Outline

• Recap: IS-LM equations
• Recap: Solution and multipliers
• What determines policy efficacy?
## Recap: Real Side

<table>
<thead>
<tr>
<th>Eq.No.</th>
<th>Equation</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>(1)</td>
<td>$Y = AD$</td>
<td>Output equals aggregate demand, an equilibrium condition</td>
</tr>
<tr>
<td>(2)</td>
<td>$AD = C + I + G + X$</td>
<td>Definition of aggregate demand</td>
</tr>
<tr>
<td>(3)</td>
<td>$C = a_o + bY_d$</td>
<td>Consumption function, $b$ is the mpc</td>
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<tr>
<td>(4)</td>
<td>$Y_d = Y - T$</td>
<td>Definition of disposable income</td>
</tr>
<tr>
<td>(5)</td>
<td>$T = TA_0 + tY$</td>
<td>Tax function; $TA_0$ is lump sum taxes, $t$ is marginal tax rate.</td>
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<tr>
<td>(6)</td>
<td>$I = e_o - dR$</td>
<td>Investment function <em>(revised)</em></td>
</tr>
<tr>
<td>(7)</td>
<td>$G = GO_0$</td>
<td>Government spending on goods and services, exogenous</td>
</tr>
<tr>
<td>(8)</td>
<td>$X = g_0 - mY - \bar{n}R$</td>
<td>Net Exports <em>(revised)</em></td>
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# Recap: Financial Side

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<thead>
<tr>
<th>Eq.No.</th>
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<td>(14)</td>
<td>$\frac{M^d}{P} = \frac{M^s}{P}$</td>
<td>Equilibrium condition</td>
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<tr>
<td>(15)</td>
<td>$\frac{M^s}{P} = \frac{M_0}{P}$</td>
<td>Money supply</td>
</tr>
<tr>
<td>(16)</td>
<td>$\frac{M^d}{P} = \mu_0 + kY - hR$</td>
<td>Money demand</td>
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Recap: IS-LM equations

(13) \[ R = -\left( \frac{1-b(1-t)+m}{d+\bar{n}} \right) Y + \left( \frac{1}{d+\bar{n}} \right) A_0 \] <IS curve>

(17) \[ R = \left( \frac{\mu_0}{h} \right) - \left( \frac{1}{h} \right) \left( \frac{M_0}{P} \right) + \left( \frac{k}{h} \right) Y \] <LM curve>
Graphical Depiction

Figure 2: Equilibrium in IS-LM
Solving for Equilibrium (I)

One way to solve this system is to substitute is to (17) in for $R$ in (12).

\[(18) \quad Y = \left( \frac{1}{1-b(1-t)+m} \right) \left[ A_0 - (d + \tilde{n}) \left( \frac{\mu_0}{h} - \frac{1}{h} M_0 + \frac{k}{h} Y \right) \right] \]

Notice that this can be solved for $Y$, by bringing the term in the (.) to the left hand side.

\[(19) \quad Y(1-b(1-t)+m) = A_0 - (d + \tilde{n}) \left( \frac{\mu_0}{h} - \frac{1}{h} M_0 \right) - (d + \tilde{n}) \frac{k}{h} Y \]

Collect up the last term on the right hand side involving “$Y$” to the left hand side:

\[(20) \quad Y[1-b(1-t)+m + \frac{(d + \tilde{n})k}{h}] = A_0 + (d + \tilde{n}) \left( \frac{1}{h} M_0 - \frac{\mu_0}{h} \right) \]

Dividing both sides by the term in [.] to obtain:

\[(21) \quad Y = \hat{\alpha} \left[ A_0 + (d + \tilde{n}) \left( \frac{M_0}{P} \right) - (d + \tilde{n}) \frac{\mu_0}{h} \right] \quad <\text{equilibrium income}> \]

Where

\[\hat{\alpha} \equiv \frac{1}{1-b(1-t)+m + \frac{(d + \tilde{n})k}{h}}\]
A “multiplier” is a parameter which summarizes the change in one variable for a one unit change in another (typically exogenous) variable. Hence, as the model changes, the “multiplier” for fiscal policy changes.

\[
\frac{1}{1 - b(1-t) + m + \frac{(d + \tilde{n})k}{h}} \equiv \hat{\alpha} \leq \bar{\alpha} \equiv \frac{1}{1 - b(1-t) + m}
\]
Solving for Multipliers, in general

\[ Y_0 = \hat{\alpha} \left[ A_0 + \frac{(d + \bar{n})(\bar{M})}{h} - \frac{(d + \bar{n})\mu}{h} \right] \] <equilibrium income>

\[ \Delta Y = \hat{\alpha} \left[ \Delta A + \frac{(d + \bar{n})}{h} \Delta \left( \frac{\bar{M}}{P} \right) - \frac{(d + \bar{n})}{h} \Delta \mu \right] \]

\[ \Delta Y = \hat{\alpha} \Delta GO \Rightarrow \frac{\Delta Y}{\Delta GO} = \hat{\alpha} \]

If it is lump sum taxes:

\[ \Delta Y = -\hat{\alpha}b \Delta TA \Rightarrow \frac{\Delta Y}{\Delta TA} = -\hat{\alpha}b \]
Graphical Depiction of Fiscal Policy

Figure 3: Fiscal (Govt. spending) Policy
Monetary Policy

If monetary policy is being used, the $\Delta A = 0$, so:

$$\Delta Y = \hat{\alpha} \left( \frac{d + \bar{\eta}}{h} \right) \Delta \left( \frac{M}{P} \right) \Rightarrow \frac{\Delta Y}{\Delta (M / P)} = \hat{\alpha} \left( \frac{d + \bar{\eta}}{h} \right)$$

- Notice this is a new “multiplier”: the change in real GDP for a one unit change in the price-deflated money stock (or “real money stock” for short).
- Critical to understand how monetary policy works.
Graphical Depiction of Monetary Policy

Figure 4: Monetary Policy
What Determines Policy Efficacy?

• Sometimes fiscal policy is relatively effective, sometimes monetary policy is relatively effective.

• There are (at least) two ways of thinking about this problem; both are aids to thinking about the economics.

• The first is algebraic.

• The second is graphical.
Fiscal (LM steep vs. flat)

\[
\hat{\alpha} = \frac{1}{1 - b(1-t) + m + \frac{(d + \bar{n})k}{h}}
\]
Fiscal (IS steep vs. flat)
Monetary (LM flat vs. steep)

\[
\frac{\Delta Y}{\Delta (M/P)} = \hat{\alpha} \left( \frac{d + \bar{n}}{h} \right)
\]
Monetary (IS steep vs. flat)