Today we will consider the IS-LM model in a small open economy setting, Mundell-Fleming model. We will

- see the implications of floating and fixed exchange rate regimes for the efficiency of policies; and
- introduce the theory of interest rate parity
Mundell-Fleming model/Key assumptions

- Consider a small open economy ⇒ world interest rate $r^*$ is exogenous for it
- There is a perfect capital mobility ⇒ the interest rate in small open economy $r = r^*$
  - If $r < r^*$ ⇒ the lenders would avoid lending in the small open economy ⇒ $l \downarrow \Rightarrow r \uparrow$
- Goods market equilibrium, i.e., the IS curve
  
  \[ Y = C (Y - T) + I (r^*) + G + NX(\epsilon), \]
  
  - where $\epsilon$ is the real exchange rate
  - In short run the prices are fixed ⇒ the $\epsilon$ is equiv. to nominal exchange rate $e \ (\epsilon = eP/P^*)$
From goods market equilibrium to IS curve

- Higher $e$ implies lower $NX$, similar to higher $r$ implies lower $I$
  - $e \uparrow \Rightarrow e \uparrow \ (given \ P/P^* = \text{const}) \Rightarrow IM \uparrow \text{ and } EX \downarrow \Rightarrow NX \downarrow$

- To be fully rigorous we have to go to Keynesian cross, however,
  - the notions and steps are the same as before

- In short, the IS curve is similar to the one before
  - The only difference is that here instead of $I$ the $NX$ changes, and with $e$ instead of $r$
  - Here the IS curve draws the relationship between $e$ and the $Y$, which arises in the real economy

- On a graph...
IS curve in small open economy

IS curve: $Y = C(Y - T) + I(r^*) + G + NX(\epsilon)$

The IS* curve is drawn for a given value of $r^*$

Intuition for the slope:
$e \uparrow \Rightarrow NX \downarrow \Rightarrow Y \downarrow$
From money market equilibrium to LM curve

- The LM curve is the similar to the one before

\[ \frac{M}{P} = L(r^*, Y), \]

- the differences are (1) \( r = r^* = \text{const} \); and (2) the LM draws the relation of \( Y \) and \( e \), instead of \( Y \) and \( r \)

The LM* curve is drawn for a given value of \( r^* \)

Intuition for the slope:

It is vertical since, given \( r^* \), \( \exists Y \) that equates \((M/P)^d\) with \((M/P)^s\), regardless of \( e \)
Mundell-Fleming model/IS-LM in small open economy

**IS* curve:** \( Y = C(Y - T) + I(r^*) + G + NX(\epsilon) \)

**LM* curve:** \( \frac{M}{P} = L(r^*, Y) \)
Floating and fixed exchange rate regimes

The government sets the exchange rate regime/system

**Floating exchange rate**  The $e$ is allowed to fluctuate in response to changing economic conditions

**Fixed exchange rate**  The central bank (commits and) trades domestic currency for foreign currency at a predetermined rate $e$

- We now consider fiscal, monetary, and trade policy
  - First we consider floating exchange rate system, then the fixed exchange rate system
Fiscal policy - Floating ex. rate regime

Consider fiscal expansion, i.e., $G \uparrow_{\Delta G}$

- $G \uparrow_{\Delta G} \Rightarrow$ higher $Y$ for any $e \Rightarrow IS^*$ shifts to the right

- $G \uparrow_{\Delta G} \Rightarrow e \uparrow_{\Delta e}$ and $\Delta Y = 0$. **Intuition behind...**
In a small open economy with perfect capital mobility, fiscal policy cannot affect the real GDP

- “Crowding out” revisited
  - **Closed economy**: Fiscal policy crowds out investment by causing the interest rate to rise
  - **Small open economy**: Fiscal policy crowds out net exports by causing the exchange rate to appreciate
    - According to this model $\Delta G = -\Delta NX \Rightarrow \Delta Y = 0$
Monetary policy - Floating ex. rate regime

Consider monetary expansion, i.e., $M \uparrow_{\Delta M}$

- $M \uparrow_{\Delta M} \Rightarrow$ higher $Y$ for any $e \Rightarrow LM^*$ shifts to the right

$\Rightarrow M \uparrow_{\Delta M} \Rightarrow e \downarrow_{\Delta e}$ and $Y \uparrow_{\Delta Y}$. Intuition behind...
Monetary policy - Floating ex. rate regime/Intuition

The effect of expansionary monetary policy

- **Closed ec.:** \( M \uparrow_{\Delta M} \Rightarrow r \downarrow_{\Delta r} \Rightarrow I \uparrow_{\Delta I} \Rightarrow Y \uparrow_{\Delta Y} \)

- **Small open ec.:** \( M \uparrow_{\Delta M} \Rightarrow e \downarrow_{\Delta e} \Rightarrow NX \uparrow_{\Delta NX} \Rightarrow Y \uparrow_{\Delta Y} \)
  - e is the USD/EUR \( \Rightarrow \) if in Spain/EU \( M \uparrow_{\Delta M} \Rightarrow e \downarrow_{\Delta e} \)
    - \( M \uparrow_{\Delta M} \Rightarrow \) the foreign products become more expensive and
      \( IM \downarrow \Rightarrow NX \uparrow_{\Delta NX} \)
    - \( \Rightarrow M \uparrow_{\Delta M} \) does not increase the world \( Y \), but it decreases the
      imports in small open economy
    - \( \Rightarrow M \uparrow_{\Delta M} \) increases the \( Y \) in small open economy in expense of losses abroad

**Think and read about trade tariffs yourself**
Fixed exchange rate regime - A closer look

- Under a system of fixed exchange rates,
  - the country’s central bank (CB) stands ready to buy or sell the domestic currency for foreign currency at a predetermined rate

- Let the currency of country $X$ be $z$
  - If $z$ becomes more worthy in the market, the arbitrageurs buy $z$ at the rate $e$ from the CB with foreign currency and sell it in the market $\Rightarrow M \uparrow$ and $z$ looses its value
  - $\Rightarrow$ fixed exchange rate matters for monetary policy (a lot!)
Fixed exchange rate regime - A closer look

- In the context of the Mundell-Fleming model,
  - the CB shifts the LM* curve as required to keep $e$ at its pre-announced rate

- This system fixes the nominal exchange rate
  - In the long run, when prices are flexible, the real exchange rate $\epsilon$ can move even if the nominal rate $e$ is fixed
Fiscal policy - Fixed ex. rate regime

Let the CB's pre-anounced exchange rate be $e_1$. Consider fiscal expansion, i.e., $G \uparrow_{\Delta G}$

1. $G \uparrow_{\Delta G} \Rightarrow$ higher $Y$ for any $e \Rightarrow IS^*$ shifts to the right (as in floating case)

2. $IS^*$ shifts to the right $\Rightarrow e \uparrow$ and $e > e_1 \Rightarrow$ e.g., market pays more USD for 1 EUR than CB

3. Arbitrageurs buy USD with EUR in the market sell it to CB for EUR
   - Process continues till $e = e_1$
   - $M \uparrow$ and $LM^*$ shifts to the right
   - On a graph...
Under floating rates, 
$G$ ineffective in changing $Y$ 

Under fixed rates, 
$G$ is very effective in changing $Y$ 

$G \uparrow_{\Delta G} \Rightarrow Y \uparrow_{\Delta Y}$ and $\Delta e = 0$
Let the CB’s pre-anounced exchange rate be $e_1$. Consider monetary expansion, i.e., $M \uparrow_{\Delta M}$

1. $M \uparrow_{\Delta M} \Rightarrow$ higher $Y$ for any $e \Rightarrow LM^* \text{ shifts to the right (as in floating case)}$

2. $LM^*$ shifts to the right $\Rightarrow e \downarrow$ and $e < e_1 \Rightarrow$ e.g., market pays less USD for 1 EUR than CB

3. Arbitrageurs buy EUR with USD in the market sell it to CB for USD
   - Process continues till $e = e_1$
   - $M \downarrow$ and $LM^*$ shifts left, back to where it was before
   - On a graph...
Fiscal policy - Fixed ex. rate regime/graph

Under floating rates, 
$M$ is very effective in changing $Y$

Under fixed rates, 
$M$ is ineffective in changing $Y$

$M \uparrow_{\Delta M} \Rightarrow \Delta Y = \Delta e = 0$
### Floating exchange rate vs. Fixed exchange rate

#### Summary of effects

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<th>Policy</th>
<th>type of exchange rate regime:</th>
<th>impact on:</th>
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<td>mon. expansion</td>
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Floating exchange rate vs. Fixed exchange rate

Supporting the floating exchange rate

- allows monetary policy to be used to pursue other goals (stable growth, low inflation)
- is more market based
- if negative shock happens, the CB may run out of foreign currency reserves under fixed exchange rate regime
Floating exchange rate vs. Fixed exchange rate

Supporting the fixed exchange rate

- can avoid uncertainty and volatility, making international transactions easier
  - examples: EURO in EURO area, USD in US, etc
- disciplines monetary policy to prevent excessive money growth & hyperinflation
- changing the level at which the exchange rate is fixed provides scope for monetary policy
  - A reduction in the official value of the currency is called a **devaluation**, and an increase in the value is called a **revaluation**
Interest rate differentials

So far we have assumed that $r = r^*$

- We were applying the law of one price, i.e.,
  
  - if, e.g., $r < r^* \Rightarrow$ lenders would prefer lending abroad
    $\Rightarrow r \uparrow = r^*$

  There are instances, however, that this logic does not work
Interest rate differentials - 2 reasons

Why $r$ can be different than $r^*$

- Country risk
  - The risk that the country’s borrowers will default on their loan repayments because of political or economic turmoil
  - Due to country risk the lenders require a higher interest rate to compensate them for this risk (risk premium)
Interest rate differentials - 2 reasons

Why $r$ can be different than $r^*$

- Exchange rate uncertainty
  - If a country's exchange rate is expected to fall, then its borrowers must pay a higher interest rate to compensate lenders for the expected currency depreciation
    - e.g., market expects that EUR will increase relative to USD ⇒ loans in EUR will repay more than loans in USD ⇒ $r$ is lower in Spain/EU in order to compensate the difference
Let $r = r^* + \theta$, where $\theta$ is the risk premium. The IS*-LM* model is then

\begin{align*}
\text{IS}^* : & \quad Y = C (Y - T) + I (r^* + \theta) + G + NX(\epsilon), \\
\text{LM}^* : & \quad M/P = L (r^* + \theta, Y)
\end{align*}
Interest rate differentials - IS*-LM* model

Let the interest rate differential increase (i.e., country becomes more risky or markets expect devaluation of currency)

\[ \theta \uparrow \Rightarrow r = r^* + \theta \uparrow \Rightarrow I \downarrow \Rightarrow IS^* \text{ shifts to the left and } LM^* \text{ shifts to the right} \Rightarrow e \downarrow \text{ and } Y \uparrow \]

- On a graph...
Interest rate differentials - IS*-LM* model/graph

$\theta \uparrow \Rightarrow$

*IS* shifts to the left
*LM* shifts to the right

$e \downarrow$ and $Y \uparrow$

More intuition...
Interest rate differentials - IS*-LM* model/intuition

- The fall in $e$ is intuitive
  - An increase in country risk or an expected depreciation makes holding the country’s currency less attractive
    - **Note:** an expected depreciation is a self-fulfilling prophecy
- The increase in $Y$ occurs because
  - the boost in $NX$ (from the depreciation, $e \downarrow$) is even greater than the fall in $I$ (from $r \uparrow$)
  - $\theta \uparrow \Rightarrow Y \uparrow$ is not intuitive at all. In such cases mainly
    - CB tries to reduce the shift in LM by reducing the money supply,
      - Fixed ex. rate: CB has to buy its currency
    - Consumers start holding more money, etc
Consider the case when the price level $P^*$ in the small open economy decreases.

- remember that given that price level is fixed we have replaced $\epsilon$ with $e$, reverse that

- let $P$ and $P^* \uparrow \Rightarrow IS^*$ remains the same and $LM^*$ shifts to the left $\Rightarrow Y \downarrow$

- **On a graph...**
From small open economy IS*-LM* to AD/graph

Slope of AD is negative since

\[ P \uparrow \Rightarrow (M/P) \downarrow \Rightarrow \]

\[ LM^* \text{ shifts to the left} \Rightarrow \]

\[ \epsilon \uparrow \Rightarrow NX \downarrow \Rightarrow Y \downarrow \]

The transition from short run to long run is similar to what we had for closed economy IS*-LM*