Does anticipation of government spending matter? Evidence from an expectation augmented VAR

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Abstract:
How does private consumption react to an exogenous increase in government expenditure? Standard structural vector autoregressions (SVARs) usually report a positive GDP as well as consumption response, while event studies report a negative consumption response. We investigate in a SVAR whether anticipation of the fiscal shock reverses the sign of this dynamic response to a negative one. As a methodological contribution, we model expectation formation within a SVAR framework. We show for the US that consumption falls in reaction to an expenditure shock once the model allows for one-period-ahead anticipation of this shock. Modelling anticipation of fiscal shocks is thus crucial to correctly capture their macroeconomic effects. Differences in results between event studies and VARs can be explained by missing anticipation in VARs. When re-estimating the two models (with and without anticipation) for non-defense related expenditures, we find a positive consumption response for both models. The implications of our results for macroeconomic theory are briefly discussed.

Keywords: Fiscal policy, government spending, net revenue, policy anticipation, structural vector autoregression.
JEL-Classification: E62, H30.

Non-technical summary

How does government spending affect the real economy, especially private consumption? The answer to this question is highly controversial, both on the theoretical as well as on the empirical side. The empirical debate concerns mostly the question of the best identification strategy. As government spending depends on many economic factors, the identification strategy has to assure that the fiscal shock is exogenous. A specific problem in this regard is the fact that fiscal policy might already affect the real economy before it actually occurs as fiscal policy actions are anticipated. This paper shows that anticipation of fiscal effects has important effects on the results of empirical studies.

The empirical literature on the effects of fiscal policy in the US can broadly be divided into two strands: On the one hand, fiscal policy events are identified with the narrative approach employing dummies for exogenous increases in military purchases. These shocks raise GDP but lower consumption and real wages. On the other hand, VAR techniques usually achieve identification by assuming that government spending is predetermined within the quarter and find that private consumption, similar to GDP, usually rises after a shock to government spending. These contrasting empirical findings have important implications for our view of the macroeconomy. While both the neoclassical and the Keynesian model predict increasing output, in the former world consumption should fall, while in a Keynesian framework consumption should increase. Thus, the narrative approach lends support to neoclassical economic theory, while evidence from VARs supports Keynesian models.

In this paper we model anticipation in a SVAR to study its importance in determining the results of the VAR approach. In contrast to Blanchard and Perotti (2002) who discuss anticipation effects on *output*, we report the effects of anticipated fiscal policy on private *consumption*, where anticipation effects could change the sign of the response. Moreover, as a methodological contribution, we introduce expected fiscal policy in a SVAR framework by modelling explicitly and transparently the process describing expectation formation. Our results are thus not based on simulations and we stay completely in the multivariate time series context.

Our main finding is that the positive consumption response in Blanchard and Perotti's (2002) VAR switches to a negative response, once the VAR is extended to allow for one-period-ahead anticipation of the shock. Modelling anticipation in VARs is thus of crucial importance. Once, the model correctly captures the timing, the empirical results are fully in line with a neoclassical model of fiscal policy. When re-estimating the two models (with and without anticipation) for non-defense related expenditures, we find a positive and clearly significant consumption response for both models. Here, the correct timing appears to be of minor importance.

Nicht-technische Zusammenfassung

Wie beeinflussen die Staatsausgaben die Realwirtschaft, insbesondere den privaten Konsum? Diese Frage ist theoretisch und empirisch umstritten. Auf der empirischen Seite gibt es eine Kontroverse darum, wie man am besten solche Schocks identifiziert, da Staatsausgaben in der Regel nicht exogen sind, sondern von anderen ökonomischen Variablen abhängen. Ein besonderes Problem besteht darin, dass Fiskalpolitik schon eine Wirkung entfalten kann, bevor sie eintritt, da Ausgaben- und Einnahmenveränderungen antizipiert werden. In diesem Papier zeigen wir, dass die Berücksichtigung von Antizipation starken Einfluss auf die Ergebnisse empirischer Studien hat.

Die empirische Literatur zu den Auswirkungen der Fiskalpolitik in den USA lässt sich grob in zwei Ansätze unterteilen. Einerseits wird zur Identifikation finanzpolitischer Ereignisse der narrative Ansatz herangezogen, bei dem für exogene Steigerungen der Militärausgaben Dummy-Variablen eingesetzt werden. Solche Schocks erhöhen zwar das BIP, senken aber den Konsum und die Reallöhne. Andererseits werden VAR-Techniken verwendet, die zur Identifikation finanzpolitischer Ereignisse üblicherweise davon ausgehen, dass die Staatsausgaben innerhalb des Quartals ihres Auftretens vorbestimmt sind. Dieser Ansatz ergibt, dass die privaten Konsumausgaben ähnlich wie das BIP nach einem Schock bei den Staatsausgaben in der Regel ansteigen. Diese widersprüchlichen empirischen Ergebnisse haben bedeutende Implikationen für unsere Auffassung der Gesamtwirtschaft. Während sowohl das neoklassische als auch das Keynesianische Modell einen Produktionsanstieg voraussagen, würden die Konsumausgaben laut dem erstgenannten Ansatz zurückgehen, beim Keynesianischen Ansatz hingegen steigen. Somit stützt der narrative Ansatz die neoklassische Wirtschaftstheorie, während die Ergebnisse von VARs den Keynesianischen Modellen Unterstützung liefern.

Im vorliegenden Beitrag wird die Antizipation finanzpolitischer Ereignisse in den USA in einem SVAR modelliert, um ihre Bedeutung für die Ergebnisse des VAR-Ansatzes zu untersuchen. Im Gegensatz zu Blanchard und Perotti (2002), die sich mit den Auswirkungen der Antizipation auf die *Produktion* beschäftigen, befassen wir uns mit dem Einfluss antizipierter finanzpolitischer Ereignisse auf die privaten *Konsumausgaben*; hier können Antizipationseffekte eine Änderung des Vorzeichens der dynamischen Reaktion bewirken. Als methodischer Beitrag wird die erwartete Fiskalpolitik durch explizite und transparente Modellierung des Erwartungsbildungsprozesses in das SVAR-Modell eingeführt. Somit basieren die Ergebnisse der Untersuchung nicht auf Simulationen und werden ausschließlich im Kontext multivariater Zeitreihenanalyse ermittelt.

Die wichtigste Erkenntnis der Untersuchung ist, dass sich die positive Reaktion der Konsumausgaben gemäß dem von Blanchard und Perotti (2002) verwendeten VAR-Modell ins Negative umkehrt, wenn das VAR dahingehend erweitert wird, dass Antizipation ermöglicht wird. Die Modellierung der Antizipation in VAR-Modellen ist somit von entscheidener Bedeutung. Sobald das Modell die zeitliche Struktur richtig erfasst, stehen die empirischen Resultate voll mit dem neoklassischen Modell der Fiskalpolitik im Einklang. Eine erneute Schätzung der beiden Modelle (mit und ohne Antizipation) für Ausgaben ohne Verteidigungsausgaben ergibt für beide eine positive und eindeutig signifikante Reaktion der Konsumausgaben. Hier scheint die korrekte zeitliche Einordnung eine untergeordnete Rolle zu spielen.

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1 Introduction

The empirical literature on the effects of fiscal policy can broadly be divided into two strands: On the one hand, fiscal policy events are identified with the narrative approach, which goes back to Romer and Romer (1989), employing dummies for announced wars.[2] Here, identification is based on the fact that wars are driven by foreign policy events exogenous to the state of the economy. Announced wars raise GDP but lower consumption and real wages (Ramey and Shapiro (1998), Edelberg, Eichenbaum, and Fisher (1999) and Burnside, Eichenbaum, and Fisher (2004)). On the other hand, VAR techniques usually achieve identification by assuming that government spending is predetermined within the quarter. The seminal paper by Blanchard and Perotti (2002) furthermore assumes that government revenue cannot be adjusted with discretion to contemporaneous GDP and therefore depends in the short run on GDP only through automatic stabilizers, which can be exogenously determined. When employing these identifying assumptions, private consumption, similar to GDP, usually rises after a shock to government spending. These empirical results have been confirmed and extended in the papers by Perotti (2005) and Perotti (2007).[3]

These contrasting empirical findings have important implications for our view of the macroeconomy. While both the neoclassical and the Keynesian model predict increasing output, in the former world consumption should fall

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[2]A very recent paper by Romer and Romer (2007) employs the narrative approach for tax changes.

[3]de Castro Fernández and de Cos (2006) for Spain, Biau and Girard (2005) for France and Giordano, Momigliano, Neri, and Perotti (2007) for Italy, Heppke-Falk, Tenhofen, and Wolff (2006) for Germany. A different identification procedure was proposed by Fatás and Mihov (2001) and Mountford and Uhlig (2005).

(Baxter and King 1993), while in a Keynesian framework consumption should increase.[4] Thus, the narrative approach lends support to neoclassical economic theory, while evidence from VARs supports (New-) Keynesian models.

In an important contribution, Ramey (2006) aims at explaining the difference in the results of these two empirical approaches. She argues that the VAR techniques miss the fact, that large government spending shocks, such as wars, are usually anticipated. Within a neoclassical model, it is easy to show, that missing the point of anticipation will result in a positive coefficient of government spending on consumption as consumption following the initial drop increases with investment.[5] In support of her hypothesis that shocks are indeed anticipated, Ramey (2006) documents that the war dummies Granger-cause government spending shocks, but not vice-versa.

In this paper we model anticipation in a SVAR to study its importance in determining the results of the VAR approach. In contrast to Blanchard and Perotti (2002) who discuss anticipation effects on *output*, we report the effects of anticipated fiscal policy on private *consumption*, where anticipation effects could change the sign of the response. Moreover, as a methodological contribution, we introduce expected fiscal policy in a SVAR framework by modelling explicitly and transparently the process describing expectation formation. Our results are thus not based on simulations and we stay completely in the multivariate time series context. We continue to rely on quarterly data to avoid problems related to annual data, such as the fact that government spending is probably not predetermined relative to GDP within a fiscal year.

Our main finding is that the positive consumption response in Blanchard and Perotti's (2002) VAR switches to a negative response, once the VAR is extended to allow for one- period-ahead anticipation of the shock. Modelling anticipation in VARs is thus of crucial importance. Our results lend strong support to Ramey's hypothesis, that the different results of the narrative approach and the VAR approach are indeed driven by missing anticipation of

[4]Galí, López-Salido, and Vallés (2007), among others, construct a New-Keynesian model with a positive consumption response. Galí, López-Salido, and Vallés (2007) as well as Linnemann and Schabert (2003) make clear, that many very special conditions have to be fulfilled in order to generate a positive consumption response.

[5]Households should respond to the increase in government spending by reducing consumption and increasing labor supply, when they first learn about the future shock as the perfectly anticipated shock lowers lifetime wealth. After the initial drop, consumption should increase again as the real wage increases with investment. This will result in a positive coefficient.

fiscal shocks in VARs. Once, the model correctly captures the timing, the empirical results are fully in line with a neoclassical model of fiscal policy, such as Baxter and King (1993). When re-estimating the two models (with and without anticipation) for non-defense related expenditures, we find a positive and clearly significant consumption response for both models. Here, the correct timing appears to be of minor importance. We discuss possible explanations of this result based on the nature of non-defense spending and alternatively based on the size of the shock.

The remainder of the paper is structured as follows. The next section develops the expectations augmented SVAR. Section 3 contrasts the results of the expectations augmented SVAR with the results of the standard SVAR of Blanchard and Perotti (2002). Subsection 3.2 checks robustness and subsection 3.3 highlights the importance of defense related expenditure and discusses possible explanations. Finally, the last section concludes.

2 The estimation approach

In order to explicitly take into account perfectly anticipated fiscal policy, we extend the empirical approach put forward by Blanchard and Perotti (2002), which constitutes the state-of-the-art SVAR methodology focusing on fiscal policy. They exploit fiscal policy decision lags to identify structural shocks and, in particular, argue that governments cannot react in the short run, e.g., within the same quarter, to changes in the macroeconomic environment, since fiscal policy decision-making is a slow process, involving many agents in parliament, government, and civil society. Consequently, reactions of fiscal policy to current developments only result from so-called "automatic" responses, which are defined by existing laws and regulations and which can be taken into account by applying exogenous output or consumption elasticities. Adjusting government expenditure or revenue using these elasticities enables us to obtain unbiased estimates of the structural coefficients and thus the structural fiscal policy shocks.

However, apart from *decision lags*, policymaking is also characterized by *implementation lags*, i.e., the realization of certain policies does not occur instantly but takes some time. This introduces the aspect of anticipated fiscal policy into this setup. Not taking account of the latter kind of lags could invalidate the analysis, since it is possible that what we (perhaps incorrectly)

identify as structural shocks are in fact anticipated by the private sector. Blanchard and Perotti (2002) address this criticism by including future fiscal policy variables in the estimation procedure. In particular, they assume that agents perfectly know fiscal policy one period in advance and are able to react to it. They derive the output response of an anticipated fiscal shock by simulating the system under rational expectations. Unfortunately, they do not report consumption responses, where anticipation effects could make a difference with respect to the sign of the response depending on the true model. Consequently, as one of the main contributions of this paper, we take up this question and investigate the relevance of anticipation effects for the dynamic response of private consumption to fiscal policy shocks.

In order to allow for anticipation of fiscal shocks by the private sector, we go beyond the three variable SVAR of Blanchard and Perotti (2002) by explicitly modeling the process describing expectation formation within the SVAR framework and derive impulse response functions. In general, we propose the following setup, based on a standard AB-model SVAR:

$$
\begin{aligned}
Y_t &= C(L)Y_{t-1} + U_t && (1)\\
AU_t &= BV_t, && (2)
\end{aligned}
$$

where $Y_t = [c_t \;\; g_t \;\; r_t \;\; E_t(g_{t+1}) \;\; E_t(r_{t+1})]'$ is the vector of endogenous variables, U_t is the vector of reduced form residuals, and $V_t = [v_t^c \;\; v_t^g \;\; v_t^r \;\; v_{t+1}^g \;\; v_{t+1}^r]'$ is the vector of structural shocks to be identified. Here c_t denotes real private consumption, g_t is real government expenditure, r_t denotes real government revenue, and v_t^i is the respective structural shock.

More specifically, the model in structural form has the following representation:

$$
\begin{aligned}
c_t &= C_{11}(L)c_{t-1} + \gamma_1 E_t(g_{t+1}) + \alpha_g^c g_t + C_{12}(L)g_{t-1} + \gamma_2 E_t(r_{t+1}) \\
&\quad + \alpha_r^c r_t + C_{13}(L)r_{t-1} + v_t^c && (3)\\
g_t &= \alpha_{c1}^g c_t + \alpha_{c2}^g c_{t-1} + \widetilde{C}_{21}(L)c_{t-2} + C_{22}(L)g_{t-1} + C_{23}(L)r_{t-1} + v_t^g && (4)\\
r_t &= \alpha_{c1}^r c_t + \alpha_{c2}^r c_{t-1} + \widetilde{C}_{31}(L)c_{t-2} + C_{32}(L)g_{t-1} + C_{33}(L)r_{t-1} \\
&\quad + \beta_g^r v_t^g + v_t^r && (5)\\
E_t(g_{t+1}) &= C_{41}(L)c_t + C_{42}(L)g_t + C_{43}(L)r_t + \beta_g^{Eg} v_{t+1}^g + \beta_r^{Eg} v_{t+1}^r && (6)\\
E_t(r_{t+1}) &= C_{51}(L)c_t + C_{52}(L)g_t + C_{53}(L)r_t + \beta_g^{Er} v_{t+1}^g + \beta_r^{Er} v_{t+1}^r, && (7)
\end{aligned}
$$

First, note that equations (3)-(5) represent the structure of the economy, while equations (6)-(7) model the process describing expectation formation. In addition, since the model is presented in structural form, the coefficients $\alpha_{c1}^{g}, \alpha_{c1}^{r}$, and β_{g}^{r} are elements of the A and B matrices, respectively. Furthermore, we pulled c_{t-1} out of the lagpolynomial, since we have to treat these coefficients separately due to the identification approach of Blanchard and Perotti (2002). Moreover, we have to assume a relative ordering of the fiscal variables. Here we act on the assumption that spending decisions come first, i.e., the structural revenue shock, v_t^r, does not enter the expenditure equation, whereas v_t^g enters the revenue equation.

However, the important thing to note here, is that we explicitly take into account anticipated fiscal policy by introducing the expectation terms in equation (3) and model the expectation process by equations (6) and (7). The assumption that fiscal policy is perfectly known one period in advance is reflected in the fact that the information set with respect to period t also includes v_{t+1}^g and v_{t+1}^r, which is reflected in the latter two equations modeling the process describing expectation formation. Even though a standard VAR also implicitly models expectation formation, here we have to augment the basic VAR equations with the expectations terms and expectational equations, since we have to deal with a special informational structure. In particular, not only variables indexed up to time t are part of the information set with respect to time t, but it also contains future variables, i.e., variables indexed $t+1$. Moreover, one might wonder how the equations modeling expectation formation are consistent with the equations modeling the fiscal part of the structure of the economy. The main difference here is that at time t future private consumption is not known, which is however part of the structural fiscal equations with respect to time $t+1$. Consequently, private agents have to estimate this "omitted variable," and this is done by using *all* the information available at time t. This is why the coefficients in the lagpolynomial in the expectational equations could differ from the respective ones in the structural equations. In addition, this is also why the coefficient of the corresponding fiscal shock in the expectational equations does not have to be one, as in the structural equation. Finally, the structural government revenue shock is also part of the expectational equation modeling government expenditure, even though it is not part of the structural fiscal equation, since it could potentially help to forecast future private consumption.

Estimation of this model basically proceeds in three steps.[6] First, we look at the fiscal equations (4) and (5). Here we start by exploiting the assumption concerning decision lags. In particular, in order to address endogeneity issues, we use exogenous consumption elasticities of government expenditure and revenue to compute adjusted real government direct expenditure and net revenue. Furthermore, we not only have to assume that there is no fiscal policy discretionary response to consumption developments within the quarter but also no response to consumption developments in the previous quarter. This leads to the following setup:

$$\begin{aligned} g_t^A \equiv g_t - \alpha_{c1}^g c_t - \alpha_{c2}^g c_{t-1} &= \widetilde{C}_{21}(L)c_{t-2} + C_{22}(L)g_{t-1} + C_{23}(L)r_{t-1} + v_t^g \quad (8) \\ r_t^A \equiv r_t - \alpha_{c1}^r c_t - \alpha_{c2}^r c_{t-1} &= \widetilde{C}_{31}(L)c_{t-2} + C_{32}(L)g_{t-1} + C_{33}(L)r_{t-1} \\ &\quad + \beta_g^r v_t^g + v_t^r. \quad (9) \end{aligned}$$

Subsequently, we recursively estimate the resulting equations by OLS to obtain the structural shocks to the respective fiscal variable, i.e., we first estimate equation (8) and obtain v_t^g, and then use this shocks series as an additional regressor to estimate equation (9).

In the second step, we consider the equation modeling private consumption. We begin by rewriting equation (3) as follows:

$$\begin{aligned} c_t &= C_{11}(L)c_{t-1} + \gamma_1 g_{t+1} + \alpha_g^c g_t + C_{12}(L)g_{t-1} + \gamma_2 r_{t+1} \\ &\quad + \alpha_r^c r_t + C_{13}(L)r_{t-1} + v_t^{c'}, \quad (10) \end{aligned}$$

where

$$g_{t+1} = E_t(g_{t+1}) + u_{t+1}^g \quad (11)$$

$$r_{t+1} = E_t(r_{t+1}) + u_{t+1}^r, \quad (12)$$

and consequently $v_t^{c'} = v_t^c - \gamma_1 u_{t+1}^g - \gamma_2 u_{t+1}^r$. Subsequently, equation (10) is estimated by means of instrumental variables regression, in order to account for the correlation of the respective regressors and error term. Since both v_{t+1}^i

[6] Here our focus is on the aspect of anticipation. A more detailed description of the general estimation approach can be found in Blanchard and Perotti (2002) and Heppke-Falk, Tenhofen, and Wolff (2006).

and v_t^i $(i = g, r)$ are perfectly known at time t, they are uncorrelated with the expectational errors in $v_t^{c'}$. Furthermore, because they are also uncorrelated with v_t^c, we can use v_{t+1}^e, v_t^e, v_{t+1}^r, and v_t^r as instruments to estimate γ_1, α_e^c, γ_2, and α_r^c.

Finally, in the third step, we look at the equations modeling expectations. Since with respect to these two equations we are only interested in forecasting and not in estimation of the structural parameters, it is sufficient to just plug equations (6) and (7) into equations (11) and (12), respectively, and estimate these by OLS.[7]

By this procedure we obtain all coefficients necessary to compute the structural impulse response functions. In particular, it is possible to estimate the dynamic response to a perfectly anticipated fiscal policy shock.

With respect to data, real private consumption, as well as real direct expenditure and real net revenue are defined as in Blanchard and Perotti (2002).[8] The series are seasonally adjusted, in per capita terms, and we take logs. The frequency of the employed time series is crucial for the identification approach. In order to exclude the possibility of discretionary fiscal policy actions within one time period, quarterly data are used. The system is estimated in levels including a constant, a time trend, and a dummy to account for the large tax cut in 1975:2. The sample starts in 1947:1 and runs up to 2006:3. The number of lags for the VAR is chosen to be three as suggested by the Akaike information criterion (AIC). With respect to the consumption elasticities, we follow Blanchard and Perotti (2002) and assume that there is no automatic response of government spending in the current and the previous quarter, and that the consumption elasticities of net revenue are $2.08 * 0.6436$ and $0.16 * 0.6436$ for time t and $t-1$, respectively, where 2.08 and 0.16 are the output elasticities and 0.6436 is the average share of consumption in GDP over the sample period.[9]

[7] OLS provides a consistent estimate of the linear projection coefficient. See, for example, Hamilton (1994), p. 76.

[8] Figures A-1 and A-2 in the appendix plot the expenditure respectively tax to GDP ratio as shown in Blanchard and Perotti (2002). The data are taken from the bureau of economic analysis website (www.bea.gov).

[9] We perform various robustness checks concerning the elasticities. In particular, as do Blanchard and Perotti (2002), we also set the output elasticity of net revenue at $t-1$ to 0 and 0.5, and consequently the consumption elasticity to 0 and $0.5 * 0.6436$.

3 Results

3.1 Benchmark

In Figure 1, we present the response of private consumption to a government spending and government revenue shock.[10] These impulse responses are derived from the benchmark three variable VAR, which does not allow for anticipation. As Blanchard and Perotti (2002), we find a positive response of

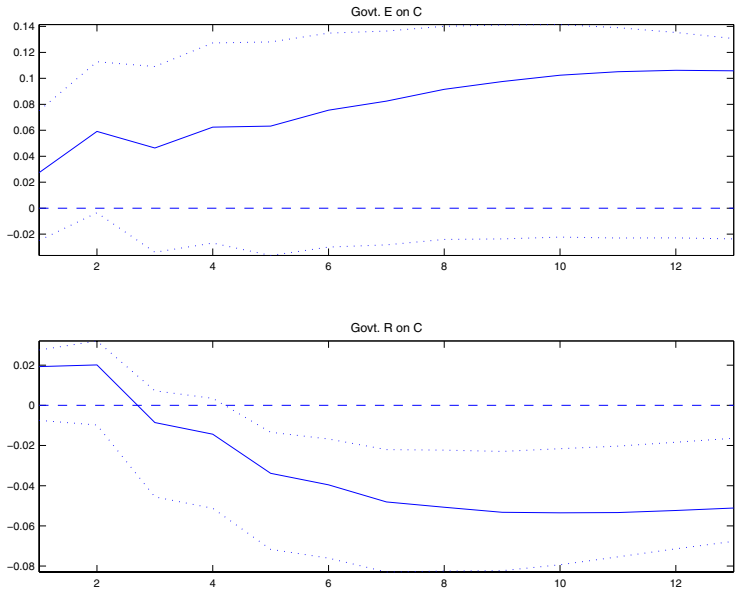

Figure 1: Reaction of private consumption to government expenditure and revenue shock. Sample: 1947q1-2006q3.

private consumption to the spending shock, which is, however, not significant. Regarding the revenue shock, we find a significantly negative response after three quarters.

If the SVAR model is extended along the lines described above to allow for one-period-ahead anticipation of the shock, the results markedly change. As Figure 2 shows, consumption falls one period before the shock realizes. The point estimate continues to decrease until one period after the shock realization but then increases towards zero. Regarding the anticipated revenue shock, we find a negative point estimate, which is, however, not significant.

These results show, that extending the SVAR model to allow for perfect anticipation of shocks changes the results substantially. In particular, it alters

[10]We plot the point estimate of the impulse response function as well as 68% bootstrap confidence bands based on 5000 replications. We show 68% confidence intervals to be able to compare our results to Blanchard and Perotti's.

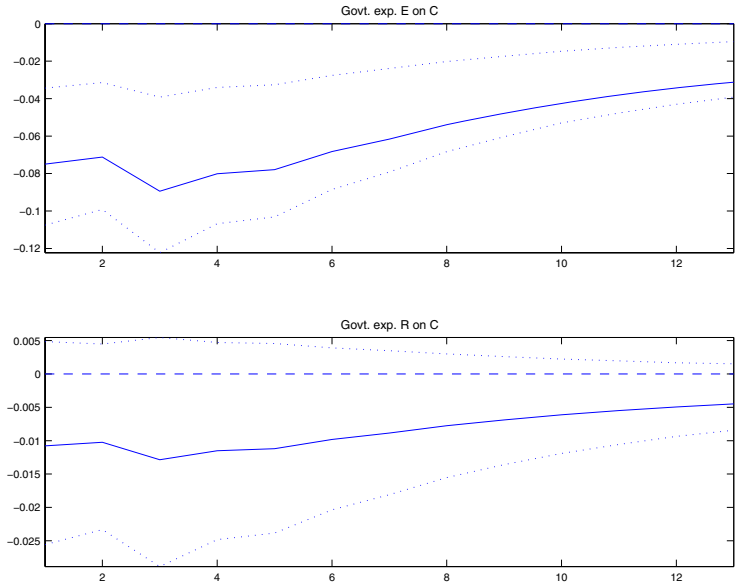

Figure 2: Reaction of private consumption to anticipated government expenditure and revenue shock. The shock occurs at time 2 and is anticipated at time 1. Sample: 1947q1-2006q3.

the sign of the response of private consumption to government expenditure. Private consumption now reacts, in line with the neoclassical model, by falling. After the realization of the shock, consumption starts increasing again. This finding indeed suggests that the different results coming from "war dummy" studies and VAR studies might be driven by the "timing." Regarding the revenue shock, allowing for anticipation renders the previously significantly negative consumption response insignificant.

3.2 Robustness with respect to elasticities and sample size

As a robustness check, we modify the elasticity of revenue to private consumption at t-1 to zero. Figure A-3 shows that the negative consumption response is unaffected. Increasing this elasticity to (0.5*0.6436) yields Figure A-4, in which the response of consumption to a revenue shock is now significantly negative, while the response to a spending shock also remains negative and significant. Furthermore, using the tax revenue elasticity to GDP as the elasticity of tax revenue to consumption does not change the results (Figures A-5 and A-6). Thus, in the sample 1947-2006, we clearly find falling consumption to a spending shock if anticipation is allowed for. For the more restricted model without anticipation, consumption increases.

As an additional robustness check, we restrict our sample to the period 1960-1997, on which most results of Blanchard and Perotti (2002) are based. Figure A-7 plots the impulse response for the three variable VAR. In line with Blanchard and Perotti (2002), we find a clear and significant positive response of consumption to a shock to government spending and a significant and negative reaction to a shock to revenue after 4 quarters.

When extending the model for the shorter sample to allow for anticipation of the shocks, we again find our results changed substantially (Figure A-8). The magnitude of the point estimate of the consumption response to a spending shock is roughly a third. Furthermore, it is insignificant. Regarding the response to a revenue shock, we also do not find a significant effect anymore. Thus, while the sign of the response does not change, the pervious result is still confirmed in the sense that the consumption response is substantially weakened if anticipation is accounted for.

3.3 Defense spending

It is well known, that the 1950s can be characterized by a strong increase in defense expenditure due to the Korean war build-up. Figure A-9 plots the evolution of the national defense consumption expenditures and gross investment to GDP ratio. The Korean war build-up along with increased defense spending due to the cold war led to an increase of this ratio from less than 7 percent in 1948 to almost 15 percent in 1952. This figure together with the results from the restricted sample starting only in 1960 suggests that an analysis of

non-defense expenditure is worthwhile.

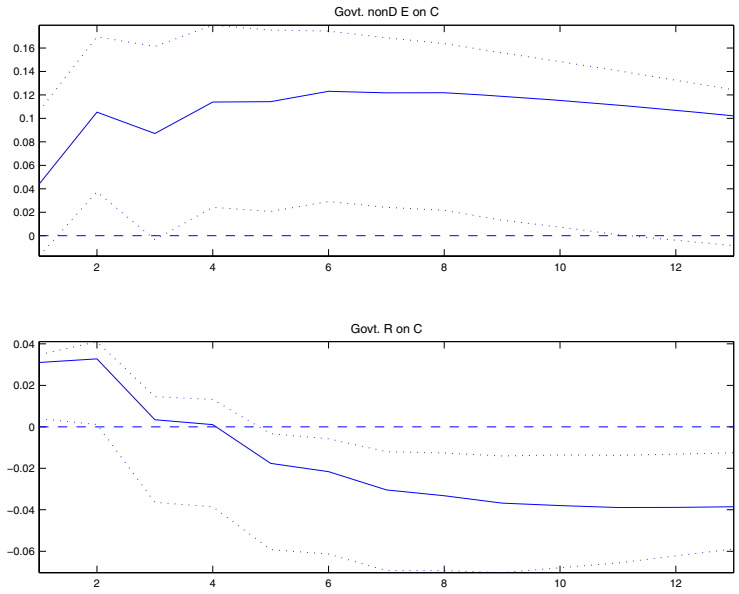

Figure 3: Reaction of private consumption to government non-defense expenditure and revenue shock. Sample: 1947q1-2006q3.

In Figure 3 we plot the impulse-response functions of a three variable VAR over the entire sample period without anticipation, in which government expenditure does not include defense spending. It is interesting to note, that the effect on consumption now appears to be more pronounced and positive. Apparently, the inclusion of defense spending in the prior benchmark analysis had reduced the positive impact on private consumption.

Extending the VAR to allow for anticipation of the shock changes the effects only slightly for government non-defense spending (Figure 4). The magnitude of the consumption response becomes smaller, while it is more clearly significant at all horizons. As regards government net revenue, the estimated effects are now insignificant at all horizons. For non-defense spending, timing issues thus appear to be of minor importance.

A potential explanation for the positive consumption response, once defense spending is omitted, might be the different nature of defense relative to non-defense spending. In fact, large parts of non-defense spending are performed by states and local authorities. We therefore looked at *federal* non-defense consumption spending and still found a significant and positive private consumption response in both models (Figures A-10 and A-11). It is also possible that defense spending is really the variable best suited to test wealth effects. Many other fiscal spending variables either constitute investment or are at least

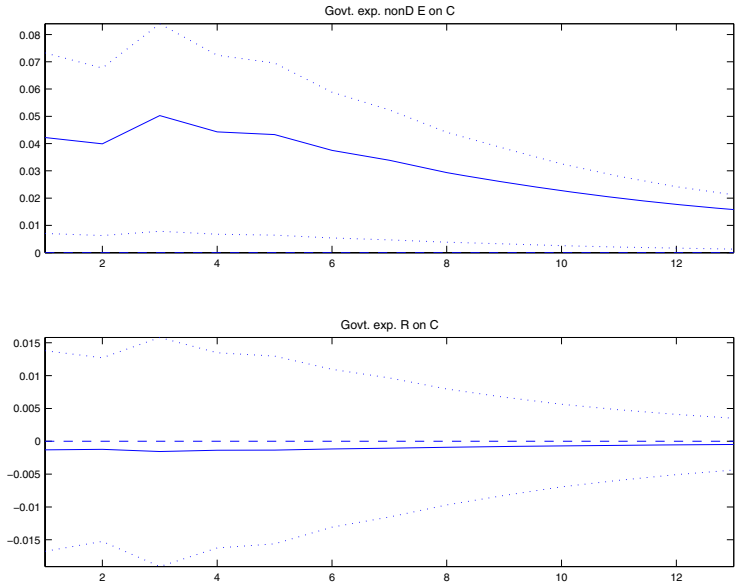

Figure 4: Reaction of private consumption to anticipated government non-defense expenditure and revenue shock. Sample: 1947q1-2006q3.

partially a substitute for private consumption. Yet another explanation is that the size of the shock matters. Figure A-12 plots real spending per capita and shows that abstracting from the trend, large variations in the series results mostly from defense spending. It is possible, that economic agents re-optimize their consumption/leisure decisions when faced with a large shock, while for smaller shocks they rather follow a model of a rule-of-thumb consumer who acts like a credit constraint person. This last interpretation would find support in recent research by Hsieh (2003), who shows that spending of Alaskan families does not appear to react to large and predictable annual payments while it does react to small and predicted income tax refunds.[11] Also, McGrattan and Ohanian (2007) show that the neoclassical model can explain the very large World War II fiscal shock well. More work along these lines remains for future research.

4 Conclusions

How does private consumption react to fiscal policy shocks? In this paper, we have shown that the estimated response significantly depends on anticipation of the shock. When estimating a standard SVAR in the spirit of Blanchard

[11]This difference is explained by the fact that computational costs of re-optimization are significant.

and Perotti (2002), we find a positive consumption response to a government spending shock. Extending this SVAR to allow for one-period-ahead anticipation of the shock dramatically changes the results. Private consumption falls one period before the expenditure shock realizes. These results are robust to changes in the exogenous elasticities needed to identify the SVAR. Modelling anticipation of fiscal shocks is thus of crucial importance.

In a second step, we re-estimate the two competing models for the entire sample 1947-2006, but exclude defense spending from government expenditure. The results now clearly show a positive consumption response for both the model allowing and not allowing for anticipation.

These findings suggest, that missing anticipation of shocks indeed appears to explain the difference of the consumption response found in event studies (Ramey and Shapiro 1998) vs. SVARs (Blanchard and Perotti 2002) as suggested by Ramey (2006). However, anticipation of fiscal expenditure shocks appears to be relevant only for defense spending. Private agents indeed lower their consumption in anticipation of a large increase in defense spending. Anticipation of other expenditure shocks is largely irrelevant. Here, private agents react to government non-defense expenditure by increasing consumption irrespective of anticipation.

The results on defense expenditure support neo-classical economic theory in the spirit of Baxter and King (1993). Private households reduce their consumption in response to the loss in future income due to non-productive war expenditures. Regarding non-defense expenditure, there are different explanations for the positive consumption response. One possibility is that parts of non-defense spending have the character of investments thereby potentially increasing wealth, which should lead to a consumption increase. A different explanation is that economic agents re-optimize their consumption/leisure decision only if shocks are large, while for small shocks they act like rule-of-thumb consumers. An answer to this question remains for future research.

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A Appendix

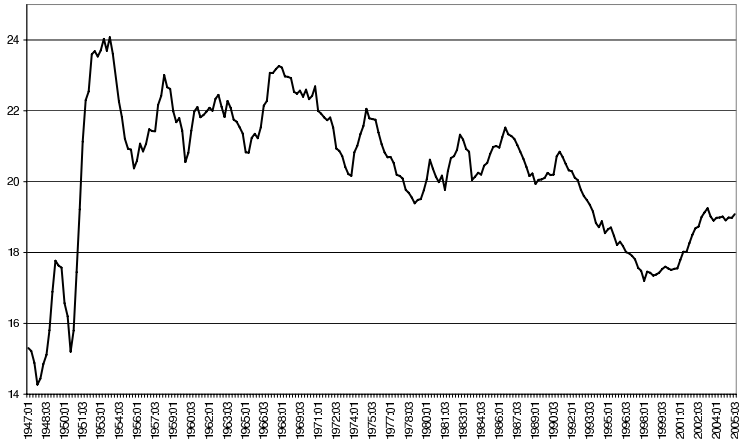

Figure A-1: Government spending to GDP ratio.

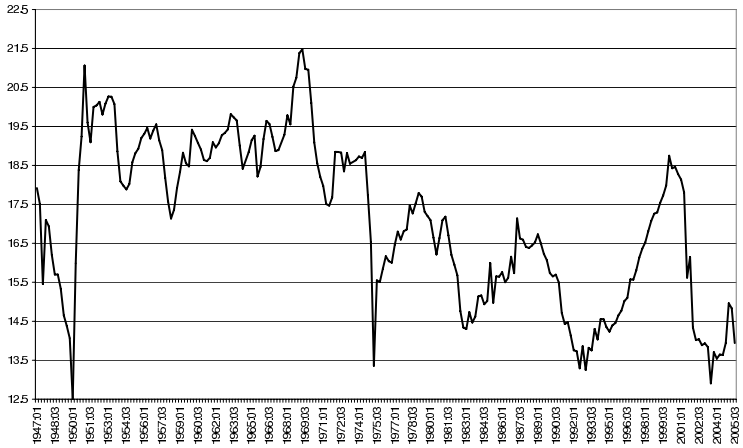

Figure A-2: Net revenue to GDP ratio.

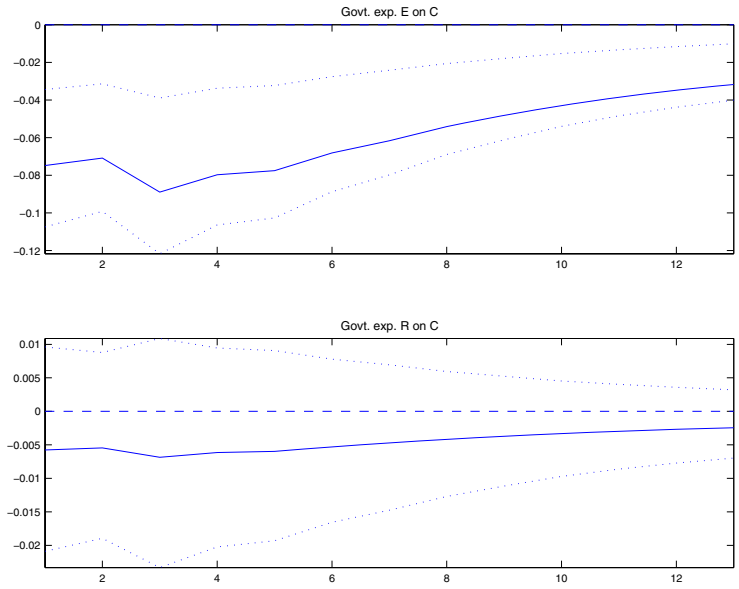

Figure A-3: Reaction of private consumption to anticipated government expenditure and revenue shock. Sample: 1947q1-2006q3, elasticity of tax revenue to consumption at t-1: 0

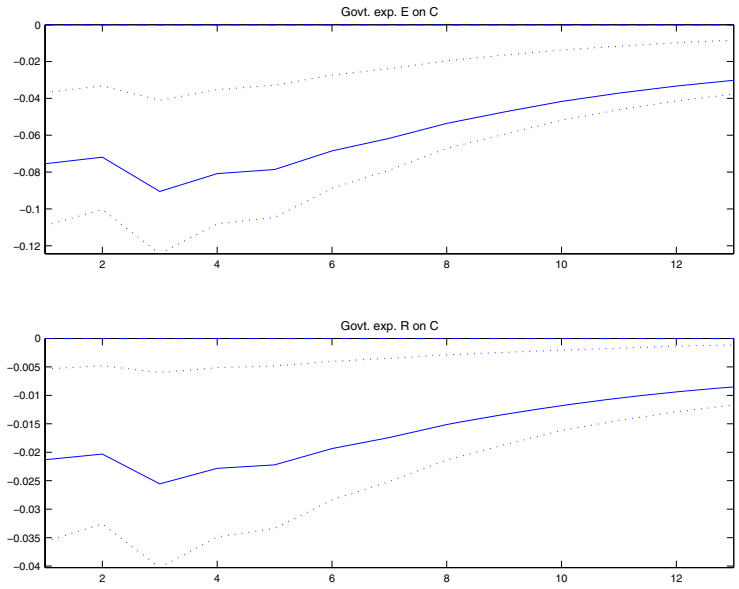

Figure A-4: Reaction of private consumption to anticipated government expenditure and revenue shock. Sample: 1947q1-2006q3, elasticity of tax revenue to consumption at t-1: 0.5*0.6436

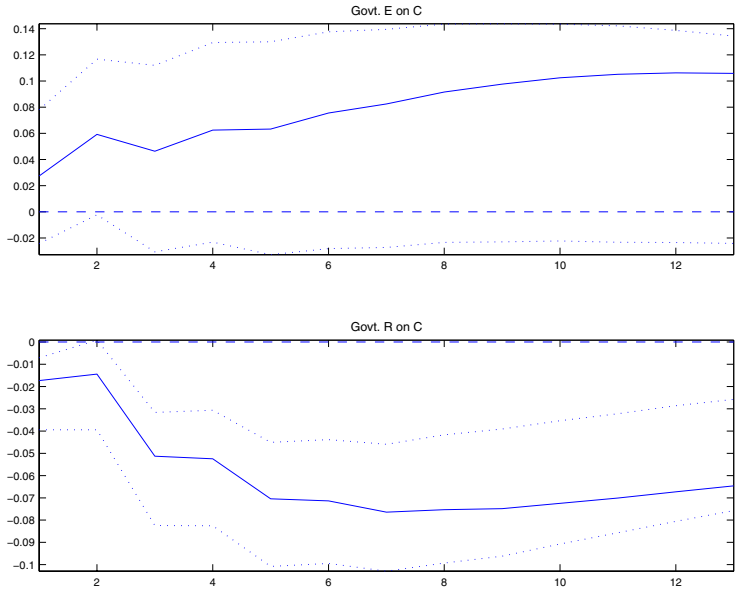

Figure A-5: Reaction of private consumption to government expenditure and revenue shock. elasticity of tax revenue to consumption at t: 2.08. Sample: 1947q1-2006q3.

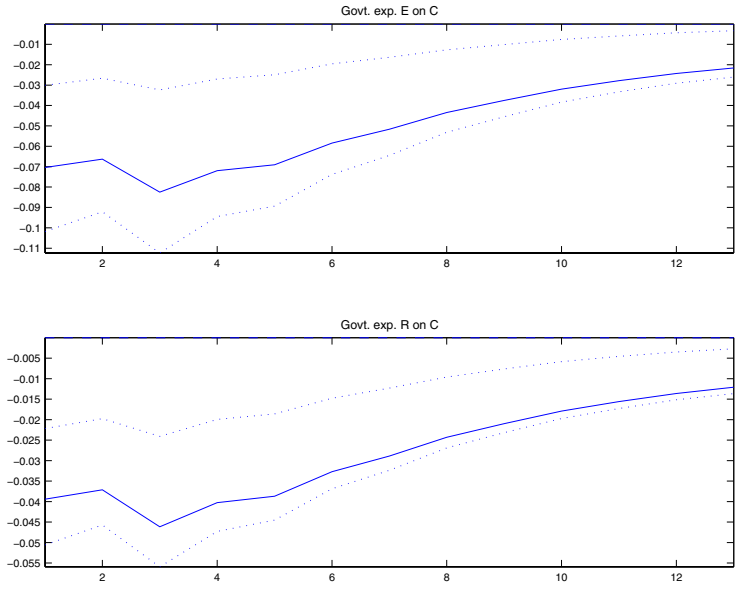

Figure A-6: Reaction of private consumption to anticipated government expenditure and revenue shock. elasticity of tax revenue to consumption at t: 2.08. Sample: 1947q1-2006q3.

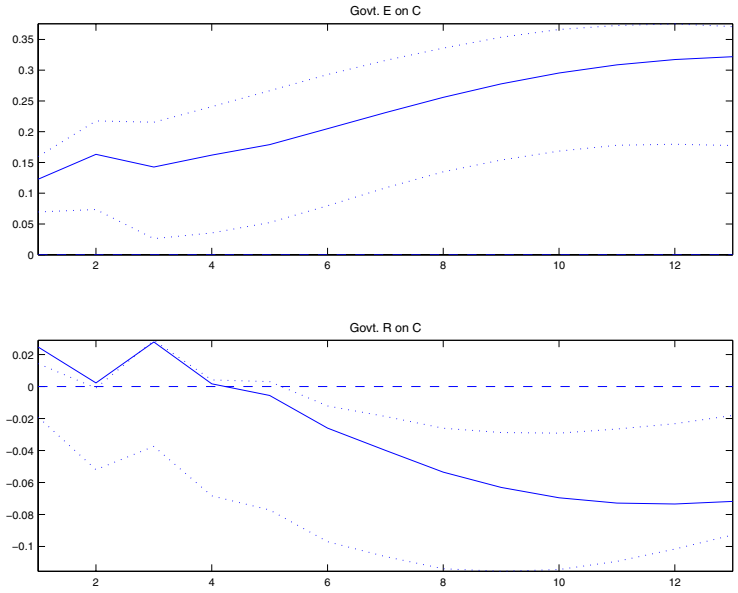

Figure A-7: Reaction of private consumption to government expenditure and revenue shock. Sample: 1960q1-1997q4.

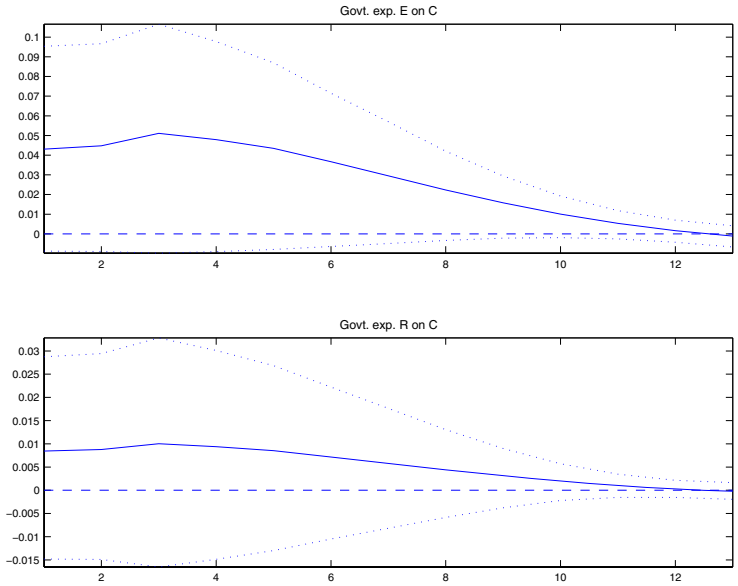

Figure A-8: Reaction of private consumption to anticipated government expenditure and revenue shock. Sample: 1960q1-1997q4.

Figure A-9: Defense expenditure to GDP ratio.

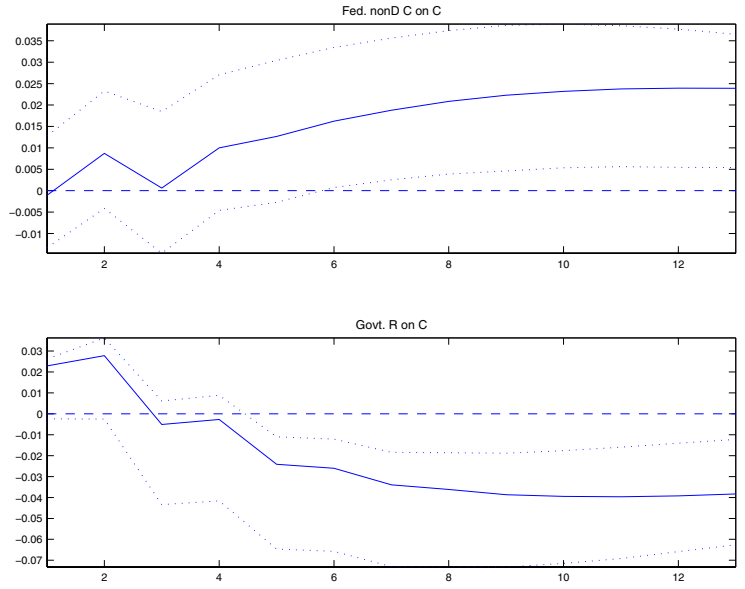

Figure A-10: Reaction of private consumption to federal non-defense consumption expenditure and revenue shock. Sample: 1947q1-2006q3.

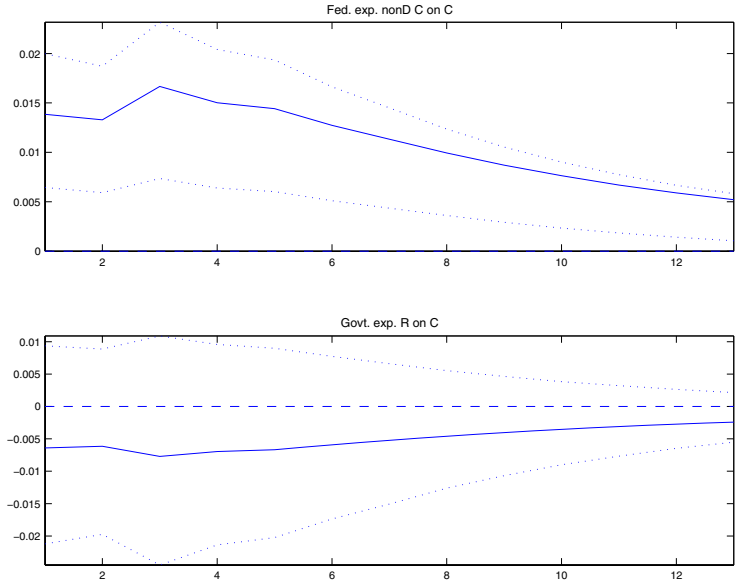

Figure A-11: Reaction of private consumption to anticipated federal non-defense expenditure and revenue shock. Sample: 1947q1-2006q3.

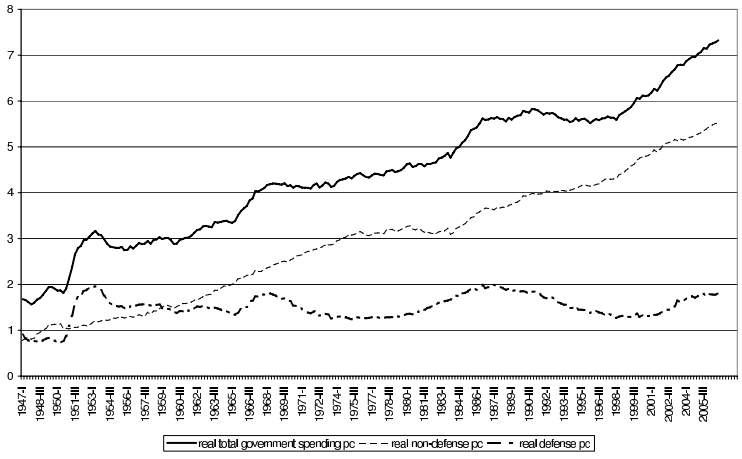

Figure A-12: Real per capita government spending in thousand US Dollars. Sample: 1947q1-2006q3.

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