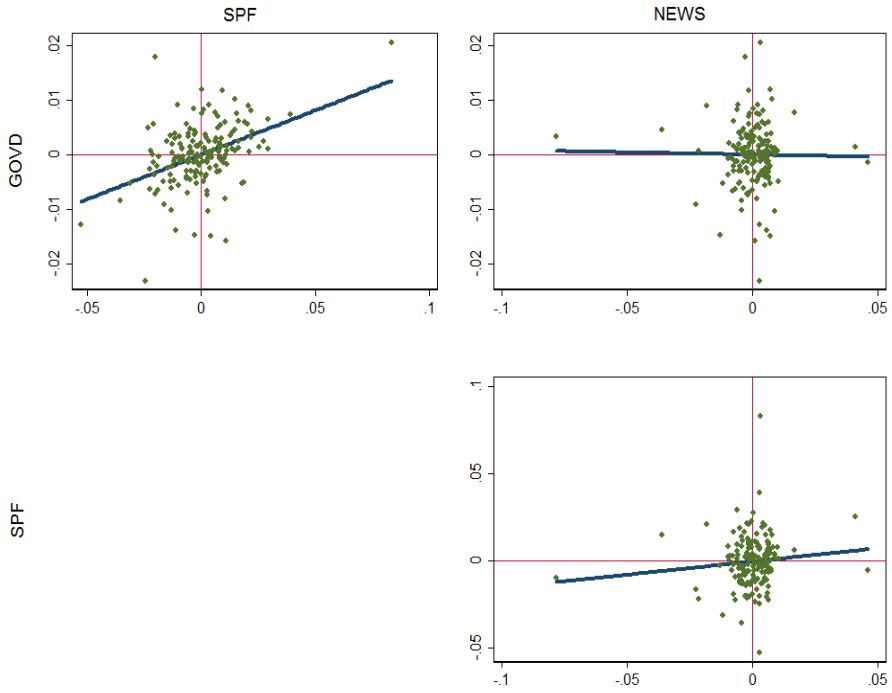
Note: Impulse response to the shock of federal government spending. Private spending is the sum of consumption and investment. Net exports are computed as the ratio of GDP. Real interest rate is computed based on the secondary market rate of 3-month treasury bills. Real exchange rate is the real trade weighted U.S. dollar index (major countries). One standard deviation confidence interval (68% CI), with control on federal government current tax receipts. Time period is 1973Q1- 2015Q4.

Figure 30: **Effect of News Shock with EVAR**



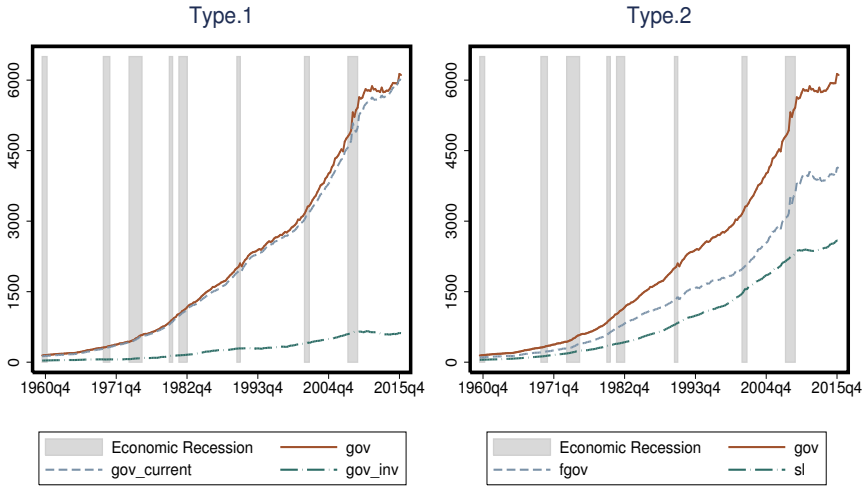
Note: Impulse response to the shock of Ramey's news variable. Ramey's news variable is constructed with anticipated defense spending. Private spending is the sum of consumption and investment. Net exports are computed as the ratio of GDP. Real interest rate is computed based on the secondary market rate of 3-month treasury bills. Real exchange rate is the real trade weighted U.S. dollar index (major countries). One standard deviation confidence interval (68% CI), with control on federal government current tax receipts. Time period is 1973Q1-2015Q4.

Figure 31: **Correlations among rnw_t, spf_t and god_t**



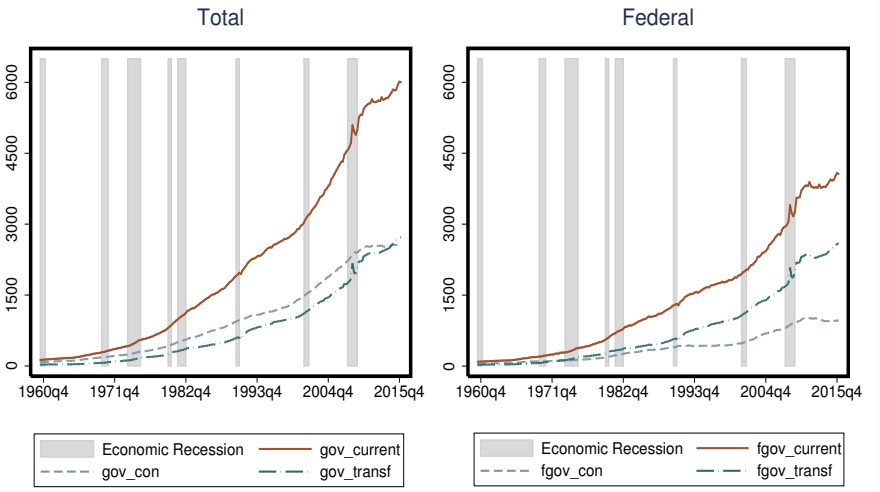
Note: "NEWS" denotes Ramey's news variables, "SPF" is the combination of Ramey's news variable and anticipated federal government spending variable in Survey of Professional Forecaster,"GOVD" is government budget deficits. Time period is 1973Q1-2015Q4.

Figure 32: **Major Components of Government Total Expenditures**



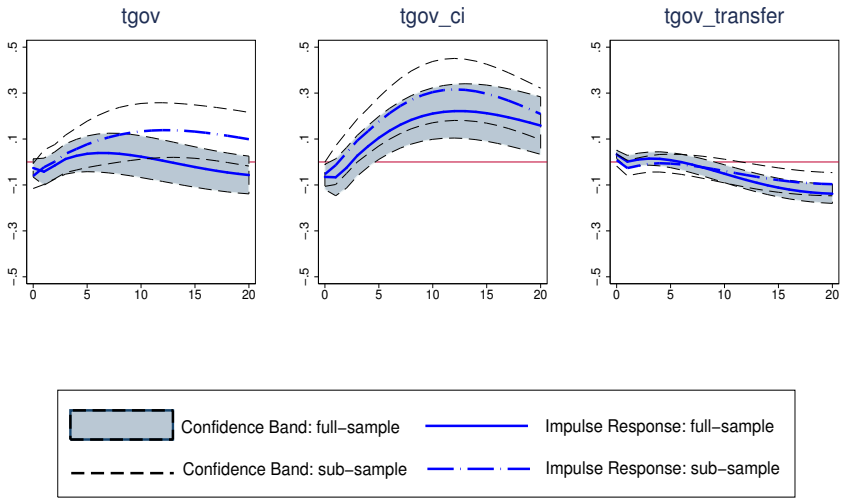
Note: "**gov**" denotes total government expenditures, "**fgov**" denotes federal government expenditures, "**sl**" denotes state and local government expenditures, "**gov_current**" is total current government expenditures, and "**gov_inv**" denotes total government investment expenditures. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. The economic recession periods are defined by NBER US Business Cycle Expansions and Contractions. Time span is 1960Q1-2015Q4.

Figure 33: **Major Components of Government Current Expenditures**



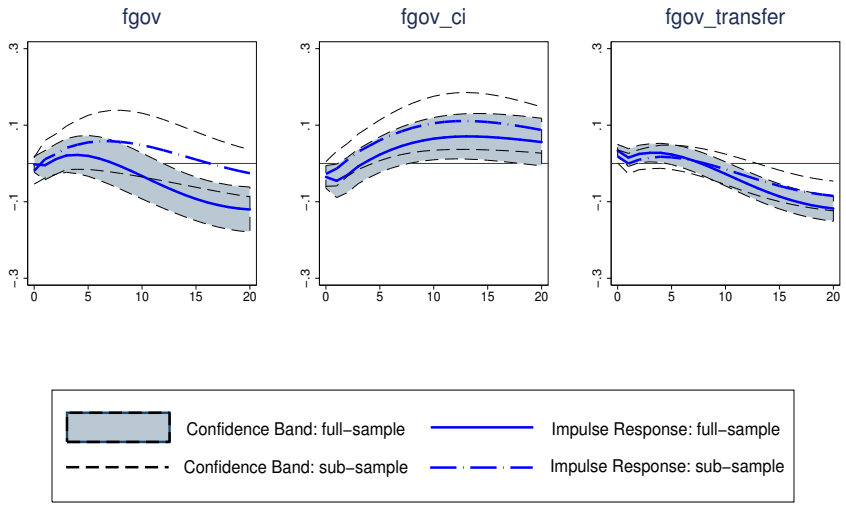
Note: "**gov_current**" is total current government expenditures, "**gov_con**" is total government consumption, and "**gov_transf**" denotes total government transfer payments. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. The economic recession periods are defined by NBER US Business Cycle Expansions and Contractions. Time span is 1960Q1-2015Q4.

Figure 34: **Shocks of Total Government Expenditures: total GDP**



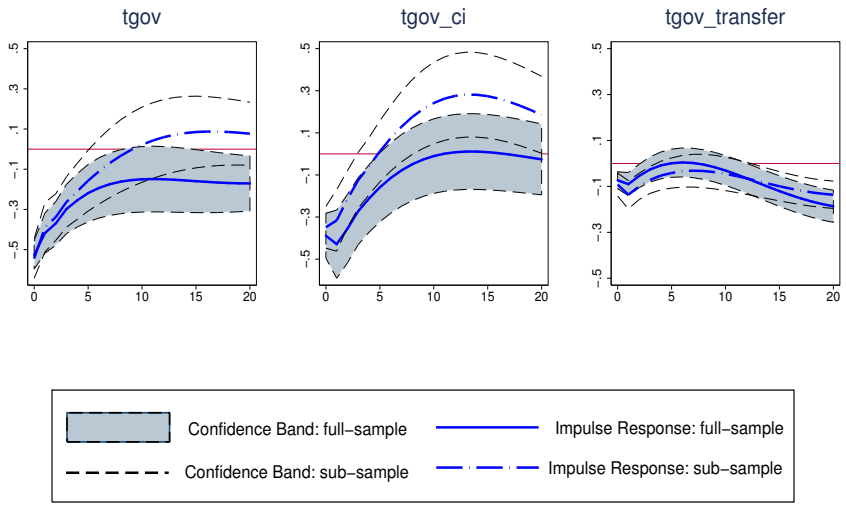
Note: Response variable: total GDP. "**tgov**" is total government expenditures, "**tgov_ci**" is total government consumption and gross investment, "**tgov_transfer**" is total government transfer payments. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Figure 35: **Shocks of Federal Government Expenditures: total GDP**



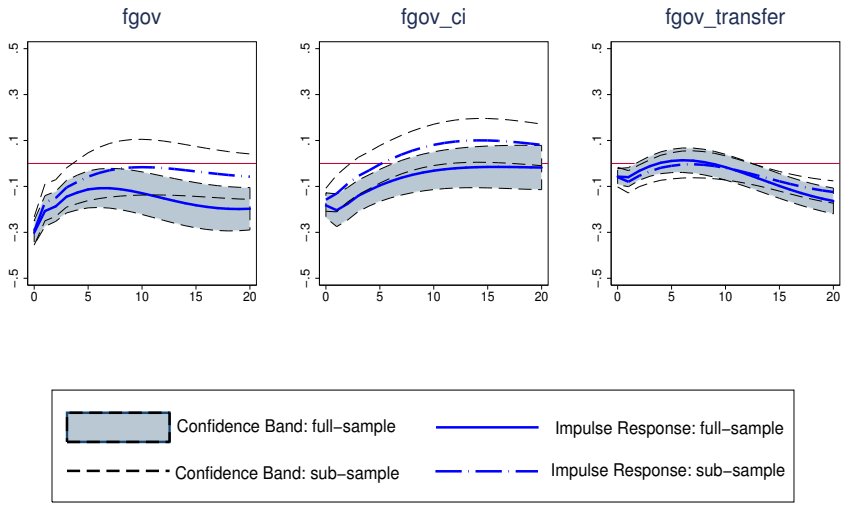
Note: Response variable: total GDP. "**fgov**" is federal government expenditures, "**fgov_ci**" is federal government consumption and gross investment, "**fgov_transfer**" is federal government transfer payments. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Figure 36: **Shocks of Total Government Expenditures: private GDP**



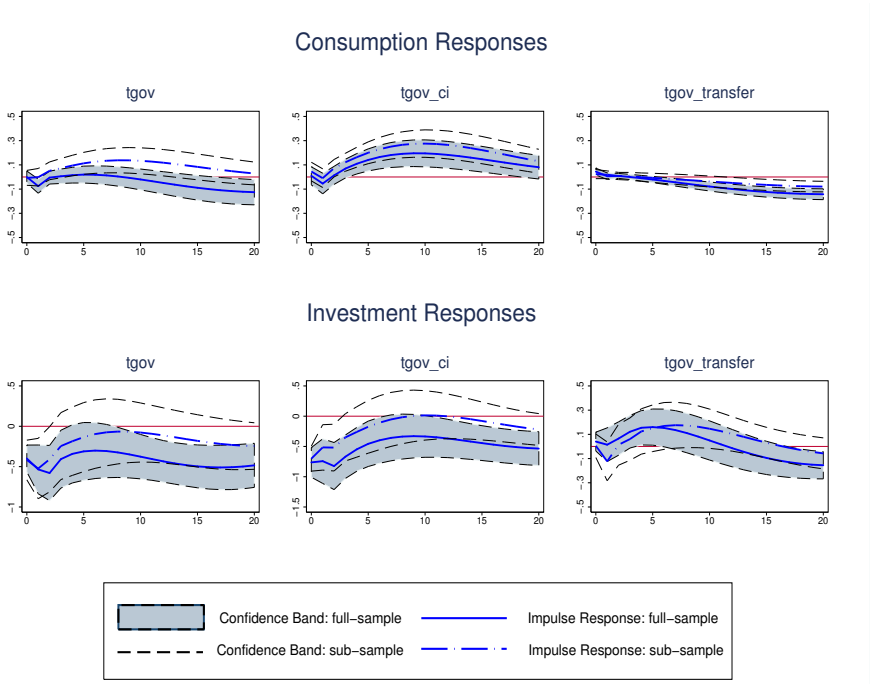
Note: Response variable: private GDP. "**tgov**" is total government expenditures, "**tgov_ci**" is total government consumption and gross investment, "**tgov_transfer**" is total government transfer payments. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Figure 37: **Shocks of Federal Government Expenditures: private GDP**



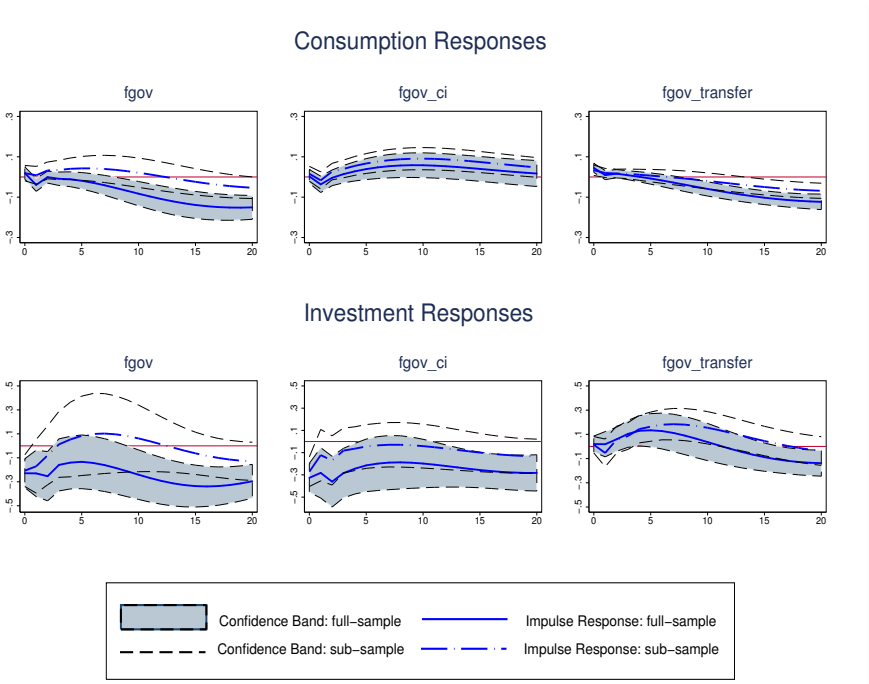
Note: Response variable: private GDP. "**fgov**" is federal government expenditures, "**fgov_ci**" is federal government consumption and gross investment, "**fgov_transfer**" is federal government transfer payments. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Figure 38: **Shocks of Total Government Expenditures: Consumption and Investment**



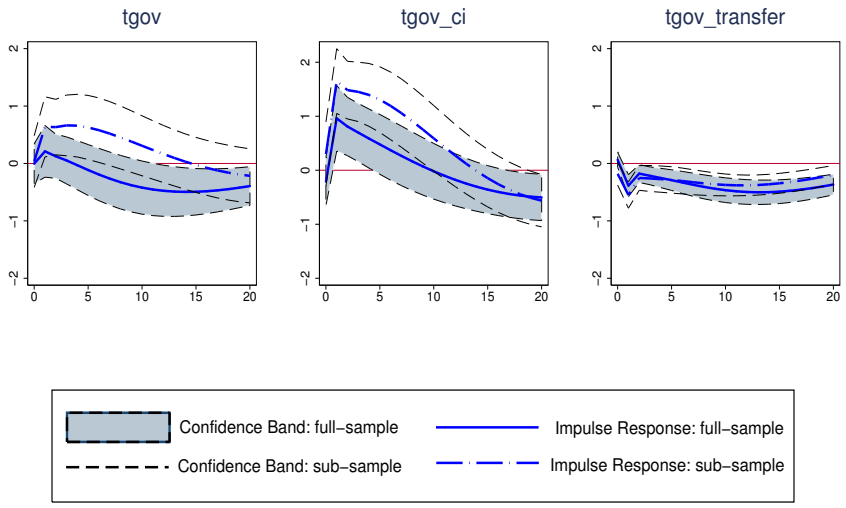
Note: "**tgov**" is total government expenditures, "**tgov_ci**" is total government consumption and gross investment, "**tgov_transfer**" is total government transfer payments. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Figure 39: **Shocks of Federal Government Expenditures: Consumption and Investment**



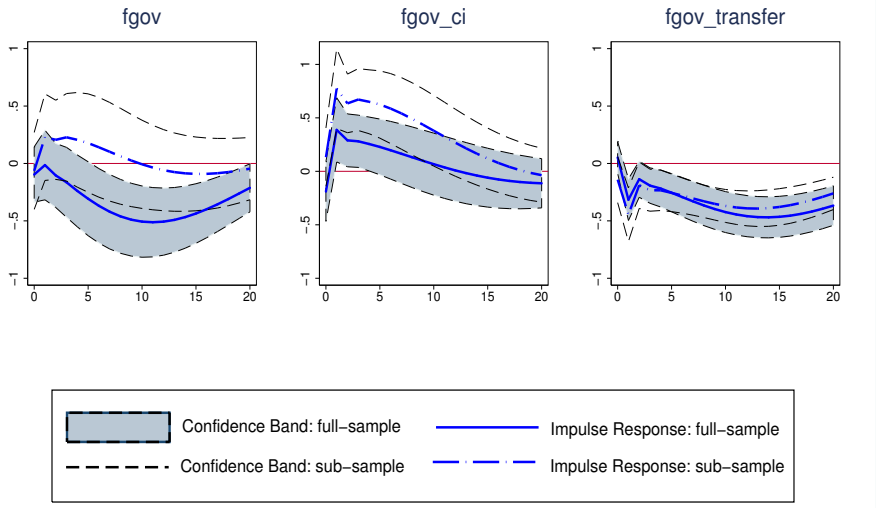
Note:"**fgov**" is federal government expenditures, "**fgov_ci**" is federal government consumption and gross investment, "**fgov_transfer**" is federal government transfer payments. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Figure 40: **Shocks of Total Government Expenditures: Sentiment**



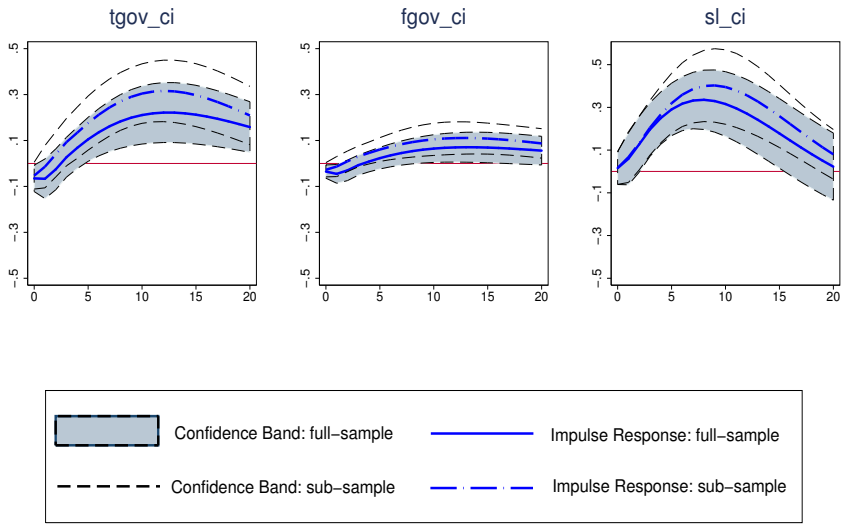
Note: Response variable: consumer sentiment. "**tgov**" is total government expenditures, "**tgov_ci**" is total government consumption and gross investment, "**tgov_transfer**" is total government transfer payments. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Figure 41: **Shocks of Federal Government Expenditures: Sentiment**



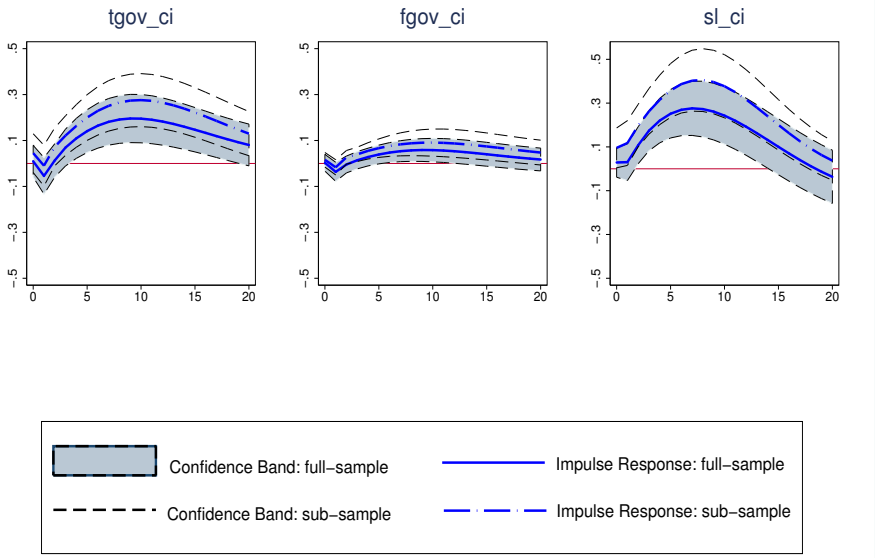
Note: Response variable: consumer sentiment. "**fgov**" is federal government expenditures, "**fgov_ci**" is federal government consumption and gross investment, "**fgov_transfer**" is federal government transfer payments. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Figure 42: **Shocks of Government Purchases: Real GDP**



Note: Response variable: real GDP. "**tgov_ci**" is total government purchases, "**fgov_ci**" is federal government purchases, "**sl_ci**" is state and local government purchases. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Figure 43: **Shocks of Government Purchases: Consumption**



Note: Response variable: consumption. "**tgov_ci**" is total government purchases, "**fgov_ci**" is federal government purchases, "**sl_ci**" is state and local government purchases. Data source is US. Bureau of Economic Analysis, selected series are retrieved from FRED, Federal Reserve Bank of St. Louis. 1-standard deviation confidence band (68% CI) with 100 times non-parametric bootstrap simulation. Time span of full sample is 1960Q1-2015Q4, and 1960Q1-2007Q4 for sub-sample.

Table 1: **Data Description (Chap.1)**

Data ID	**Description**
GDP	Gross Domestic Product
PCE	Personal Consumption Expenditures
PCEDG	Personal Consumption Expenditures: Durable Goods
PCEND	Personal Consumption Expenditures: Nondurable Goods
PCES	Personal Consumption Expenditures: Services
GPDI	Gross Private Domestic Investment
W068RCQ027SBEA	Government total expenditures
W019RCQ027SBEA	Federal government total expenditures
GDPDEF	Gross Domestic Product: Implicit Price Deflator, Index 2009 =100
W006RC1Q027SBEA	Federal government current tax receipts
POP	Total Population: All Ages including Armed Forces Overseas
TB3MS	3-Month Treasury Bill: Secondary Market Rate
M2	M2 Money Stock
USPRIV	All Employees: Total Private Industries
A132RC1Q027SBEA	Compensation of employees: Wages and salaries, Private industries
UMCSENT	Consumer Sentiment Index: Survey of University of Michigan
News	Defense News Series: Valerie Ramey's website
SPF	Survey of Professional Forecasters from Philadelphia Fed.

Note: We obtained most data from the Fred. UMCSENT is from the Surveys of Consumers website at the University of Michigan. "News" variable is from Valerie Ramey's website. "SPF" denotes the mean responses of the real federal government spending data from the Survey of Professional Forecasters database obtained from the Philadelphia Fed website. The data prior to 1981 SPF data are obtained from Tom Stark at the Philadelphia Fed. Time span is 1960:I to 2013:II.

Table 2: **Data Description (Chap.2)**

Data ID	**Description**
GDP	Gross Domestic Product
NETFI	Balance on Current Account, NIPA's
NETEXP	Net Exports of Goods & Services
TWEXMPA	Real Trade Weighted U.S. Dollar Index: Major, Index March 1973=100
TB3MS	3-Month Treasury Bill: Secondary Market Rate
FDEFX	Federal Government: National Defense Consumption Expenditures & Gross Investment
GPDI	Gross Private Domestic Investment
GDPDEF	Gross Domestic Product: Implicit Price Deflator, Index 2009 =100
UMCSENT	Consumer Sentiment Index: Survey of University of Michigan
W068RCQ027SBEA	Government total expenditures
W019RCQ027SBEA	Federal government total expenditures
W006RC1Q027SBEA	Federal government current tax receipts
W054RC1Q027SBEA	Government current tax receipts
USAIMPORTQDSNAQ	Imports of Goods and Services
EXPGS	Exports of Goods and Services
M2	M2 Money Stock
PCE	Personal Consumption Expenditures
SPF	Survey of Professional Forecasters from Philadelphia Fed.
ConsSent	Consumer Sentiment: Servey of Consumers, University of Michigan
news	Ramey's News Variable

Note: Most quarterly data is from Federal Reserve Economic Database, ConsSent is from survey of consumers online database (http://www.sca.isr.umich.edu/), and news variable is from Valerie Ann Rameys research database (http://econweb.ucsd.edu/ vramey/). Time span is 1973Q1-2015Q4.

Table 3: **Government Expenditure Data Description (Chap.3)**

Data ID	Description
W068RCQ027SBEA	Government Total Expenditures
GEXPND	Government Current Expenditures
A955RC1Q027SBEA	Government Consumption Expenditures
A782RC1Q027SBEA	Gross Government Investment
GCE	Government Consumption Expenditures and Gross Investment
A084RC1Q027SBEA	Government Current Transfer Payments
W019RCQ027SBEA	Federal Government Total Expenditures
FGEXPND	Federal Government: Current Expenditures
A957RC1Q027SBEA	Federal Government Consumption Expenditures
A787RC1Q027SBEA	Gross Government Investment: Federal
FGCE	Federal Consumption Expenditures and Gross Investment
W014RC1Q027SBEA	Federal Government Current Transfer Payments
W079RCQ027SBEA	State and Local Government Total Expenditures
SLEXPND	State and Local Government Current Expenditures
A991RC1Q027SBEA	Government Consumption Expenditures: State and Local
SLINV	State and Local Government Gross Investment
SLCE	State and Local Consumption Expenditures & Gross Investment
FDEFX	Federal Government: National Defense Consumption Expenditures and Gross Investment
A997RC1Q027SBEA	Government Consumption Expenditures: Federal: National defense
DGI	Federal Government: Real National Defense Gross Investment
FNDEFX	Federal Government: Nondefense Consumption Expenditures and Gross Investment
A542RC1Q027SBEA	Government Consumption Expenditures: Federal: Nondefense
NDGI	Federal Nondefense Gross Investment

Note: US. Bureau of Economic Analysis, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series. Time span is 1960Q1-2015Q4.

Table 4: **Interested Macroeconomic Data Description (Chap.3)**

Data ID	**Description**
GDP	Gross Domestic Product
PCE	Personal Consumption Expenditures
GPDI	Gross Private Domestic Investment
GDPDEF	Gross Domestic Product: Implicit Price Deflator
W006RC1Q027SBEA	Federal government current tax receipts
POP	Total Population: All Ages including Armed Forces Overseas
TB3MS	3-Month Treasury Bill: Secondary Market Rate
M2	M2 Money Stock
ConsSent	Consumer Sentiment Index: Servey of Consumer, conducted by University of Michigan
news	Ramey's News Variable

Note: US. Bureau of Economic Analysis, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series. Time span is 1960Q1-2015Q4. Consumer Sentiment Index is collected from Survey of Consumers, UMC online database (http://www.sca.isr.umich.edu/), and news variable is from Valerie Ann Rameys research database (http://econweb.ucsd.edu/ vramey/).

Table 5: **Summary of Different Sample Periods Across Studies (Chap.3)**

Authors (publish year)	**Sample Period**
Baxter and King (1993)	1930-1985, annual
Hooker and Knetter (1997)	1963-1994, annual
Finn (1998)	1950q1-1993q4
Ramey and Shapiro (1998)	1949q1-1996q4
Blanchard and Perotti (2002)	Post WWII: 1947q1-1997q4
Burnside, Eichenbaum and Fisher (2003)	Post WWII: 1947q1-1995q4
Perotti (2004)	1. Countries except for U.S.: 1979q4-2001q4; 2. U.S.: 1960q1-2001q4.
Tenhofen and Wolff (2007)	1947q1-2006q3
Galí, López-Salido and Vallés (2007)	1954q1-2003q4
Perotti (2008)	1947q1-2003q4
Pappa (2009)	1969-2001, annual
Hall (2009)	1930-2008, annual
Fisher and Peters (2009)	1. Top panel: 1948q1-2007q4; 2. Second panel: 1957q3-2007q4.
Fishback and Kachanovskaya (2010)	1930-1940, annual
Leeper, Walker and Yang (2010)	1960q1-2008q1
Mertens and Ravn (2010)	1959q1-2006q4
Monacelli, Perotti and Trigari (2010)	1954q1-2006q4
Ramey (2011)	1. News variable: 1939q1-2008q4 ; 2. SPF variable: 1969q1-2008q4
Barro and Redlick (2011)	1. Defense or nondefense spending: 1914-2006, annual; 2. Government purchase: 1929-2006, annual.
Corsetti, Meier and Müller (2012)	1975-2008, annual
Corsetti, Meier and Müller (2012)	1983q1-2007q4
Mittnik and Semmler (2012)	1954q1-2008q4
Auerbach and Gorodnichenko (2012)	1947q1-2008q4
Nakaruma and Steinsson (2013)	1966-2006, annual panel dataset
Perotti (2014)	1939q1-2008q4
Zeev and Pappa (2015)	1947:Q1-2008:Q4

Note: See reference for details.