Dynamics of Fiscal Financing in the United States

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Recent run-ups in government debt have placed increased importance on fiscal financing issues.
This Paper

- **Objective:** Examine source and timing of fiscal financing in estimated in post-war U.S.

- **Model:** Medium scale DSGE model without nominal rigidities

- **Method:** Bayesian estimation
Findings

- Assumptions about which fiscal instruments adjust to stabilize debt have nontrivial effects.
- Speed at which debt is stabilized is crucial for the effects of a shock on the economy.
- Short-run impacts can differ sharply from long-run effects, even being of different signs.
Connections to Previous Works

- Identified VARs

- Bayesian DSGE Estimation
Estimated Model’s Features

- RBC Model consisting of households, firms, and a government
  - Intertemporal investment adjustment costs
  - Variable capacity utilization
  - External habit formation
  - 34 parameters estimated; 21 fiscal parameters
  - 9 transitory shocks
\[ E_t \sum_{t=0}^{\infty} \beta^t u_t^b \left[ \frac{1}{1-\gamma} (c_t - hC_{t-1})^{1-\gamma} - u_t^l \frac{l_t^{1+\kappa}}{1 + \kappa} \right] \]

subject to

\[(1+\tau^c_t)c_t + i_t + b_t = (1-\tau^l_t)w_t l_t + (1-\tau^k_t)R_t^k v_t k_{t-1} + R_{t-1} b_{t-1} + z_t \]

\[k_t = (1 - \delta(v_t))k_{t-1} + \left[ 1 - s \left( \frac{u_t^j i_t}{i_{t-1}} \right) \right] i_t\]
Maximize profits:

$$u_t^a (v_t k_{t-1})^\alpha / l_t^{1-\alpha} - w_t l_t - R_t^k v_t k_{t-1}$$

- Technology
- Labor costs
- Capital costs
Fiscal Policy

Government Budget Constraint:

\[ B_t + \tau_t^k R_t^k v_t k_{t-1} + \tau_t^l w_t L_t + \tau_t^c C_t = R_{t-1} B_{t-1} + G_t + Z_t \]
\[
\hat{Z}_t = -\varphi Z \hat{Y}_t - \gamma Z \hat{B}_{t-1} + u^Z_t
\]

“automatic stabilizer” debt response exogenous policy

\[
\hat{G}_t = -\varphi_g \hat{Y}_t - \gamma_g \hat{B}_{t-1} + u^g_t
\]

\[
\hat{r}^k_t = \varphi_k \hat{Y}_t + \gamma_k \hat{B}_{t-1} + \phi_{kl} u^l_t + \phi_{kc} u^c_t + u^k_t
\]

“tax comovements”

\[
\hat{r}^l_t = \varphi_l \hat{Y}_t + \gamma_l \hat{B}_{t-1} + \phi_{kl} u^k_t + \phi_{lc} u^c_t + u^l_t
\]

\[
\hat{r}^c_t = \phi_{kc} u^k_t + \phi_{lc} u^l_t + u^c_t
\]

completely exogenous
Fiscal Policy Rules

\[
\begin{align*}
\hat{Z}_t &= -\varphi Z \hat{Y}_t - \gamma Z \hat{B}_{t-1} + u_t^Z \\
&\text{“automatic stabilizer” debt response exogenous policy}
\end{align*}
\]

\[
\hat{G}_t = -\varphi_g \hat{Y}_t - \gamma_g \hat{B}_{t-1} + u_t^g
\]

\[
\begin{align*}
\hat{r}_t^k &= \varphi_k \hat{Y}_t + \gamma_k \hat{B}_{t-1} + \phi_{kl} u_t^l + \phi_{kc} u_t^c + u_t^k \\
&\text{“tax comovements”}
\end{align*}
\]

\[
\begin{align*}
\hat{r}_t^l &= \varphi_l \hat{Y}_t + \gamma_l \hat{B}_{t-1} + \phi_{kl} u_t^k + \phi_{lc} u_t^c + u_t^l
\end{align*}
\]

\[
\hat{r}_t^c = \phi_{kc} u_t^k + \phi_{lc} u_t^l + u_t^c
\]

completely exogenous
Fiscal Policy Rules

\[ \hat{Z}_t = \underbrace{-\varphi_Z \hat{Y}_t}_{\text{“automatic stabilizer”}} - \underbrace{\gamma_Z \hat{B}_{t-1}}_{\text{debt response}} + \underbrace{u_t^Z}_{\text{exogenous policy}} \]

\[ \hat{G}_t = -\varphi_g \hat{Y}_t - \gamma_g \hat{B}_{t-1} + u_t^g \]

\[ \hat{\tau}_t^k = \varphi_k \hat{Y}_t + \gamma_k \hat{B}_{t-1} + \underbrace{\phi_{kl} u_t^l + \phi_{kc} u_t^c + u_t^k}_{\text{“tax comovements”}} \]

\[ \hat{\tau}_t^l = \varphi_l \hat{Y}_t + \gamma_l \hat{B}_{t-1} + \phi_{kl} u_t^k + \phi_{lc} u_t^c + u_t^l \]

\[ \hat{\tau}_t^c = \phi_{kc} u_t^k + \phi_{lc} u_t^l + u_t^c \] completely exogenous
Fiscal Policy Rules

\[ \hat{Z}_t = -\varphi Z \hat{Y}_t - \gamma Z \hat{B}_{t-1} + u^Z_t \]

“automatic stabilizer” debt response exogenous policy

\[ \hat{G}_t = -\varphi_g \hat{Y}_t - \gamma_g \hat{B}_{t-1} + u^g_t \]

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“tax comovements”

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\[ \hat{\tau}_t^c = \phi_{kc} u^k_t + \phi_{lc} u^l_t + u^c_t \]

completely exogenous
Estimate four models by varying debt response

- Benchmark model - only lump-sum transfers adjust to debt
- Only government spending adjusts
- Only capital and labor taxes adjust
- All four fiscal instruments adjust to debt
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- Only capital and labor taxes adjust
- All four fiscal instruments adjust to debt

Observables: real consumption, investment, government spending, government debt, capital tax revenues, labor tax revenues, consumption tax revenues, government transfers, and hours worked

Log of variables and remove linear trend.
<table>
<thead>
<tr>
<th></th>
<th>log marginal</th>
<th>Bayes Factor</th>
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</thead>
<tbody>
<tr>
<td>all instruments adjust</td>
<td>-68</td>
<td>1.0</td>
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<tr>
<td>transfers adjust</td>
<td>-75</td>
<td>exp[7]</td>
</tr>
<tr>
<td>gov. spending adjusts</td>
<td>-97</td>
<td>exp[29]</td>
</tr>
<tr>
<td>taxes adjust</td>
<td>-102</td>
<td>exp[34]</td>
</tr>
</tbody>
</table>

- **Strong preference for more complex model.**
\[ \hat{Z}_t = -0.13\hat{Y}_t - 0.5\hat{B}_{t-1} + u^Z_t \]

\[ \hat{G}_t = -0.034\hat{Y}_t - 0.23\hat{B}_{t-1} + u^g_t \]

\[ \hat{\tau}^k_t = 1.7\hat{Y}_t + 0.39\hat{B}_{t-1} + 0.19u^l_t + 0.024u^c_t + u^k_t \]

\[ \hat{\tau}^l_t = 0.36\hat{Y}_t + 0.049\hat{B}_{t-1} + 0.19u^k_t - 0.028u^c_t + u^l_t \]

\[ \hat{\tau}^c_t = 0.024u^k_t - 0.028u^l_t + u^c_t \]
Exogenous Increase to Gov. Spending

- Output Response
  - Taxes Adjust
  - All Instruments Adjust

- Consumption Response
  - Taxes Adjust
  - All Instruments Adjust

- Investment Response
  - Taxes Adjust
  - All Instruments Adjust
Exogenous Increase to Labor Taxes
Following Mountford and Uhlig (2009), calculate present value multiplier at horizon $k$

$$
\text{Present Value Multiplier}(k) = \frac{E_t \sum_{j=0}^{k} \left( \prod_{i=0}^{j} R_{t+i}^{-1} \right) \Delta Y_{t+j}}{E_t \sum_{j=0}^{k} \left( \prod_{i=0}^{j} R_{t+i}^{-1} \right) \Delta G_{t+j}}
$$
<table>
<thead>
<tr>
<th>Variable</th>
<th>1 quarter</th>
<th>5 quarters</th>
<th>10 quarters</th>
<th>25 quarters</th>
<th>$\infty$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{PV(\Delta Y)}{PV(\Delta G)}$</td>
<td>0.64</td>
<td>0.43</td>
<td>0.33</td>
<td>0.2</td>
<td>0.03</td>
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<tr>
<td>Capital and Labor Taxes Adjust</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{PV(\Delta Y)}{PV(\Delta G)}$</td>
<td>0.59</td>
<td>0.32</td>
<td>0.14</td>
<td>-0.21</td>
<td>-0.99</td>
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</tbody>
</table>
### Present-Value Multipliers Following Capital Tax Increase

<table>
<thead>
<tr>
<th>Variable</th>
<th>1 quarter</th>
<th>5 quarters</th>
<th>10 quarters</th>
<th>25 quarters</th>
<th>∞</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{PV(\Delta Y)}{PV(\Delta T^k)}$</td>
<td>-0.18</td>
<td>-0.26</td>
<td>-0.33</td>
<td>-0.5</td>
<td>-0.72</td>
</tr>
<tr>
<td><strong>All Instruments Adjust</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{PV(\Delta Y)}{PV(\Delta T^k)}$</td>
<td>-0.14</td>
<td>-0.2</td>
<td>-0.18</td>
<td>0.42</td>
<td>-3.7</td>
</tr>
<tr>
<td><strong>Capital and Labor Taxes Adjust</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Present-Value Multipliers Following Labor Tax Increase

<table>
<thead>
<tr>
<th>Variable</th>
<th>1 quarter</th>
<th>5 quarters</th>
<th>10 quarters</th>
<th>25 quarters</th>
<th>∞</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{PV(\Delta Y)}{PV(\Delta T')} \quad$ All Instruments Adjust</td>
<td>-0.19</td>
<td>-0.19</td>
<td>-0.19</td>
<td>-0.19</td>
<td>-0.21</td>
</tr>
<tr>
<td>$\frac{PV(\Delta Y)}{PV(\Delta T')} \quad$ Capital and Labor Taxes Adjust</td>
<td>-0.14</td>
<td>-0.12</td>
<td>-0.04</td>
<td>0.22</td>
<td>0.92</td>
</tr>
</tbody>
</table>
Present-Value Multipliers

PV $\tau^l$ Multipliers: $G$ Adjusts

PV $\tau^k$ Multipliers: $G$ Adjusts

PV $\tau^l$ Multipliers: $\tau^k$ Adjusts

PV $\tau^k$ Multipliers: $\tau^l$ Adjusts
• Assumptions about which fiscal instruments adjust to stabilize debt have nontrivial effects.

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• Speed at which debt is stabilized is crucial for the effects of a shock on the economy.