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Comment   Lawrence J. Christiano

This is an excellent chapter on the effects of government spending that is well worth studying. Most of my discussion focuses on the background and motivation for the analysis. I begin by describing what it is about the current economic situation in the United States and other countries that motivates interest in the economic effects of government spending. Perhaps the natural place to look for information on the effects of government spending is the time series data. I review the information in the US time series data since 1940 using the different approaches taken by Ramey and Hall in this volume. I show that whatever information there is in the data about the effects of government spending primarily stems from the Korean War and World War II

episodes. I explain why the evidence on the government spending multiplier (i.e., the output effect of an increase in government spending) in these episodes is probably of limited value from the perspective of the current situation. This is why it is important to study other sources of evidence on the multiplier. Giavazzi and McMahon's chapter studies other such evidence by examining the response of consumption and labor in a cross-section of states in the United States. As the authors themselves emphasize, however, inferring information on the multiplier from the evidence they gather is problematic. Still, the work they do is important because it clarifies some of the channels by which government spending affects household decisions.

One Set of Reasons for Taking an Interest in the Effects of Government Spending

The authors' work can be appreciated from many different angles and I begin by describing one of them. There is widespread concern in the United States and other countries about the weak level of economic activity and high level of unemployment since 2008. One view is that the low level of activity reflects a failure of aggregate demand. A popular version of this view holds that the failure of aggregate demand stems from reduced spending by households and others as they struggle to reduce their levels of debt. In models of well-functioning markets, this kind of situation would trigger a fall in the relative price of current goods (i.e., the real interest rate), thus encouraging other people (e.g., the people who own the debt of the heavily indebted people) to shift expenditures away from future goods and toward present goods. In this way, the price mechanism minimizes what would otherwise be a waste of the resources available for current production. The aggregate demand failure view holds that, for various reasons, the fall in the real interest rate just described is prevented from occurring. To see why, consider the real rate of interest

$$\frac{R_t}{\pi_{t+1}^e}$$

where R_t denotes the gross nominal rate of interest and π_{t+1}^e denotes the public's expectation of inflation. In the United States and other countries, the nominal rate of interest is near its lower bound of unity. At the same time, π_{t+1}^e does not rise, presumably because of the credibility of central banks' commitment to low inflation. According to the aggregate demand failure view of the current slump, the inability of the real rate of interest to fall sufficiently is the cause of the low current rate of utilization of capital and labor.

Various policies have been proposed for addressing the problem of low aggregate demand. One set of policies would use various types of taxes to stimulate spending (see, e.g., Correia et al. 2010). Another set of policies would directly boost aggregate demand by increasing government spend-

ing (see, e.g., Christiano, Eichenbaum, and Rebelo 2011; Eggertsson 2011). Those who argue for government spending note that low utilization of resources suggests the benefits, net of the social cost, of additional spending is high. For example, unemployed teachers could be working to raise the human capital of children. Layed-off construction workers could be doing much-needed repairs to the crumbling US infrastructure. Proponents of government spending also note that financial markets are willing to lend funds to the US Federal government at virtually zero interest.

A key question in evaluating government spending as a way to help get us out of the current slump, is how much will it boost output? If for every bridge the government repairs, a factory somewhere else goes unbuilt, then it is not so obvious that government spending is desirable. A rise in government spending could in principle even have a negative effect on output if it creates large enough tax distortions, either through standard deadweight loss effects or by creating a climate of uncertainty.[1]

These considerations are what motivate interest in the size of the government spending multiplier, the ratio of the increase in output divided by the increase in government spending. The objective of this chapter is to shed light on the government spending multiplier using data and a minimum of economic assumptions. Of course, in this endeavor it is important that the evidence be drawn from circumstances that resemble our current situation. That is, we are interested in the effects of an increase in government spending that (a) must presumably be financed eventually, but not by an immediate rise in taxes; (b) is most likely temporary; and (c) is unlikely to be accompanied by a rise in the nominal rate of interest, since the zero bound on that rate appears to be very binding.

Time Series Evidence

The amount of relevant information in the time series about the government spending multiplier appears to be limited. Consider, for example, the vector autoregression (VAR) study in Valerie Ramey's contribution to this volume (chapter 1). The three panels in figure 3C.1 display the implications of her "News EVAR" for the government spending multiplier. For the purpose of these calculations, I define this multiplier as follows:

$$\text{multiplier} = \frac{\sum_{j=0}^{\infty}[1/(1+\text{r})]^{j}\overline{Y}_{t+j}}{[1/(1+\text{r})]^{j}\overline{G}_{t+j}}.$$

Here, $\overline{Y}_t$ and $\overline{G}_t$ denote the responses in GDP and government spending, respectively, to a government spending news shock. Also, the real interest rate, r, was set to 3.6 percent, at an annual rate.

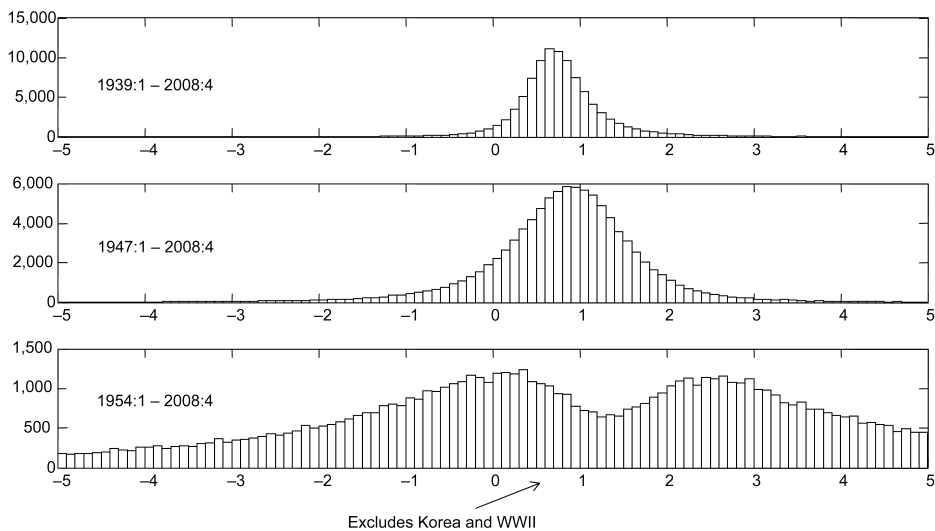1. See Baker, Bloom, and Davis (2011).

Fig. 3C.1   Posterior distribution of government spending multiplier implied by Ramey VAR

The calculations in figure 3C.1 were performed as follows. The vector of variables, y_t, in the VAR (kindly provided by Valerie Ramey) is defined as follows:

$$y_t = \left[\frac{PV_t}{\text{GDP}_{t-1}} \log G_t \ \log(\text{GDP}_t - G_t) R_t \ \text{average marginal tax rate} \right]'.$$

Here, G_t denotes Federal, state, and local government purchases of goods and services, GDP_t denotes real gross domestic product in quarter t, R_t denotes the three-month Treasury bill rate, and the last variable is an estimate of the average marginal tax rate constructed by Barro and Redlick (2011). The variable PV_t is Ramey's measure of the present discounted value of government spending. Following Ramey, the VAR includes a constant, four lags of y_t, and a quadratic time trend. I compute the innovation to PV_t / GDP_{t-1} (the "news shock"), applying the approach in Ramey's "News EVAR" specification.[2] The posterior distribution of the multiplier using several sample periods is reported in figure 3C.1.[3] The top panel in figure

2. The average value of the private spending to government spending ratio, $(\text{GDP}_t - G_t) / G_t$, in the data set is 3.76. Then, $\bar{Y}_t = 3.76 \times \hat{y}_{3,t} + \hat{y}_{2,t}$ and $\bar{G}_t = \hat{y}_{2,t}$, $y_t = [y_{1,t}, y_{2,t}, y_{3,t}, y_{4,t}, y_{5,t}]$, and a hat over a variable indicates its impulse response to the news shock.

3. The posterior distribution was computed using the Markov chain Monte Carlo (MCMC) algorithm. The results in figure 3C.1 make use of a flat prior on the VAR parameters. The computations were also performed with a "Minnesota prior" and the results were virtually the same. Let θ denote the vector of VAR parameters. Corresponding to each MCMC draw of θ, impulse responses in $(\bar{Y}_t, \bar{G}_t)$ to a news shock were computed and these were used to compute
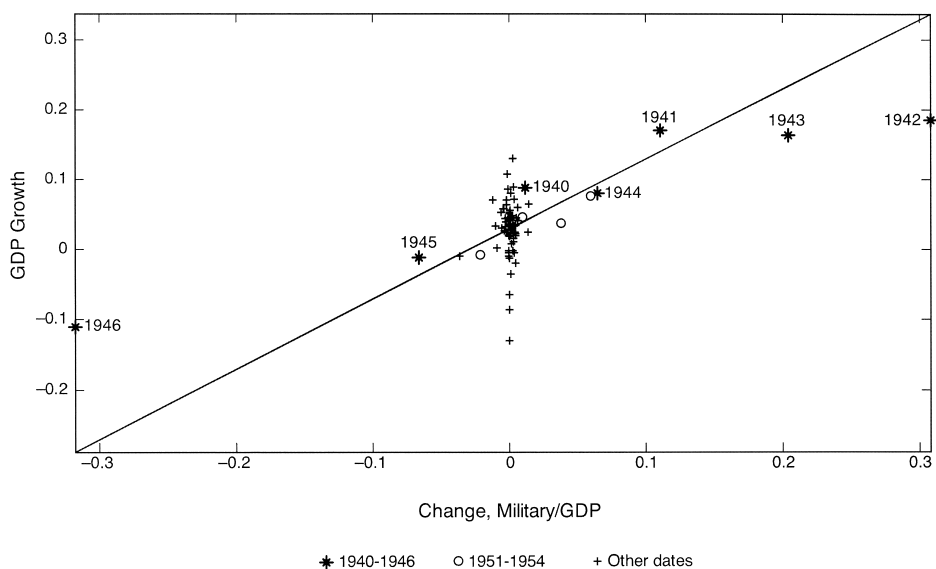
Fig. 3C.2   Hall's evidence on the multiplier

3C.1 displays the posterior distribution when the whole sample of data is used. The mode is below unity, and the distribution is moderately spread out. The middle distribution excludes the World War II period—note how the posterior distribution fans out substantially more. Finally, the distribution in the bottom panel drops both during the World War II and Korean episodes. Note that now the data are essentially completely uninformative about the multiplier. I conclude that the only information about the multiplier comes from the Korea and World War II episodes.[4]

My next time series evidence uses the methodology and annual data covering 1930 to 2008 used by Hall in his comment to chapter 2 in this volume.[5] The data are the annual change in military spending and the annual change in real GDP, each divided by lagged GDP. Let the military spending variable be denoted m_t and let GDP growth be denoted by y_t. The scatter plot of m_t and y_t is displayed in figure 3C.2. As a benchmark, I also display the curve, $y_t = a + m_t$, where a is the sample mean of y_t minus the sample mean of m_t. The data in figure 3C.2 are differentiated according to whether they belong to the World War II period, the period of the Korean War, or other periods.

the multiplier defined in the text (the infinite sum was truncated at horizon 500). A large number of θ's were drawn using the MCMC algorithm and the multiplier was computed in each case. Figure 3C.1 displays the resulting histogram of the multiplier.

4. A version of figure 3C.1 was computed using Ramey's "Blanchard-Perotti SVAR" approach, with similar results.

5. These were kindlly provided by Hall in an Excel file with the name, "Fig weights, Tables VARs and regs."

Table 3C.1   **Least squares regression estimates of $y_t = a + bm_t$**

$y_t \sim$ GDP growth, $m_t \sim$ (military spending$_t$ – military spending$_{t-1}$)/GDP$_{t-1}$		
Sample period	a	b
Nonwar period	0.03	0.45
World War II	0.06	0.51
Korean War	0.02	0.90
Whole sample, 1930–2008	0.03	0.55

Note first that there is very little variation in military spending outside of the two war periods (see the observations indicated by a "+"). With so little variation, we do not expect to be able to get a precise measure of the multiplier, dy_t/dm_t, from these observations. Still, the least squares line computed using these data implies a very small multiplier, 0.45 (see table 3C.1). The observations indicated by circles in figure 3C.2 correspond to the Korean War. There is notably more variation in m_t during the Korean war period. Those observations generally lie along a line that is flatter than the 45 degree line, so those data suggest the multiplier is below unity. According to table 3C.1, the least squares estimate of the multiplier is 0.90. Finally, the greatest degree of variation in m_t is exhibited by the World War II data. Those observations lie along a line noticeably flatter than the benchmark curve. This is why, according to table 3C.1, the least squares estimate of the multiplier for that period is so small, 0.51.

The evidence in figure 3C.1 is consistent with the implications of the Ramey VAR analysis. Most of the information about the multiplier in the time series comes from World War II and the Korean War. Moreover, they do not provide much support for the notion that the multiplier is much larger than unity.

But is the evidence on the government spending multiplier from the two wars relevant to the current situation? Part of the answer can be seen in figure 3C.3. The top panel displays the Barro and Redlick (2011) tax data. Note that in both World War II and the Korean War, there was a sharp rise in taxes. Thus, those episodes do not share characteristic (a) in the current situation, that the rise in government spending is not likely to be accompanied by a rise in taxes right away. The top panel displays Hall's data on the log of real defense spending. Note that the expansion in military spending in the Korean War turned out to be essentially permanent. To the extent that people had a sense of this in real time—perhaps they interpreted Korea as the first battle in a long (mostly) cold war—they would have viewed the rise in military spending as being persistent. In this respect, the Korean War episode does not satisfy our characteristic (b) that it be temporary.[6] Finally,

6. It is not clear what the direction of bias might be. The impact of the persistence of government spending shocks on the spending multiplier is not robust across dynamic economic
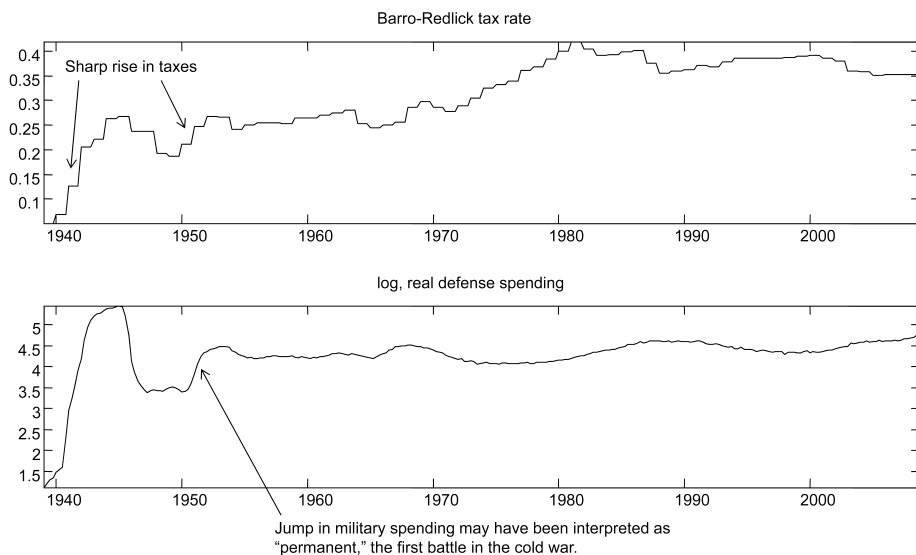
Barro-Redlick tax rate

log, real defense spending

Jump in military spending may have been interpreted as
"permanent," the first battle in the cold war.

Fig. 3C.3   Government spending and tax data

rationing during World War II greatly biases estimates of the multiplier based on that period. Arithmetic requires that for the multiplier to be big, private spending must increase. But under rationing this possibility is ruled out by law. For these reasons, the US time series data beginning with World War II appear to have little information about the government spending multiplier that is relevant to the current situation.

Interestingly, Gordon and Krenn (2010) argue that the two years right before the entry of the United States into World War II do provide information about the government spending multiplier that is relevant to present circumstances. Military spending began to rise sharply "starting in June 1940, fully 18 months before Pearl Harbor" (Gordon and Krenn abstract). They note that the interest rate was roughly constant during that period, so that is it consistent with (c). Also, there was no rationing at that time and there was considerable slack in the economy, as there has been in the US economy in recent years. Gordon and Krenn (2010) argue that the quarterly data on this period warrant the conclusion that the multiplier is as high as 2.5. This is an important observation. Still, given the short sample on which it is based, it is important to find additional corroborating evidence.

models. According to a real business cycle model, the more persistent is the rise in government spending the greater is the government spending multiplier. This reflects the negative wealth effect of government spending on labor supply. The New Keynesian model deemphasizes labor supply. As a result, the more persistent is a government spending shock in that model, the smaller is the multiplier. This reflects the negative wealth effect on consumption. See Christiano, Eichenbaum, and Rebelo (2011) for further discussion.

Observations on the Chapter

The preceding observations make clear why the topic of this chapter is important. My brief summary of the time series evidence suggests that additional sources of information about the multiplier are needed. Exploiting one such source of information is the stated objective of this chapter.

The authors study the household consumption and labor supply response to a government spending shock. Identification proceeds as in Nakamura and Steinsson (2011). When government spending increases, its distribution across states in the United States is not completely predictable. States that receive an unexpectedly high share of government spending experience a positive spending shock and states that receive an unexpectedly low share of government spending receive a negative spending shock. Because of the richness of the authors' data set, they can identify how different types of households in a state respond to a state government spending shock and how their responses might vary over the business cycle. This type of information is of great interest for understanding how people respond to shocks.

As the authors themselves emphasize, it is not so clear whether the analysis sheds light specifically on the government spending multiplier, as discussed in the first section. For example, the positive spending shock received by a state under the authors' identification generates virtually no need for additional future taxes. The reason is that if one dollar of additional government spending finds its way into a particular state, the extra taxes to finance that extra dollar are paid by all states. As a result, one of the objectives of the research appears not to be infeasible. It is not possible to use the authors' analysis to determine whether the transmission mechanism for government spending implied by the IS/LM model corresponds better with the data than the mechanism implied by intertemporal models like the real business cycle model. A key difference between these models is that households in the former ignore future taxes, while households in the latter fully internalize them.

Perhaps a better way to think of the analysis in the chapter is to think of the states of the United States as separate, small open economies.[7] In effect, a rise in government spending in a particular state is equivalent to a rise in that state's exports. When a country experiences a rise in export demand, there is no sense in which the citizens expect to pay higher taxes in the future to finance those exports. Thinking of the analysis as shedding light on the effects of an export shock may also clarify some results that at first seem puzzling. For example, the authors find that low-income households respond to a rise in government spending shocks by working longer hours and consuming less. High-income households respond by consum-

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7. This is an interpretation of this type of analysis stressed in Nakamura and Steinsson (2011).

ing more. Pursuing the small open economy idea, imagine that each state is a small open economy with a traded good and a nontraded good sector. Suppose that a state experiences a rise in government spending in the form of increased government purchases from the state's higher-income people. Suppose also that this increases the rent those people earn on their human and physical capital. Because the increased government spending raises their wealth, the higher-income people respond by purchasing more consumption goods, including nontradable consumption goods. This raises the price of nontradable consumption goods and, in effect, acts as a tax on the low-income people. This negative wealth effect suffered by poor people causes them to work harder and consume less.

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