When is the Government Spending Multiplier Large?

Lawrence Christiano, Martin Eichenbaum and Sergio Rebelo

Discussant: Todd B. Walker
Indiana University

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Macroeconomists remain quite uncertain about the quantitative effects of fiscal policy. This uncertainty derives not only from the usual errors in empirical estimation but also from different views on the proper theoretical framework and econometric methodology. Therefore, robustness is a crucial criterion in policy evaluation. Robustness requires evaluating policies using other empirically-estimated and tested macroeconomic models. From this perspective Figure 1 is a concern because it shows that the Romer-Bernstein estimates apparently fail a simple robustness test, being far different from existing published results of another model. For these reasons an examination of the Romer-Bernstein results is in order.

Figure 1: Estimated Impact on GDP of Increase in Government Purchases of 1 Percent of GDP
When Is the Government Spending Multiplier Large?

1. Model Structure
2. Preferences
3. Interaction between fiscal and monetary policy
4. Dynamics and expectations
5. Fiscal financing

Abstract: When the zero bound on nominal interest rates is binding.
When is the Government Spending Multiplier Large?

1. Model Structure
2. Preferences
3. Interaction between fiscal and monetary policy
4. Dynamics and expectations
5. Fiscal financing

“Monetary-Fiscal Policy Interactions, Expectations, and Dynamics in the Current Economic Crisis”
My Comments

1. Government spending process and expectations

2. Existence and uniqueness of equilibria
# ARRA (2009)

<table>
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<tr>
<td><strong>Estimated Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Authorization</td>
<td>379.0</td>
<td>114.7</td>
<td>53.6</td>
<td>11.2</td>
<td>9.8</td>
<td>16.2</td>
<td>580.7</td>
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<td>Outlays</td>
<td>120.1</td>
<td>219.3</td>
<td>126.2</td>
<td>46.2</td>
<td>30.3</td>
<td>27.9</td>
<td>575.3</td>
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<tr>
<td><strong>Infrastructure</strong></td>
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<tr>
<td>Authorization</td>
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<tr>
<td>Outlays</td>
<td>2.75</td>
<td>6.875</td>
<td>5.5</td>
<td>4.125</td>
<td>3.025</td>
<td>2.75</td>
<td>27.5</td>
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*Billions of Dollars*

Source: CBO
Typically assume

\[ g_t = \rho g_{t-1} + \varepsilon_t \]  

(1)

Slight change

\[ g_t = \rho g_{t-1} + \varepsilon_{t-1} \]  

(2)

If agents observe \( \{\varepsilon_{t-j}\}_{j=0}^{\infty} \) then agents have foresight about future \( g \) [Ramey (2008), Leeper, Walker, Yang (2009)]

Important Expectational Effects: knowledge of \( \varepsilon_t \) is equivalent to knowledge of \( g_{t+1} \)
EXPECTATIONS

Simple Model

\[ \pi_t = \beta E_t \pi_{t+1} + \Gamma_1 Y_t - \Gamma_2 G_t \]
\[ Y_t = \Theta_1 (G_t - E_t G_{t+1}) + E_t Y_{t+1} + \Theta_2 E_t \pi_{t+1} - \Theta_2 \{\phi_1 \pi_t + \phi_2 Y_t\} \]

↑ in \( G_t \) → ↑ \( t \) Total Demand → ↓ Markup\(_t\) → ↑ \( N_t \) → ↑ \( C_t \)

\[ \frac{dY_t}{dG_t} = \frac{1}{g} \frac{\hat{Y}_t}{\hat{G}_t} = 1 + \frac{1 - g}{g} \frac{\hat{C}_t}{\hat{G}_t} \]

(3)

Anticipated ↑ in \( G_{t+1} \) → ↑ \( t + 1 \) Total Demand → ↓ Markup\(_{t+1}\)

→ ↑ \( N_{t+1} \) → ↑ \( C_{t+1} \)
**FIGURE 2:** Impulse response of 1 unit increase in $G$ (No Anticipation)

$G_t = \rho G_{t-1} + \varepsilon_t$
**Figure 3:** Impulse response of 1 unit increase in $G$ (Anticipation)

$G_t = \rho G_{t-1} + \varepsilon_{t-1}$
IMPULSE RESPONSE III

Figure 4: Impulse response of 1 unit increase in $G$ (Anticipation)

$G_t = \rho G_{t-1} + \theta_0 \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \theta_3 \varepsilon_{t-3} + \theta_4 \varepsilon_{t-4}$
### Present Value Multiplier

\[
PVMultiplier(Q) = \frac{E_t \sum_{j=0}^{Q} \prod_{i=0}^{j} (1 + r_{t+i})^{-j} \Delta Y_{t+Q}}{E_t \sum_{j=0}^{Q} \prod_{i=0}^{j} (1 + r_{t+i})^{-j} \Delta G_{t+Q}}
\]

<table>
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<tr>
<th>(Q)</th>
<th>2</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
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<td>No Gov Foresight* (AR(1))</td>
<td>1.12</td>
<td>1.12</td>
<td>1.12</td>
<td>1.12</td>
<td>1.12</td>
</tr>
<tr>
<td>Gov Foresight (ARMA)</td>
<td>0.09</td>
<td>0.78</td>
<td>1.02</td>
<td>1.05</td>
<td>1.06</td>
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* Differs from CER (1.05) because \(\beta = \theta_1^{-1} = 0.99\)
**Zero Bound**

**Experiment**

\[
\pi_t = \beta(s_t)E_t\pi_{t+1} + \Gamma_1 Y_t - \Gamma_2 G_t
\]

\[
Y_t = \Theta_1(G_t - E_tG_{t+1}) + E_tY_{t+1} + \Theta_2 E_t\pi_{t+1} - \Theta_2\{\phi_1(s_t)\pi_t + \phi_2 Y_t\}
\]

Two states: Normal Model (NM), Zero Bound (ZB)

\[\rightarrow \{\beta^l > 1, \phi_1^l = 0\}\]

Markov Switching Determines State

\[
Pr(ZB_{t+1}|ZB_t) = p_{11}, \quad Pr(NM_{t+1}|ZB_t) = 1 - p_{11},
\]

\[
Pr(NM_{t+1}|NM_t) = p_{22}, \quad Pr(ZB_{t+1}|NM_t) = 1 - p_{22}
\]
**Zero Bound**

Markov Switching Determines State (Assumptions)

\[
Pr(ZB_{t+1}|ZB_t) = 0.8, \quad Pr(NM_{t+1}|ZB_t) = 0.2, \\
Pr(NM_{t+1}|NM_t) = 1, \quad Pr(ZB_{t+1}|NM_t) = 0
\]

Initial Probability \([ZB_0 = 1, NM_0 = 0]\)

To solve model, CER assume equilibrium characterized by two values for each variable and solve two separate systems.

Existence and uniqueness of equilibrium


**Figure 3:** Now that’s a multiplier!

**Figure 5:** Output multiplier with binding zero bound
DETERMINACY WITH A ZERO BOUND

$$\pi_t = \beta(s_t)E_t\pi_{t+1} + \Gamma_1 Y_t - \Gamma_2 G_t$$

$$Y_t = \Theta_1(G_t - E_tG_{t+1}) + E_tY_{t+1} + \Theta_2 E_t\pi_{t+1} - \Theta_2\{\phi_1(s_t)\pi_t + \phi_2 Y_t\}$$

Davig & Leeper (2007) like CER posit two processes for each variable

$$E[\pi_{t+1}|s_t = ZB] = p_{11}E[\pi_{1t}] + p_{12}E[\pi_{2t}]$$

Cannot stay in zero bound state too long.
**Determinacy with a Zero Bound**

“Stacked System”

\[
egin{bmatrix}
1 & 0 & -\Gamma_1 & 0 \\
0 & 1 & 0 & -\Gamma_1 \\
\Theta_2 \phi_1 & 0 & (1 + \Theta_2 \phi_2) & 0 \\
0 & \Theta_2 \phi_1 & 0 & (1 + \Theta_2 \phi_2)
\end{bmatrix}
\begin{bmatrix}
\pi_{1t} \\
\pi_{2t} \\
Y_{1t} \\
Y_{2t}
\end{bmatrix}
= 
\begin{bmatrix}
\beta l p_{11} & \beta l p_{12} & 0 & 0 \\
0 & \beta p_{12} & \beta p_{22} & 0 \\
\Theta_2 p_{11} & \Theta_2 p_{21} & p_{11} & p_{21} \\
\Theta_2 p_{21} & \Theta_2 p_{22} & p_{21} & p_{22}
\end{bmatrix}
\begin{bmatrix}
\pi_{1t+1} \\
\pi_{2t+1} \\
Y_{1t+1} \\
Y_{2t+1}
\end{bmatrix}
+ 
\begin{bmatrix}
-\Gamma_2 & 0 & 0 & 0 \\
0 & -\Gamma_2 & 0 & 0 \\
\Theta_1 & 0 & -\Theta_1 p_{11} & -\Theta_1 p_{12} \\
0 & \Theta_1 & -\Theta_1 p_{21} & -\Theta_1 p_{22}
\end{bmatrix}
\begin{bmatrix}
G_{1t+1} \\
G_{2t+1} \\
E_t G_{1t+1} \\
E_t G_{2t+1}
\end{bmatrix}
\]

\[AX_t = BE_t X_{t+1} + CG_t\]  \hspace{1cm} (4)

Existence and Uniqueness = Generalized Eigenvalues of \((A, B)\)
DETERMINACY REGIONS

\[ p_{11}, \kappa \]

**Figure 6:** Determinacy Regions in \((p_{11}, \kappa)\) space
Figure 7: Output multiplier with binding zero bound
1. Nice paper that demonstrates when zero bound binds, fiscal multipliers can be big.

2. Critiques Extend to Model with K