Lecture 5
Chapter 9

• Government budgets – updated from text
• Multiplier model with government and net taxes exogenous
• Multiplier model with government and net taxes endogenous
• Government spending multipliers ($G$ and $TR$)
• Tax multiplier ($t$)
• Balanced budget amendment
NOTATION

- $Y$ output or income
- $C$ consumption
- $I$ investment
- $G$ government purchases of goods and services
- $TR$ government spending on transfer payments (a negative tax)
- $t$ tax rate
- $TAX$ taxes
- $T$ net taxes ($TAX - TR$)
- $Y_d$ disposable income ($Y - T$)
MULTIPLIER MODEL, T EXOGENOUS

• \( Y_d \equiv Y - T \)  Definition
• \( C = a + bY_d \)  Behavioral
• \( Y = C + I + G \)  Equilibrium condition

SOLUTION

\[
Y = C + I + G \\
= a - bT + bY + I + G \\
= \frac{1}{1-b}(a - bT + I + G) \\
= \frac{a}{1-b} - \frac{b}{1-b}T + \frac{1}{1-b}(I + G) \quad \text{Reduced form equation}
\]

\[
\frac{\Delta Y}{\Delta G} = \frac{1}{1-b} = \frac{1}{1-\text{MPC}} = \frac{1}{1-.75} = 4
\]

\[
\frac{\Delta Y}{\Delta T} = \frac{-b}{1-b} = \frac{-\text{MPC}}{1-\text{MPC}} = \frac{-.75}{1-.75} = -3
\]
BALANCED BUDGET MULTIPLIER  
(ONLY WHEN T IS EXOGENOUS)

If $\Delta G = 10$ and $\Delta T = 10$, then:

$$\Delta Y = \frac{10}{1-b} - \frac{10b}{1-b} = 10\left(\frac{1-b}{1-b}\right) = 10$$

So

$$\frac{\Delta Y}{\Delta G} = 1$$
MULTIPLIER MODEL, T ENDOGENOUS

• \(Y_d \equiv Y - T\)  Definition
• \(C = a + bY_d\)  Behavioral
• \(Y = C + I + G\)  Equilibrium condition
• \(TAX = tY\)  Behavioral
• \(T \equiv TAX - TR\)  Definition

SOLUTION

\[ Y = C + I + G \]
\[ = a + b(Y - tY + TR) + I + G \]
\[ = \frac{a}{1-b+bt} + \frac{b}{1-b+bt}TR + \frac{1}{1-b+bt}(I + G) \]
Reduced form equation

If \(b = .75\) and \(t = \frac{1}{3}\), then \(\frac{1}{1-.75+.25} = 2\)
and \(\frac{.75}{1-.75+.25} = 1.5\)
MULTIPLIER MODEL, T ENDOGENOUS, BALANCED BUDGET AMENDMENT

• $Y_d \equiv Y - T$  Definition
• $C = a + bY_d$  Behavioral
• $Y = C + I + G$  Equilibrium condition
• $TAX = tY$  Behavioral
• $T \equiv TAX - TR$  Definition
• $G = T$  Behavioral

SOLUTION

\[
Y = C + I + G \\
= a + b(Y - tY + TR) + I + tY - TR \\
= \frac{a}{1-b+bt-t} + \frac{b}{1-b+bt-t}TR + \frac{1}{1-b+bt-t}(I - TR)  \quad \text{Reduced form equation}
\]

If $b = .75$ and $t = \frac{1}{3}$, then $\frac{1}{1-.75+.25-.33} = 5.9$
### GDP in 2016 = 18,625

<table>
<thead>
<tr>
<th>Expenditures</th>
<th>Federal 2016</th>
<th>State &amp; Local 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>965</td>
<td>1,694</td>
</tr>
<tr>
<td>TR</td>
<td>3,093</td>
<td>693</td>
</tr>
<tr>
<td>GIA</td>
<td>556</td>
<td>-</td>
</tr>
<tr>
<td>Interest</td>
<td>475</td>
<td>197</td>
</tr>
<tr>
<td>Other</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4,149</strong></td>
<td><strong>2,584</strong></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Receipts</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal tax</td>
<td>1,541</td>
<td>420</td>
</tr>
<tr>
<td>Corporate tax</td>
<td>401</td>
<td>58</td>
</tr>
<tr>
<td>Saleed property d other tax</td>
<td>370</td>
<td>5363</td>
</tr>
<tr>
<td>Social Security tax</td>
<td>1,230</td>
<td>20</td>
</tr>
<tr>
<td>GIA</td>
<td>-</td>
<td>556</td>
</tr>
<tr>
<td><strong>Deficit (-)</strong></td>
<td><strong>3,452</strong></td>
<td><strong>2,417</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>-697</strong></td>
<td><strong>-167</strong></td>
</tr>
</tbody>
</table>

**Aggregate tax rate** = \( t = \frac{3,452 + 2,417 - 556}{18,625} = 0.29 \)
CHANGE IN G

- Government increases its purchases of goods and services, \( G \).

- Output (income), \( Y \), increases to meet the added sales.

- Taxes, \( tY \), increase. So does disposable income, \( Y_d \), because \( t \) is less than 1.0.

- Because of the increase in disposable income, consumption, \( C \), increases. This further increases \( Y \), etc. Reduced form equation is needed to see the final solution.
CHANGE IN TR

- Government increases its transfer payments to households, $TR$.
- Disposable income, $Y_d$, increases because transfer payments are part of disposable income.
- Because of the increase in disposable income, consumption, $C$, increases. Consumption increases by $b$ times the change in $TR$, where $b$ is the marginal propensity to consume. The initial increase in demand is thus $b$ times the change in $TR$, not the entire change in $TR$.
- Output (income), $Y$, increases to meet the added sales.
- Taxes, $tY$, increase. Disposable income increases further because $t$ is less than 1.0.
- Because of the further increase in disposable income, consumption increases further. This further increases $Y$, etc. Reduced form equation is needed to see the final solution.
- Note: the initial injection of demand is not the entire change in $TR$, unlike when $G$ is changed, where the entire change in demand is the change in $G$. 