Outline

- Recap: IS-LM equations
- Recap: Solution
- Graphical derivation of IS, LM curves
- What determines policy efficacy?
- Current events: Liquidity Trap
## Recap: Real Side

<table>
<thead>
<tr>
<th>Eq.No.</th>
<th>Equation</th>
<th>Description</th>
</tr>
</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>
</tr>
<tr>
<td>4</td>
<td>$Y_d = Y - T$</td>
<td>Definition of disposable income</td>
</tr>
<tr>
<td>5</td>
<td>$T = T_A_0 + tY$</td>
<td>Tax function; $T_A_0$ is lump sum taxes, $t$ is marginal tax rate.</td>
</tr>
<tr>
<td>6</td>
<td>$I = e_0 - dR$</td>
<td>Investment function <em>(revised)</em></td>
</tr>
<tr>
<td>7</td>
<td>$G = G_O_0$</td>
<td>Government spending on goods and services, exogenous</td>
</tr>
<tr>
<td>8</td>
<td>$X = g_0 - mY - \ddot{\mu}R$</td>
<td>Net Exports <em>(revised)</em></td>
</tr>
</tbody>
</table>
## Recap: Financial Side

<table>
<thead>
<tr>
<th>Eq.No.</th>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(14)</td>
<td>$\frac{M^d}{P} - \frac{M^s}{P}$</td>
<td>Equilibrium condition</td>
</tr>
<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>
</tr>
</tbody>
</table>
Recap: IS-LM equations

\begin{align*}
\text{(12)} \quad Y &= \left( \frac{1}{1 - b(1 - t) + m} \right) \left[ A_0 - (d + \tilde{n})R \right] \\
\text{<IS curve>} \\
\text{(17)} \quad R &= \left( \frac{\mu_0}{h} \right) - \left( \frac{1}{h} \right) \left( \frac{M_0}{P} \right) + \left( \frac{k}{h} \right) Y \\
\text{<LM curve>}
\end{align*}
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).

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

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

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

Collect up the last term on the right hand side involving "\( Y \)" to the left hand side:

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

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

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

Where

\[
\hat{\alpha} \equiv \frac{1}{1-b(1-t)+m + \frac{(d + \bar{n})k}{h}}
\]
Graphical Derivation: IS Curve

**FIGURE 8.3** Graphic Derivation of the IS Curve (top)

**FIGURE 8.3** Graphic Derivation of the IS Curve (bottom)
FIGURE 8.5 Graphical Derivation of the LM Curve
The “Multiplier”

- 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.

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

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

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

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

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
Monetary Policy

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

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

• 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)

\[ \hat{\alpha} = \frac{1}{1 - b(1-t) + m + \frac{(d + \bar{n})\bar{k}}{h}} \]
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)
Monetary Policy in a Liquidity Trap

\[ R \]

\[ A_0/(d+n) \]

\[ Y \]

\[ LM|M_0,P_0,\mu_0 \]

\[ LM|M_1,P_0,\mu_0 \]
Monetary Policy in a Liquidity Trap

\[ R \]

\[ \text{IS} | A_1 \]

\[ A_0/(d+n) \]

\[ \text{LM} | M_0, P_0, \mu_0 \]

\[ Y \]