Topics for Today

1.) Trade in Goods & Assets
   - Nominal vs. Real Exchange Rates
   - Uncovered Interest Parity

2.) IS-LM in a Small Open Economy
    (The "Mundell-Fleming Model")
    - Real Exchange Rates & Net Exports
    - Monetary & Fiscal Policies with Flexible Exchange Rates
    - Monetary & Fiscal Policies with Fixed Exchange Rates
M1 Money Multiplier (MULT)
Source: Federal Reserve Bank of St. Louis

Shaded areas indicate US recessions.
2009 research.stlouisfed.org
We are now going to extend the IS-LM model to an open economy, i.e., one that trades goods and assets with other countries.

- There are 2 key new variables:
  1. The nominal exchange rate: The value of one currency in terms of another.

We will define the nominal exchange rate as the value of domestic currency in foreign currency.

\[ e = \frac{\text{foreign currency}}{\text{domestic currency}} \]

Thus, \( e \uparrow \Rightarrow \text{domestic currency appreciates} \)

\( e \downarrow \Rightarrow \text{domestic currency depreciates} \)
2. What matters for people's spending decisions is the real exchange rate, i.e., how many foreign goods can be acquired per unit of domestic goods?

$$\varepsilon = \text{Real Ex. Rate} = \frac{e}{p^*}$$

$$= \frac{\text{for. curr.} \times \frac{\$}{\text{dom. goods}}}{\text{for. curr.} \text{ for. goods}}$$

$$= \frac{\text{foreign goods}}{\text{domestic goods}}$$

$$\varepsilon \uparrow \Rightarrow \text{Real Ex. Rate Appreciation}$$

$$\varepsilon \downarrow \Rightarrow \text{Real Ex. Rate Depreciation}$$
The Foreign Exchange Market

The FX market is by far the world's largest financial market.

On a typical day, roughly $1.5-2.0 trillion changes hands.

⇒ in less than a week FX transactions exceed the annual value of world trade.

The FX market is a decentralized multiple-dealer market. It never closes!

Most trading is between dealers (about 60-70%).

About \( \frac{1}{2} \) of inter-dealer trades go through FX brokers.
Major Participants
1.) Commercial Banks
2.) Other financial institutions
3.) Corporations
4.) Central Banks

Leading Trading Centers
1.) London
2.) New York
3.) Tokyo
4.) Frankfurt, Hong Kong, Singapore

Major Instruments
1.) Spot (2 day settlement lag)
2.) Forwards \{ “over-the-counter” markets
3.) Swaps

Futures & options also exist, but they are less important.

Most volume is in forwards & swaps (~60%), with swaps being more important than forwards.
Most FX trading takes place in and through the U.S. dollar.

Cross rates are determined by "triangular arbitrage"

\[
\frac{C$}{¥} = \frac{C$}{\$} \cdot \frac{\$}{¥}
\]

i.e.

\[
\text{C$} \quad \text{¥}
\quad \text{¥} \quad \text{C$} \quad \text{¥}
\]
The Demand for FX Assets

Like all assets, the demand for foreign currency-denominated assets depends on 3 factors:

1.) Expected (real) returns
2.) Risk
3.) Liquidity

In turn, the expected dollar return on foreign currency assets depends itself on 2 factors:

1.) Their interest rate (or cash flows).
2.) Expected exchange rate changes

Note: When comparing real $ returns on domestic and foreign assets, we can ignore inflation, since it is the same for both.
Uncovered Interest Parity

- In addition to trading goods, countries also exchange assets (borrow and lend).

- With open, integrated capital markets, assets denominated in different currencies must offer the same expected rate of return when expressed in common currency units.

- This equality is called "Uncovered Interest Parity." If r is the domestic interest rate and r* is the foreign interest rate it says
  
  \[ r = r^* + (\text{expected rate of depreciation of the domestic currency}) \]

- For example, if the domestic currency is expected to depreciate, then the only way you can get people to hold domestic assets is if they offer a higher interest rate.

- Following the original Mundell-Fleming model, we will usually assume no expected change in the exchange rate, so \( r = r^* \).
Uncovered Interest Parity

- Suppose you have some money to invest. You can either invest in Canada or Japan. Suppose all you care about is the expected rate of return.

- We can visualize the 2 investment strategies as follows:

  1.) Invest in Canada and get $1+r$ per $ invested ($r = \text{Canadian interest rate}$)

  2.) Convert C$1.00 to \( \frac{e(1+r^*)}{e} \) at spot exchange rate
      - Invest the \( \frac{e(1+r^*)}{e} \) per \( \frac{e}{e} \)
      - Convert \( \frac{e}{e} \) back to C$ at the expected future spot exchange rate, \( e_f \).
Uncovered Interest Parity (UIP) just states that these 2 alternative investment strategies offer the same expected return.

\[ 1 + r = e (1 + r^*) \frac{1}{e^r} \]

Re-arranging,

\[ \frac{e^f - e}{e} = \frac{r^* - r}{1 + r} \approx r^* - r \]

Or,

\[ r = r^* - \frac{e^f - e}{e} \]

In words, + Expected Depreciation of \( c^* \)

Domestic Interest Rate = Foreign Interest Rate - Expected Appreciation of Domestic Currency

If domestic currency expected to appreciate, then investors are willing to invest domestically, even when interest rate is lower!
2. Key Ingredients of Mundell-Fleming Model

1.) Small Country + Capital Mobility

\[ r = r_w \]

If \( r > r_w \) \( \Rightarrow \) Massive Capital Inflows
If \( r < r_w \) \( \Rightarrow \) Massive Capital Outflows

2.) Capital Inflows \( \Rightarrow \) Currency Appreciation
    (with flexible exchange rates)
    \( \Rightarrow \) Increase in Money Supply
    (with fixed exchange rates)

Capital Outflows \( \Rightarrow \) Currency Depreciation
    (with flexible exchange rates)
    \( \Rightarrow \) Decrease in Money Supply
    (with fixed exchange rates)
Open Economy IS-LM (The Mundell-Fleming Model)

$e$ = Nominal Exchange Rate (Value of domestic Currency)

$e$ = Real Exchange Rate
   = Foreign Goods per domestic goods
   = $\frac{eP}{P^*}$

In the short-run, with prices sticky, $e$ is proportional to $e$.

$Y = C(Y-T) + I(r) + G + NX(e)$

$Y$ (Goods mar. $\text{Equil.}$)
$\Delta I \Rightarrow NX \downarrow \Rightarrow IS$ shifts left

$\Delta I \Rightarrow NX \downarrow \Rightarrow IS(\varepsilon, I)$

$\varepsilon_2 > \varepsilon_1$

$\Delta I \Rightarrow NX \uparrow \Rightarrow IS$ shifts right

$\Delta I \Rightarrow NX \uparrow \Rightarrow IS(\varepsilon, I)$

$\varepsilon_2 > \varepsilon_1$
Flexible Exchange Rates

**Fiscal Policy**

At B: \( r > r_w \)
- \( \Rightarrow \) capital inflow
- \( \Rightarrow \) Currency Appreciation
- \( \Rightarrow \) NX ↓
- \( \Rightarrow \) IS shifts left
- \( \Rightarrow \) Return to A

**Monetary Policy**

At B: \( r < r_w \)
- \( \Rightarrow \) capital outflow
- \( \Rightarrow \) Currency Depreciation
- \( \Rightarrow \) NX ↑
- \( \Rightarrow \) IS shifts right
- \( \Rightarrow \) Go to C
Fixing the Exchange Rate

- Fixing the exchange rate is essentially no different from fixing the price of milk or wheat. In general, the govt. must intervene in the fx market, since there is no guarantee the fixed rate clears the market.

2 Cases

1.) An "overvalued" exchange rate

\[ \frac{\text{Supply of C\$}}{\text{Canadian imports}} \]
\[ \frac{\text{Demand for C\$}}{\text{Canadian exports}} \]

\[ \text{Excess supply of C\$ (or excess demand for C\$)} \]

Govt. must buy C\$ using its fx reserves.

2.) An "undervalued" exchange rate

\[ \frac{\text{Supply of C\$}}{\text{Demand for C\$}} \]

\[ \text{Excess demand for C\$ (or excess supply of C\$)} \]

Govt. must buy fx using its own currency.
Fixed Exchange Rates

**Fiscal Policy**

At B, r > rw

- Capital inflow
- Pressure for currency to appreciate
- Central Bank increases the money supply (buys foreign exchange)
- LM shifts right
- Go to C

**Monetary Policy**

At B, r < rw

- Capital outflow
- Pressure for currency to depreciate
- Central Bank must decrease the money supply (sell FX)
- LM shifts left
- Return to A
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<thead>
<tr>
<th>Flexible</th>
<th>Monetary</th>
<th>Fiscal</th>
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<tbody>
<tr>
<td></td>
<td>Effective</td>
<td>Ineffective (Crowds out NX)</td>
</tr>
<tr>
<td>Fixed</td>
<td>Ineffective (Monetary Policy must be used to fix the ex. rate)</td>
<td>Effective</td>
</tr>
</tbody>
</table>
Flexible Ex. Rates

**IS shocks**

- LM
- $r_w$
- $I_{S_1}$
- $I_{S_2}$

Flex. rates insulates economy from IS shocks

**LM shocks**

- $r_w$
- $I_{S_1}$
- $I_{S_2}$
- $LM_1$, $LM_2$

Flex. rates accentuate the economy's response to LM shocks
Fixed Ex. Rates

IS Shocks

Fixed rates accentuate the economy's response to IS shocks.

Fixed rates insulate the economy from LM shocks.
Policy Transmission with Flexible Exchange Rates

**Monetary Policy**

**USA**

- LM shifts left
- \( r_{US} > r_{Can} \)
- Capital Inflow into USA
- Capital Outflow from Canada
- US $ Appreciates relative to Canadian $
- \( NX_{US} \downarrow \)
- Canadian \( NX \uparrow \)
- USA IS Shifts left
- Canadian IS Shifts right

**New Equil. at C**
Policy Transmission with Flexible Exchange Rates

**Fiscal Policy**

USA

Canada

USA Fiscal Contraction $\rightarrow$ USA IS Shifts left

$\Rightarrow$ $Y_{USA} < Y_{Canada}$

$\Rightarrow$ Capital Outflow from USA

$\Rightarrow$ Capital Inflow into Canada

$\Rightarrow$ US $\$$ Depreciates relative to Canadian $\$$

$\Rightarrow$ USA NX $\uparrow$

Canadian NX $\downarrow$

$\Rightarrow$ USA IS shifts right

Canadian IS shifts left

$\Rightarrow$ New Equil. at C
Policy Transmission with Fixed Exchange Rates

Monetary Policy

From Canada's perspective, a U.S. Monetary contraction raises the "world" interest rate.

To prevent its currency from depreciating, Canada must also raise its interest rate (by cutting its money supply).

Conclusion
With fixed exchange rates, monetary policy is transmitted "positively," i.e., in the same direction.
From Canada's perspective, a U.S. fiscal contraction lowers the "world" interest rate.

To prevent its currency from appreciating, Canada must also lower its interest rate (by expanding the money supply).

**Conclusion**

With fixed exchange rates, fiscal policy is transmitted "negatively".
Foreign Financial Crisis

USA

[Graph showing LM and IS curves]

1. $M^d \uparrow \Rightarrow LM$ shifts up
2. $r \uparrow$, $Y \downarrow$, currency appreciates
3. $NX \downarrow \Rightarrow IS$ shifts down

CANADA

[Graph showing LM and IS curves]

1. Currency depreciates $\Rightarrow NX \uparrow$
2. $IS$ shifts out
3. $Y \uparrow$!

Qualification: Financial crisis in U.S. could spillover to the Canadian financial markets, and thus affect Canadian LM curve.
To keep its exchange rate pegged to the U.S. $, China must match the rise in U.S. interest rates. U.S. recession gets transmitted abroad.
The U.S. recession pushes Canada from A to B.

To get back to the original output level, the Bank of Canada should shift the LM out to LM₂, by cutting interest rates (or expanding the money supply).

Fiscal policy is likely to be relatively ineffective.
Import Tariff

Flexible Ex. Rate

Tariff $\Rightarrow$ Imports More Expensive
$\Rightarrow$ NX $\uparrow$
$\Rightarrow$ IS shifts out
$\Rightarrow$ $r$ $\uparrow$, Capital Inflow
$\Rightarrow$ Currency Appreciates
$\Rightarrow$ NX $\downarrow$
$\Rightarrow$ No lasting effect on output!

Fixed Ex. Rate

Tariff $\Rightarrow$ Imports More Expensive
$\Rightarrow$ NX $\uparrow$
$\Rightarrow$ IS shifts out
$\Rightarrow$ $r$ $\uparrow$, Capital Inflow
$\Rightarrow$ To prevent currency appreciation, govt. must expand money supply (purchase $FX$)
$\Rightarrow$ LM shifts out
$\Rightarrow$ Y $\uparrow$ in short-run

What happens in Long-Run?

A, B, C, IS, LM, Y
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