

# **OPEN ECONOMY MACROECONOMICS 2**

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# AGENDA

- ~~International linkage and Balance of payments~~
- ~~Foreign exchange market and Exchange rate determination~~
- **Macroeconomics framework for open-economy**
- **Shocks and propagation under open-economy**
- **Policy in open-economy**

**Reading: Froyen Chapter 15**

# MACROECONOMICS FRAMEWORK FOR OPEN-ECONOMY

# IMPLICATIONS OF OPEN ECONOMY FOR MACROECONOMICS FRAMEWORK

- Traditional closed-economy model becomes **incomplete** for the analysis, i.e. needing some **modifications**
- Missing a market that summarizes overall activities in the international aspect, i.e. **balance of payments**.
- Open-economy macroeconomic model: **IS-LM-BP model (Mendell-Fleming model; a limiting case)**

# THE IS-LM-BP MODEL

## ➤ Three interconnected markets

- Goods market  $\rightarrow$  IS
- Money market  $\rightarrow$  LM
- International transactions  $\rightarrow$  BP

## ➤ **Two questions:**

1. Does the relationship between “ $r$ ” and “ $y$ ” *change* under the open-economy?
2. To fix the original idea of IS-LM, how can we characterize the relationship between “ $r$ ” and “ $y$ ” that represent the equilibrium in the overall international activities?

# FOREIGN SECTOR AND IS

- **Net exports ( $X - IM$ )** is now part of aggregate expenditure (AE and IS curve).
  - Structure of the goods-market conditions slightly changes.
- **Behavioral assumptions** of exports and imports:
  - **Exports** are determined by foreign income ( $Y^f$ ) and real exchange rate ( $rer$ ), and etc.
  - **Imports** are determined by domestic income ( $Y$ ) and real exchange rate ( $rer$ ), and etc.

# PRODUCT MARKET EQUILIBRIUM (IS)

$$Y = C(Y_d, r) + I(Y, r) + G$$

$\Downarrow$

$$Y = C(Y_d, r) + I(Y, r) + G + X(Y^f, rer) - IM(Y, rer)$$

where  $rer = \frac{eP^*}{P}$

$$\frac{\partial IM}{\partial Y} > 0; \frac{\partial IM}{\partial rer} < 0 \text{ and } \frac{\partial X}{\partial Y^f} > 0; \frac{\partial X}{\partial rer} > 0$$

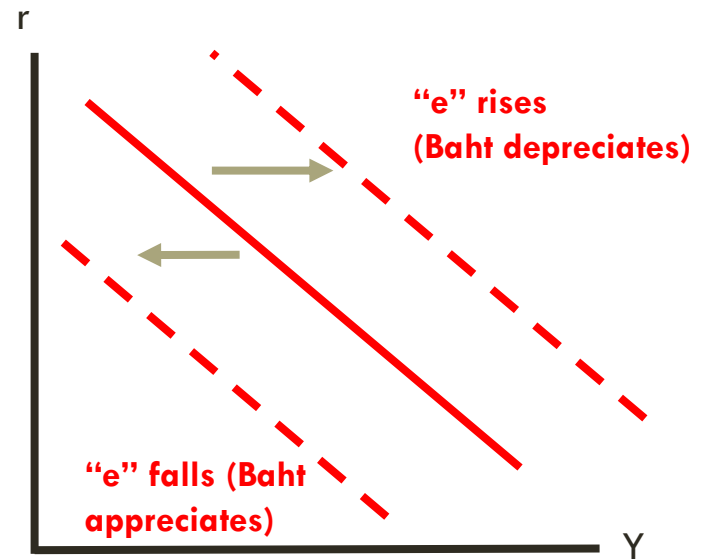
# OPEN-ECONOMY IS CURVE

## ➤ Still downward sloping.

- For fixing everything else constant, higher “ $r$ ”  
→ lower “Investment” and “Consumption”  
→ Lower “AE”, and hence output ( $Y$ ).

## ➤ New? The role of **exchange rate** can now be discussed.

- Higher (lower) “ $e$ ” causes a rise (decline) in net exports, for a given real interest rate.
- → IS curve shift right (left).



**IS curve**

# FOREIGN SECTOR AND LM

- Nothing affects money market.
- LM curve remains upward sloping.
  - → higher  $Y$  causes a higher demand for money,
  - → higher demand for money leads to rising market interest rate.

# NEW FEATURE: BALANCE OF PAYMENTS

- International activities can be summarized by the balance of payment (BOP).

$$\begin{aligned} \text{BOP} &= (X - \text{IM}) + (F_{in} - F_{out}) \\ &= \text{Net exports} + \text{Net inflows} \\ &= \text{CA} + \text{KA} \end{aligned}$$

# BALANCE OF PAYMENTS: BEHAVIOR

- Behavior of the balance of payments can be analyzed by the behavior of its component.

$$BOP(*) = [X(Y^f, rer) - IM(Y, rer)] + KA(r - r^f - \theta)$$


CA:

negatively in “Y” (domestic income)

Positively in “Y<sup>f</sup>” (foreign/world income)

Positively in “rer = eP\*/P” (P\* = world price; P = domestic price)

# BALANCE OF PAYMENTS: BEHAVIOR

- Behavior of the balance of payments can be analyzed by the behavior of its component.

$$BOP(*) = [X(Y^f, rer) - IM(Y, rer)] + \underbrace{KA(r - r^f - \theta)}$$

Relative returns:  $r - r^f$

*Risk-adjusted* relative returns:

$$r - r^f - \theta$$

*Risk?*

$$\theta = E\left(\frac{e_{t+1}}{e_t} - 1\right) + \mu + \dots$$

KA: risk-adjusted relative returns

$r$  = domestic (real) interest rate;

$r^f$  = foreign (real) interest rate;

$\theta$  = risk premium

KA: **Positively** linked to the risk-adjusted relative returns.

$E(e_{t+1}/e_t)$  = expected depreciation of domestic currency (exchange rate risk);  $\mu$  = country credit risk...

# EQUILIBRIUM IN THE BALANCE OF PAYMENTS

- BOP is in the equilibrium if **BOP = 0**.

$$[X(Y^f, rer) - IM(Y, rer)] + KA(r - r^f - \theta) = 0$$

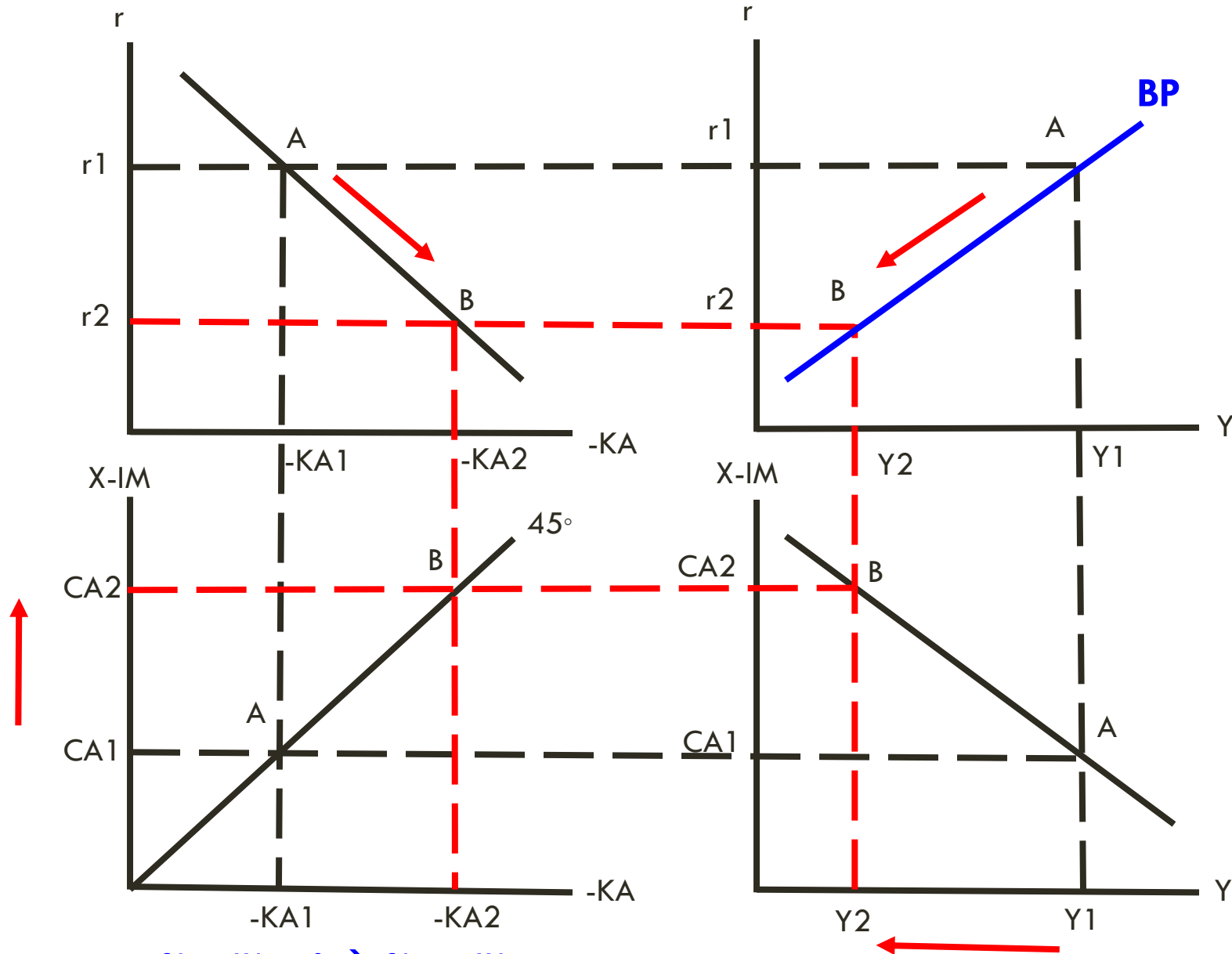
- To analyze the balance of payments in equilibrium, we fix the same organizing idea and ask “what can we learn about the relationship between “r” and “y” that governs the equilibrium BOP?” (given other things fixed!)
- The equilibrium relationship between “r” and “Y” that puts the balance of payments in the equilibrium is captured by **BP curve**.

# THE BP CURVE: INTUITIONS

➤ **An upward sloping curve.** Why?

- **Start from a situation with “zero BOP”**
- **Lower interest rate** reduces net capital inflows (KA worsened) → worsening BOP
- BOP can be balanced if this is compensated by an increase in net exports (CA improved).
- Net exports can be improving when **“y” is lower**; lowering imports.
- Hence, we have **positive relationship** between “r” and “y” under the BOP equilibrium

# THE BP LINE: GRAPHICAL



$$CA + KA = 0 \rightarrow CA = -KA$$

$$\rightarrow CA = \text{Net capital outflows}$$

# THE BP LINE: MATHEMATICAL VERSION

- Suppose linear equation in current account and capital account

$$[X(Y^f, rer) - IM(Y, rer)] = \alpha_0 - \alpha_1 Y + \alpha_2 Y^f + \alpha_3 rer$$

$$KA(r - r^f - \theta) = \beta_0 + \beta_1(r - r^f - \theta)$$

- Equilibrium:

$$\alpha_0 - \alpha_1 Y + \alpha_2 Y^f + \alpha_3 rer + \beta_0 + \beta_1(r - r^f - \theta) = 0$$

- BP equation:

$$r = r^f + \theta + \left( \frac{1}{\beta_1} \right) [\alpha_1 Y - (\alpha_0 + \alpha_2 Y^f + \alpha_3 rer + \beta_0)]$$

# THE BP CURVE: DISEQUILIBRIUM

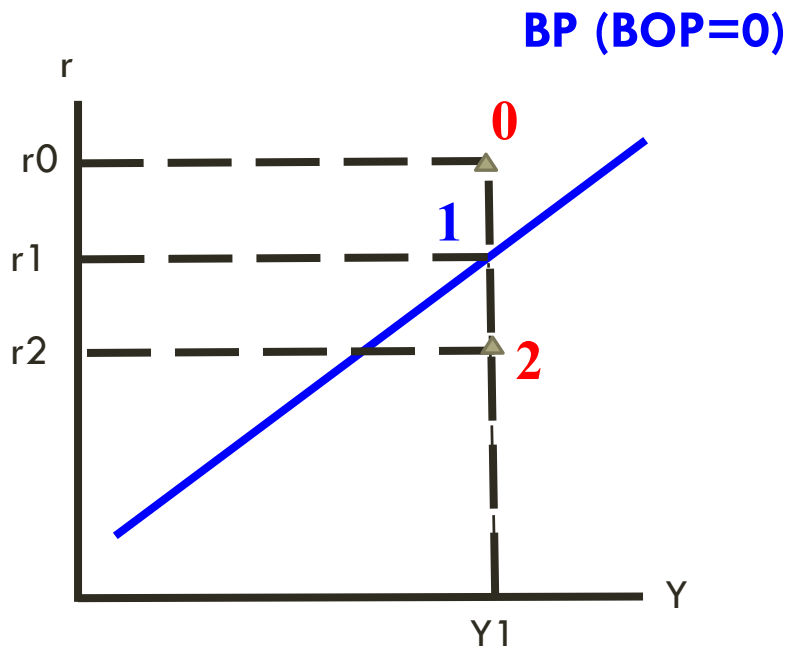
Off the BP curve?

If above the BP, “ $r$ ” is **too high**.

BOP is positive (surplus); net capital inflow is better than the level needed to ensure  $BOP = 0$ .

If below the BP, “ $r$ ” is **too low**.

BOP is negative (deficit); net capital inflow is worse than the level needed to ensure  $BOP = 0$ .

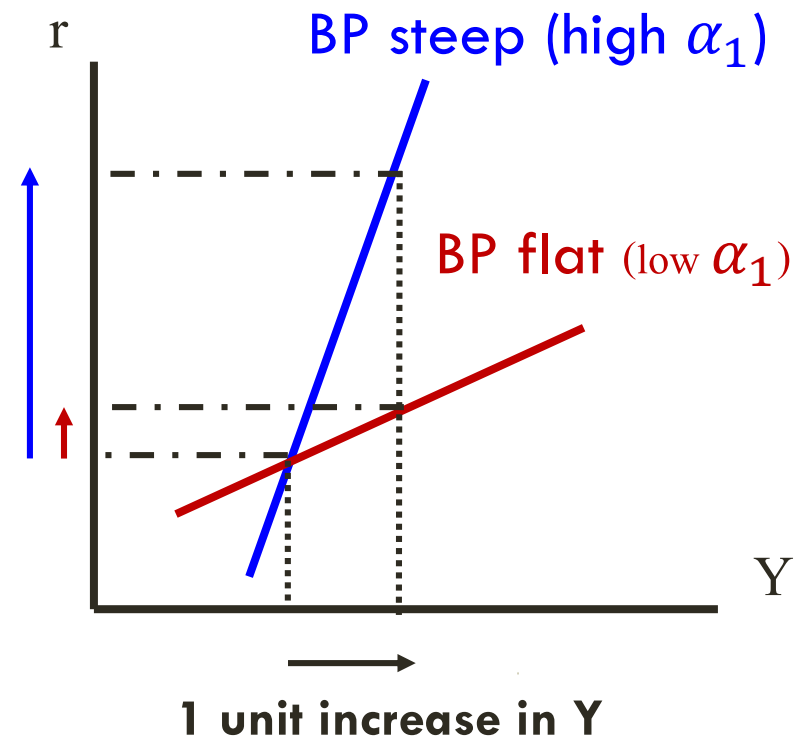


# SLOPE OF BP LINE

The slope of BP line depends on

## 1. Sensitivity of imports to real GDP ( $Y$ )

- Higher propensity to imports ( $\alpha_1$ ) implies that CA **sizably deteriorates** when income increases.
- Other things being equal, “ $r$ ” must be **sizably rising** as well, to induce an improvement in KA.
- SO, highly sensitive of imports to real GDP ( $Y$ )  $\rightarrow$  **steeper BP curve**.

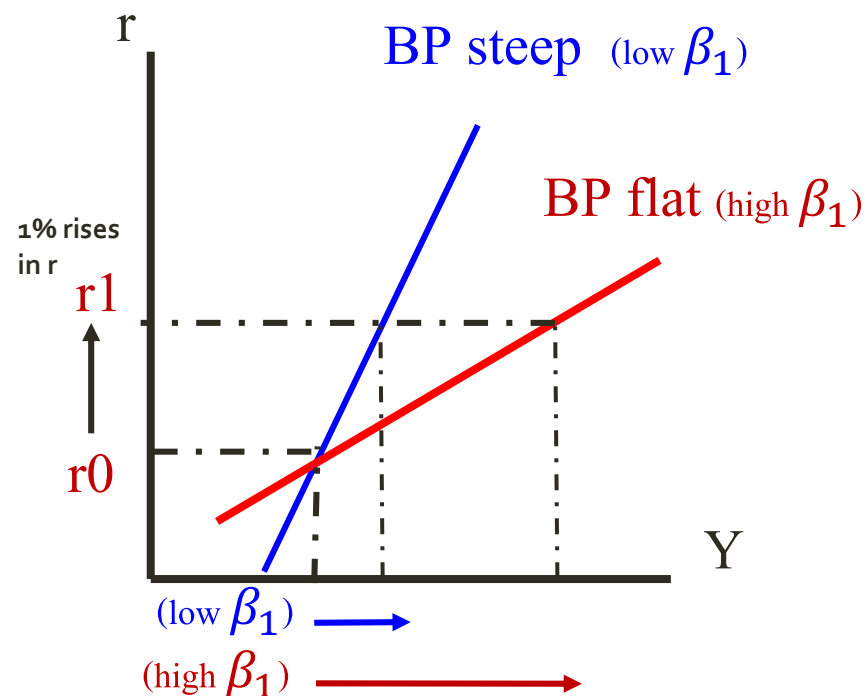


# SLOPE OF BP CURVE

The slope of BP line depends on

## 2. Sensitivity of net capital flow (KA) to the risk-adjusted relative return ( $\beta_1$ );

- The higher  $\beta_1$  implies that KA **sizably improves** when domestic interest rate increases.
- Other things being equal, “Y” must be rising a lot, to ensure the deterioration in the CA that is large enough to offset the big change in KA.
- SO, Sensitivity of net capital flow (KA) to the risk-adjusted relative return  $\rightarrow$  flatter BP curve.

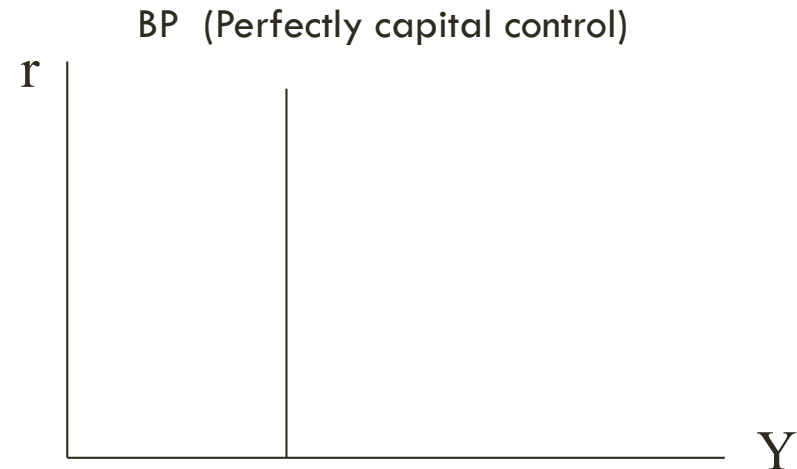


# SLOPE OF BP CURVE

## ➤ Two extreme cases

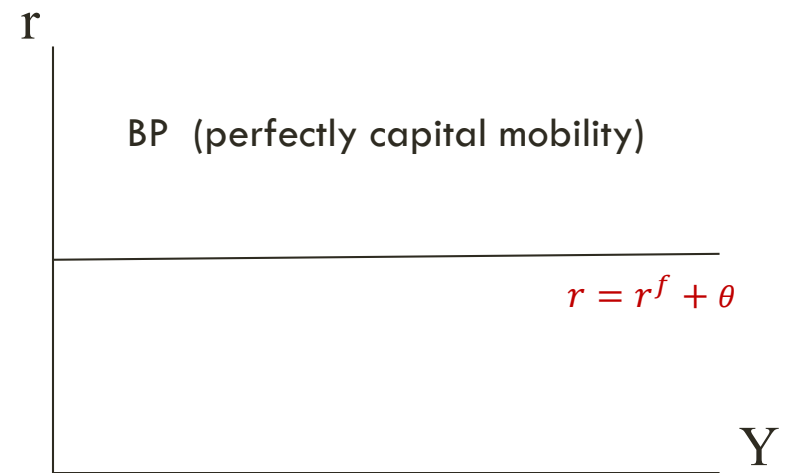
### ▪ *Vertical BP*

- Investors are not sensitive to risk-adjusted return; country-biased investment; ( $\beta_1=0$ )
- Perfect capital control (capital mobility is ruled out.)



### ▪ *Horizontal BP*

- Perfect degree of capital mobility
- Investors are very sensitive to the risk-adjusted return; **very large value of  $\beta_1$**  ( $\rightarrow \infty$ )
- Domestic interest rate ( $r$ ) must be equal  $r^f + \theta$

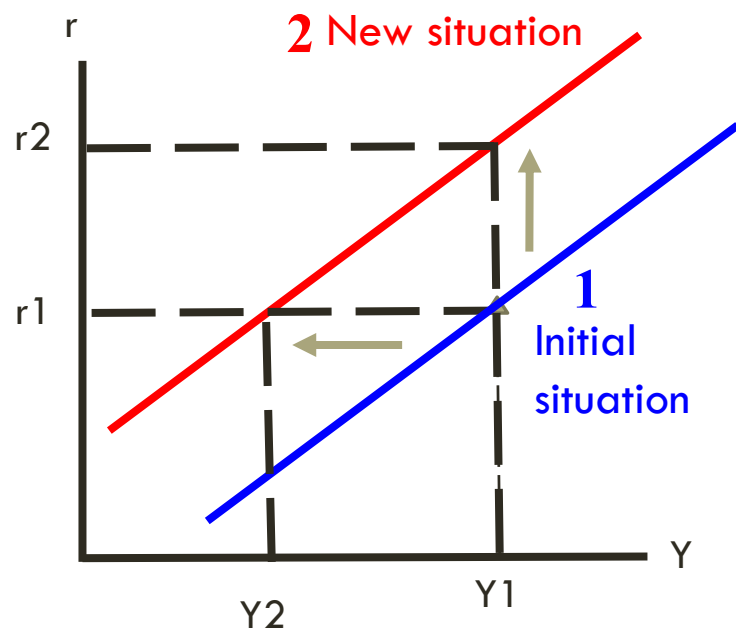


# SHIFTING THE BP LINE

➤ Changes in **factors** affecting BOP

➤ Recall our equilibrium condition

$$BOP = [X(Y^f, rer) - IM(Y_1, rer)] + KA(r_1 - (r^f + \theta)) = 0$$



➤ Left shift in the BP line can occur because of

- Higher in  $r^f + \theta \rightarrow$  foreign investment more attractive
- Lower in  $Y^f \rightarrow$  foreign can afford less
- Lower in  $rer \left( = \frac{eP^*}{P} \right) \rightarrow$  foreign product becomes cheaper

➤ Develop your own intuition for the right shift. (opposite to above)

# OPEN-ECONOMY EQUILIBRIUM

## ➤ Notions of equilibrium concepts

### 1. Internal equilibrium (IE)

“ $r$ ” and “ $y$ ” clear goods and money market: **IS-LM intersection**

### 2. External equilibrium (EE)

“ $r$ ” and “ $y$ ” clear the balance of payments: **on the BP**

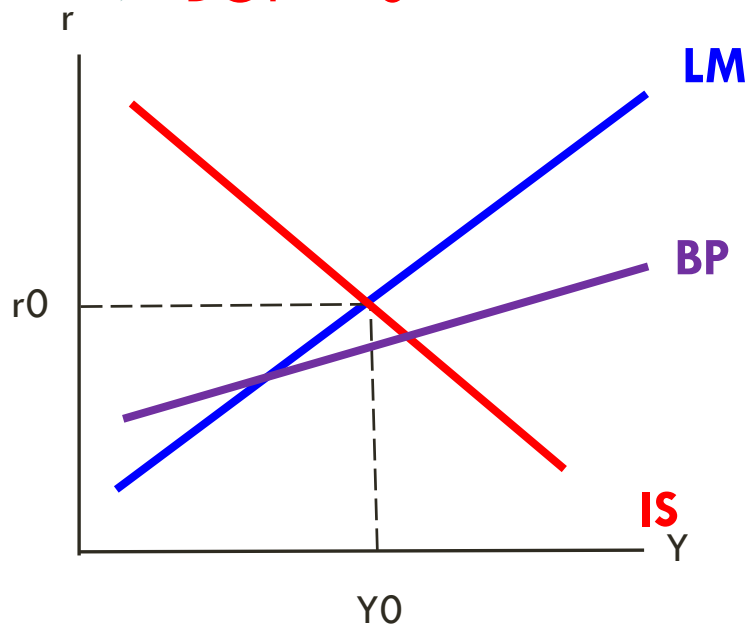
## ➤ Open-economy equilibrium: **The General equilibrium (GE)**

Internal + External: ***intersections among IS-LM-BP.***

# OPEN-ECONOMY (DIS) EQUILIBRIUM

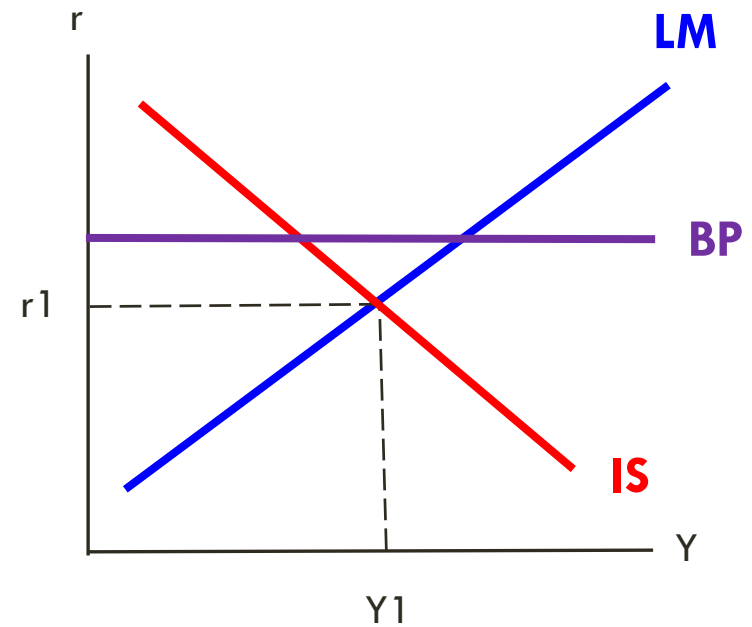
➤  $(r_0, y_0)$ : Internal equilibrium

➤  $BOP > 0$



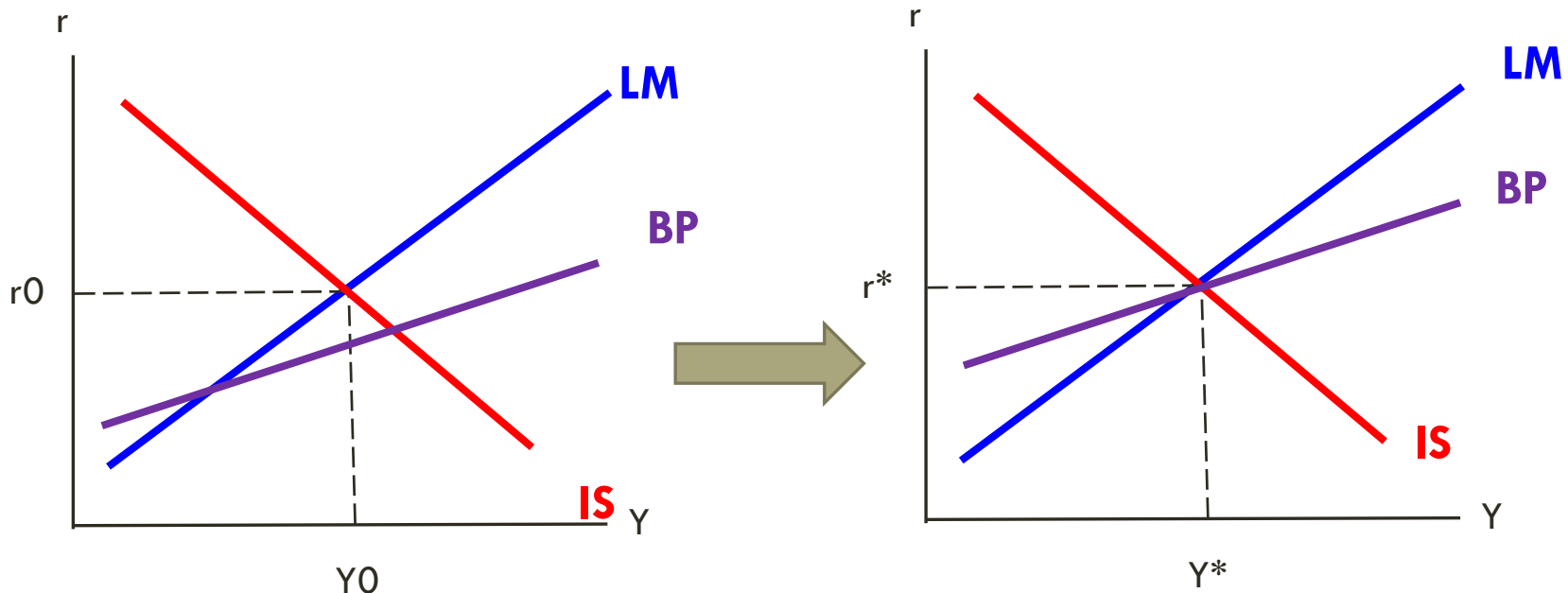
➤  $(r_1, y_1)$ : Internal equilibrium

➤  $BOP < 0$



# OPEN-ECONOMY (DIS) EQUILIBRIUM: ADJUSTMENT PROCESS

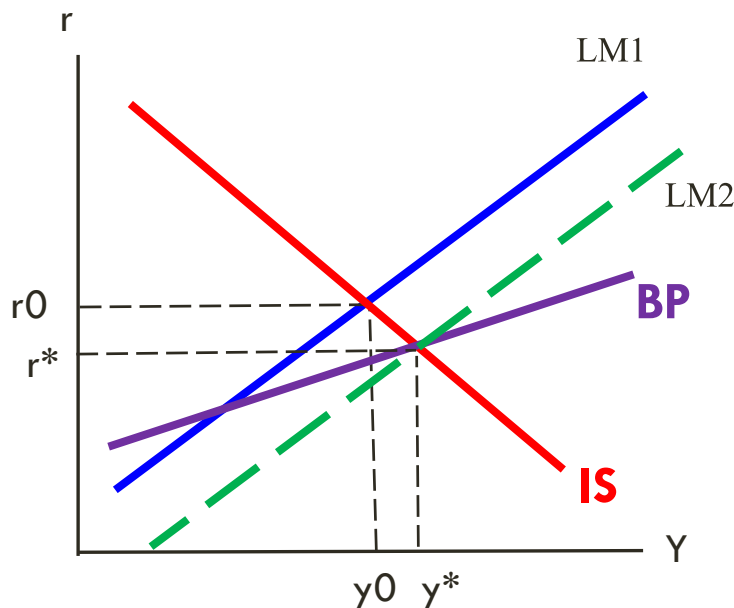
- Given the Internal equilibrium, how does the economy reach the GE? Mechanism?



- Answer depends on the choice of exchange rate regime!

# OPEN-ECONOMY (DIS) EQUILIBRIUM: ADJUSTMENT PROCESS

- Under the **fixed exchange rate**, nominal exchange rate is fixed.
- The adjustment mechanism will work through the level of **money supply**.

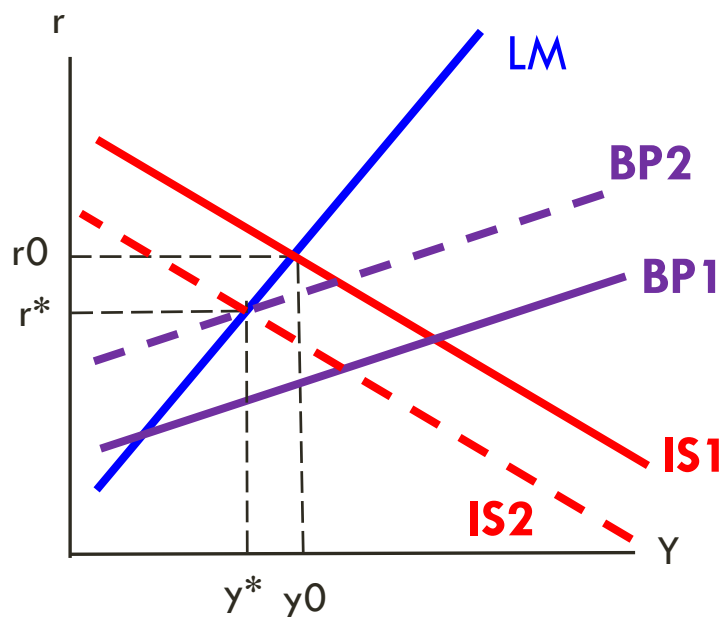


- $(r_0, y_0)$ :  $BOP > 0$  (IE equilibrium)
- To maintain fixed “ $e$ ”, **central bank buys all surplus of forex**; this causes money supply to rise, i.e.  $LM1 \rightarrow LM2$ .
- Rising  $M$  lowers “ $r$ ” (worsening KA) and increase “ $y$ ” (causing more import)
- net positive BOP is gradually eliminated while the economy reaches the GE  $(r^*, y^*)$ .

# OPEN-ECONOMY (DIS) EQUILIBRIUM: ADJUSTMENT PROCESS

➤ Under the flexible exchange rate, “e” will directionally move to clear the imbalance of BOP.

➤ BOP surplus  $\rightarrow$  “e” falling (appreciate); BOP surplus  $\rightarrow$  “e” rising (depreciate)



➤  $(r_0, y_0)$ : BOP  $> 0$

➤ Without any intervention, “e” will fall.

- Directly causing a deterioration in BOP: **BP1  $\rightarrow$  BP2**
- Causing a lower in AE: **IS1  $\rightarrow$  IS2**; indirectly solving the surplus in BOP.

➤ The initial net positive BOP is gradually eliminated while the economy reaches the GE  $(r^*, y^*)$ .

# SHOCKS AND PROPAGATION UNDER OPEN-ECONOMY

# SHOCKS AND PROPAGATION

- Equilibrium occurs where **all three lines intersect**.
- Fluctuations in output arise because **shocks** *randomly* hit the economy, causing the movement of equilibrium.
- In the closed economy, we usually think about **shocks in IS as IS shocks** and **shocks in LM as monetary (financial) shocks**.
- Under the opened-economy, shocks can also be classified on **the basis of country origin (domestic v.s. external)**.

# SHOCKS AND PROPAGATION

| <div>Type</div> <div>Country</div> | IS                                                                                                                                                    | Monetary / finance                                                                                                                                  |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Domestic<br/>(local)</b>        | <ul style="list-style-type: none"> <li>- Business/consumer confidence changing</li> <li>- Government spending</li> </ul>                              | <ul style="list-style-type: none"> <li>- domestic banking panics</li> <li>- Money supply (CB's policy)</li> <li>- Financial deregulation</li> </ul> |
| <b>External</b>                    | <ul style="list-style-type: none"> <li>- World GDP growth</li> <li>- Global productivity</li> <li>- Oil price</li> <li>- Geopolitical risk</li> </ul> | <ul style="list-style-type: none"> <li>- Global financial downturn;</li> <li>- Global Interest rate trends</li> </ul>                               |

# SHOCKS AND PROPAGATION

## Question

1. How do the different types of shocks work under open-economy; **contraction v.s. expansion?**
2. Can shocks get amplified, i.e. **large or small?**
3. What is the characteristic of the economy that is prone to have high volatility? **Resiliency; self-correcting mechanism?**

# SHOCKS AND PROPAGATION

➤ We will focus on the analysis under “*small open-economy with perfect capital mobility*”

- Horizontal BP line. → Mundel-Flemming world
- Shocks by line.

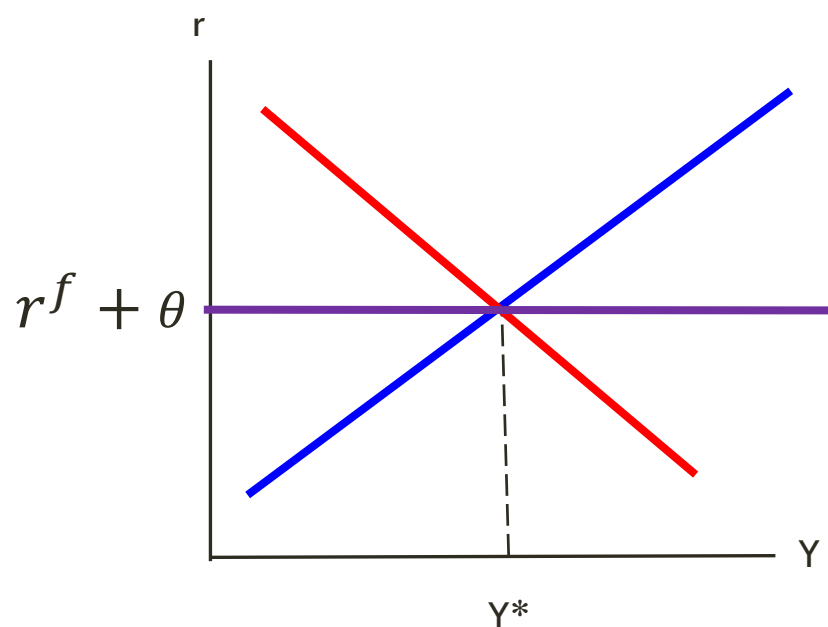
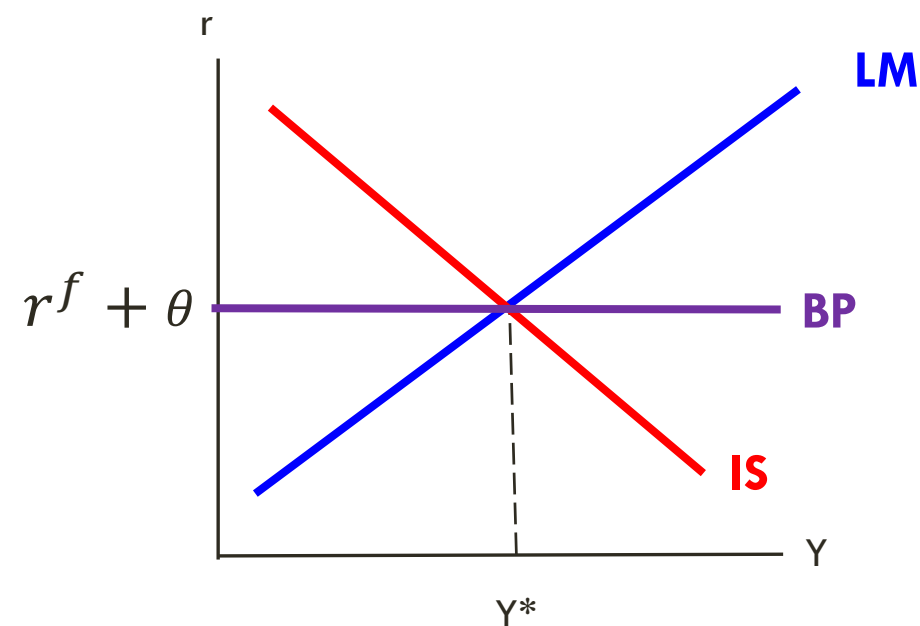
➤ Answers/Insights to the posted questions are:

1) Nature of shocks: *origin (country/type)*.

2) Choice of exchange rate regime: *fixed v.s. flexible*.

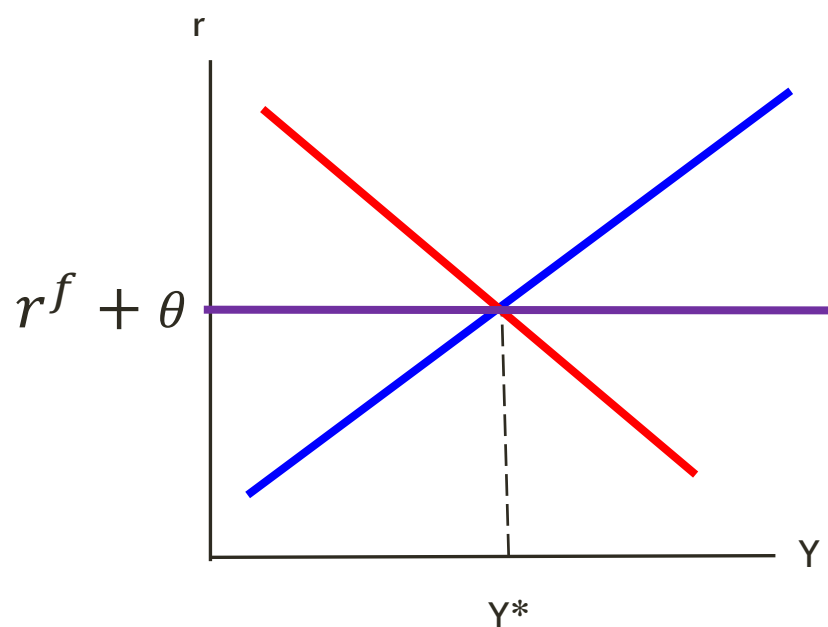
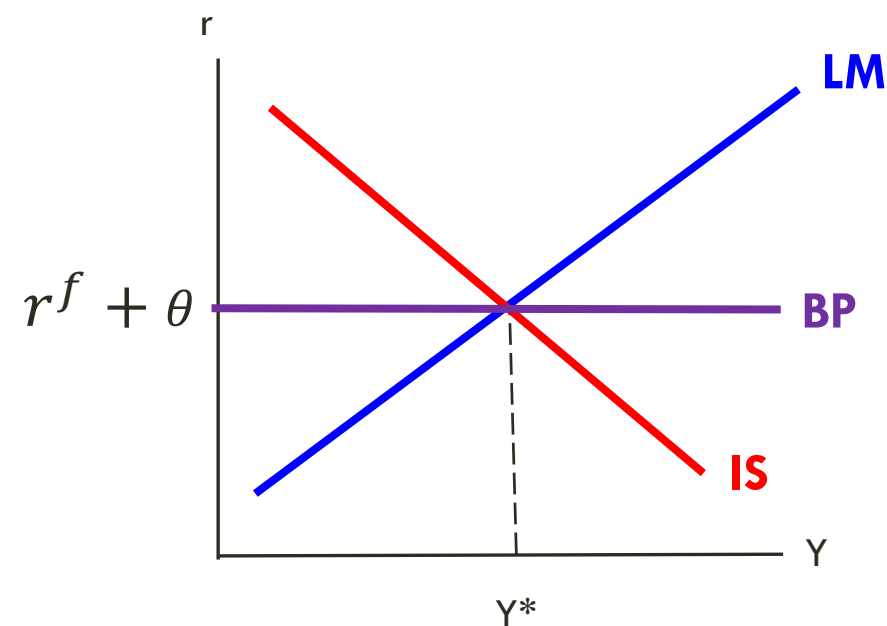
# DOMESTIC SHOCKS: IS SHOCKS

Case 1: Improvement in business sentiments / fixed exchange rate



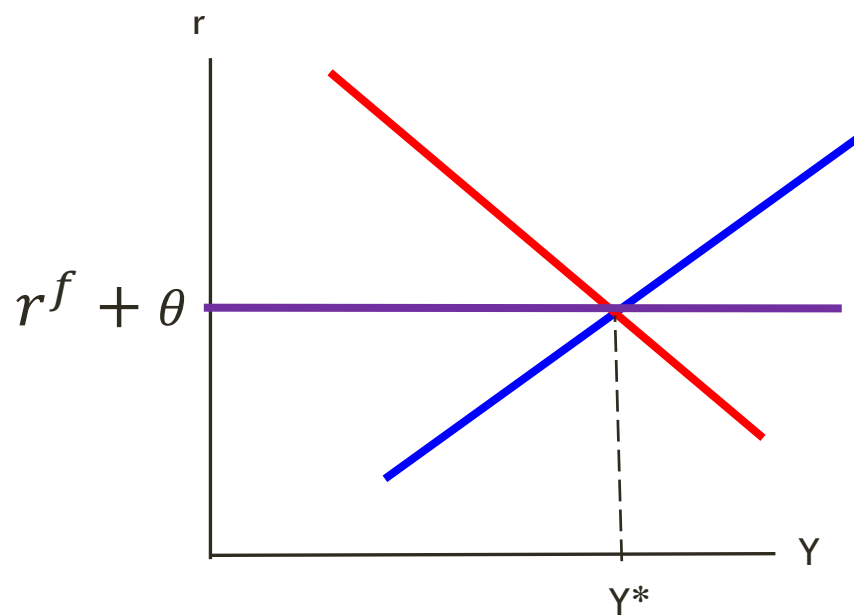
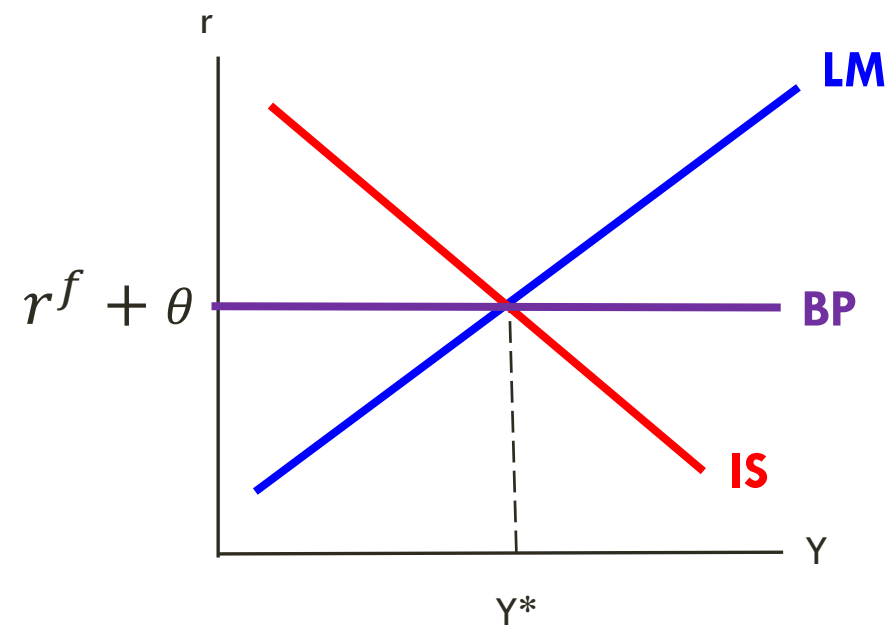
# DOMESTIC SHOCKS: IS SHOCKS

Case 2: Improvement in business sentiments / flexible exchange rate



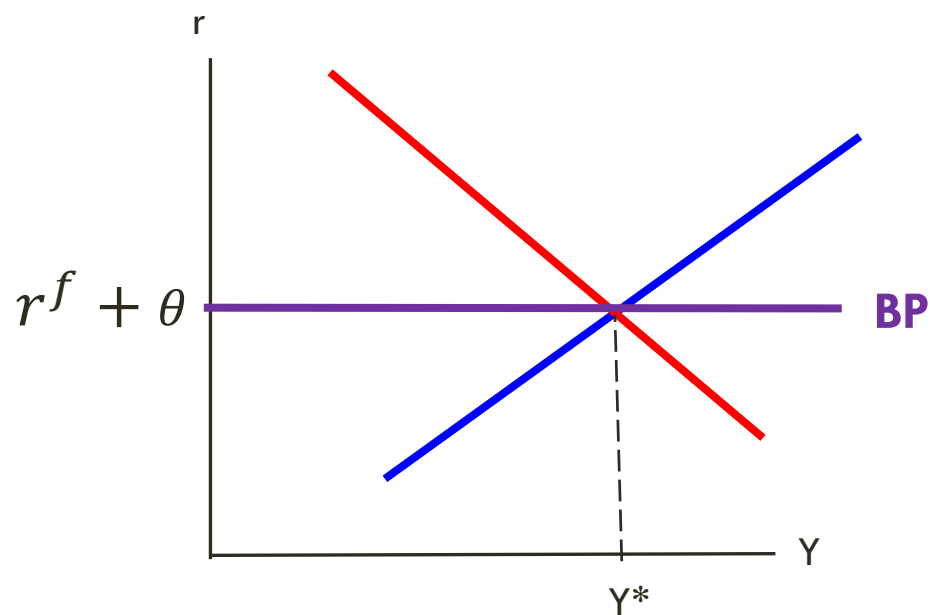
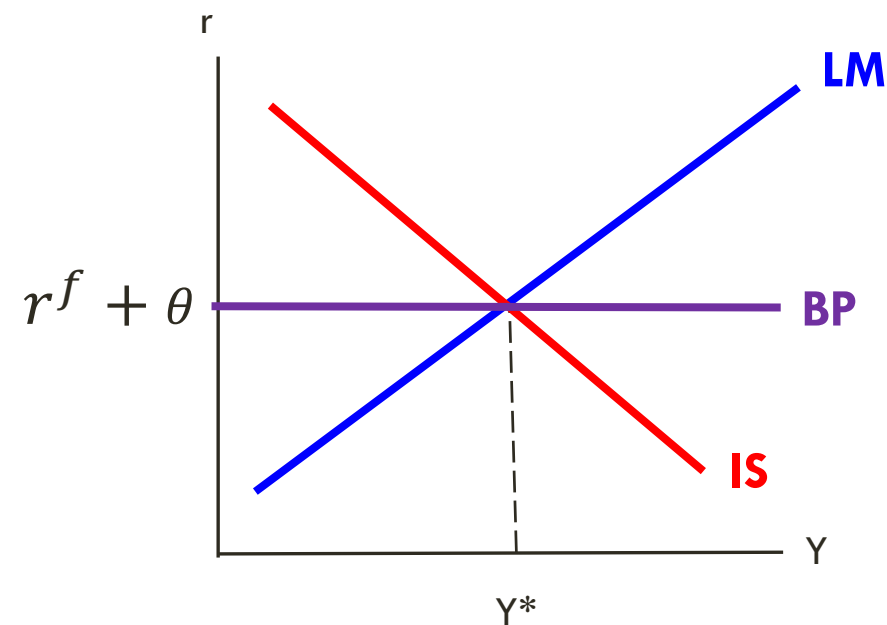
# DOMESTIC SHOCKS: LM SHOCKS

Case 3: Banking panic / fixed exchange rate



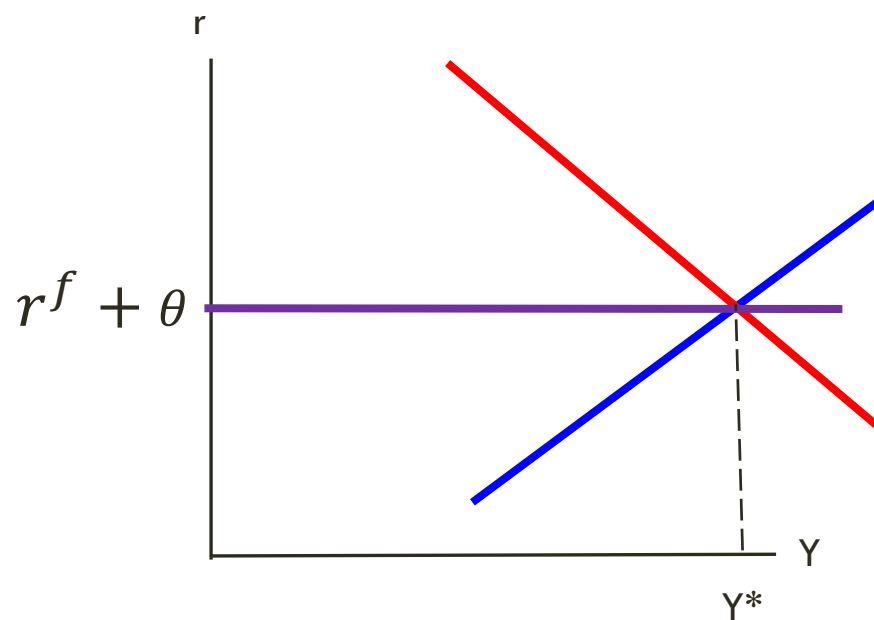
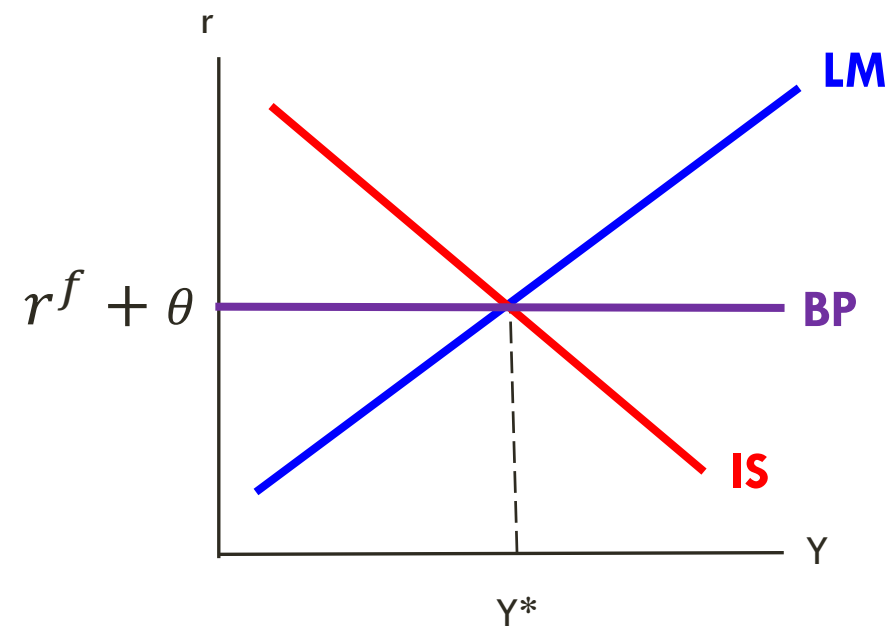
# DOMESTIC SHOCKS: LM SHOCKS

Case 4: Banking panic / flexible exchange rate



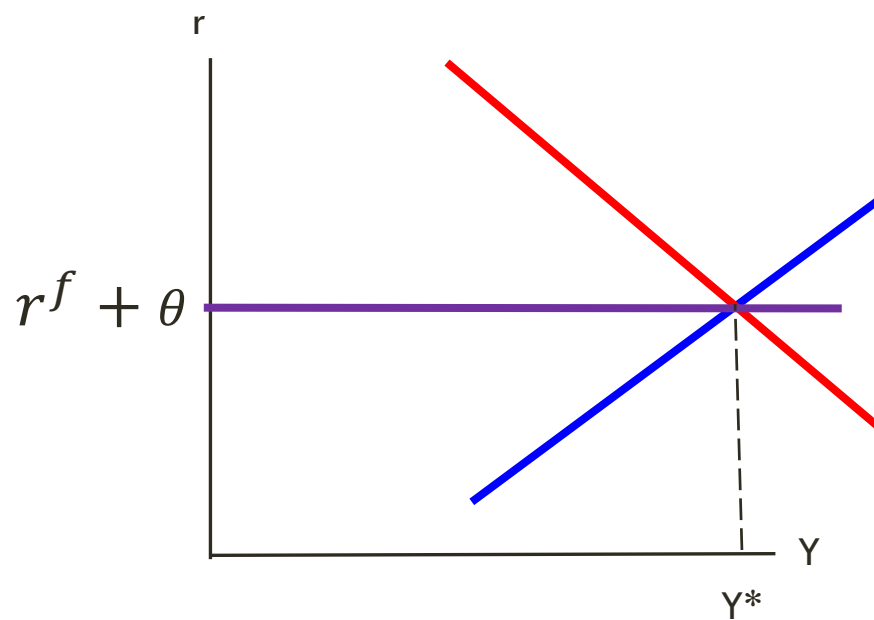
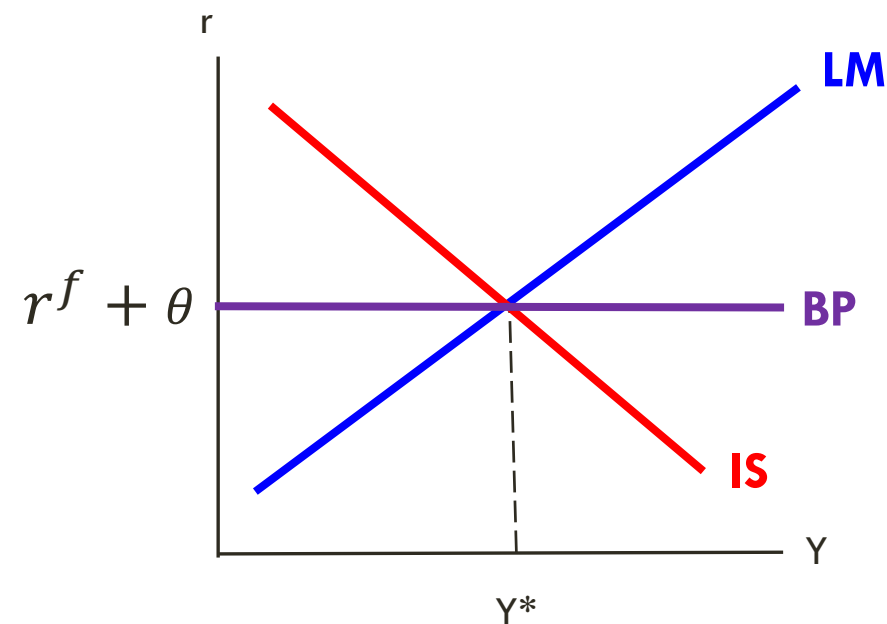
# EXTERNAL SHOCKS: IS SHOCKS

Case 5: Global GDP recession / fixed exchange rate



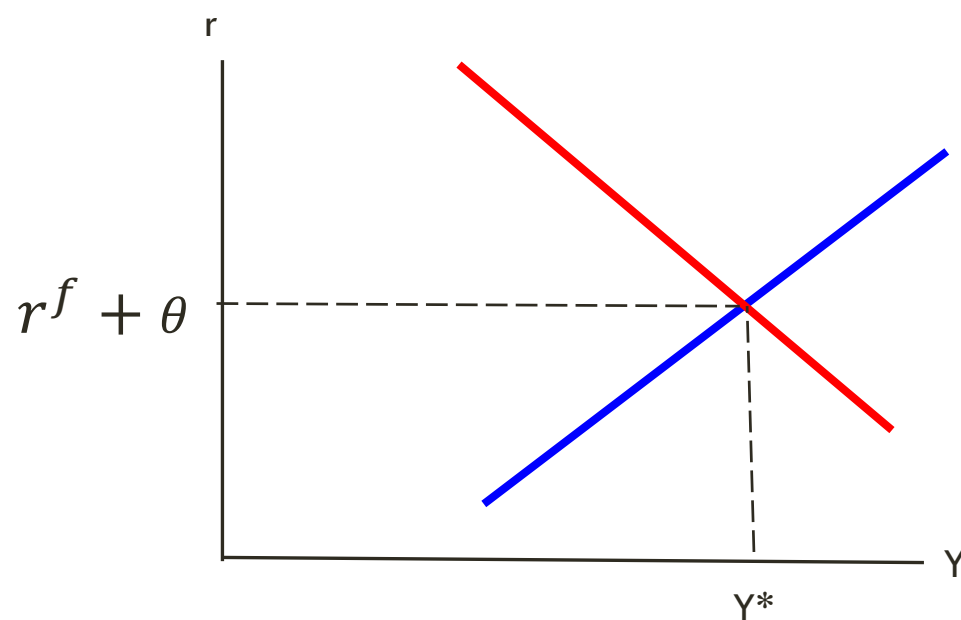
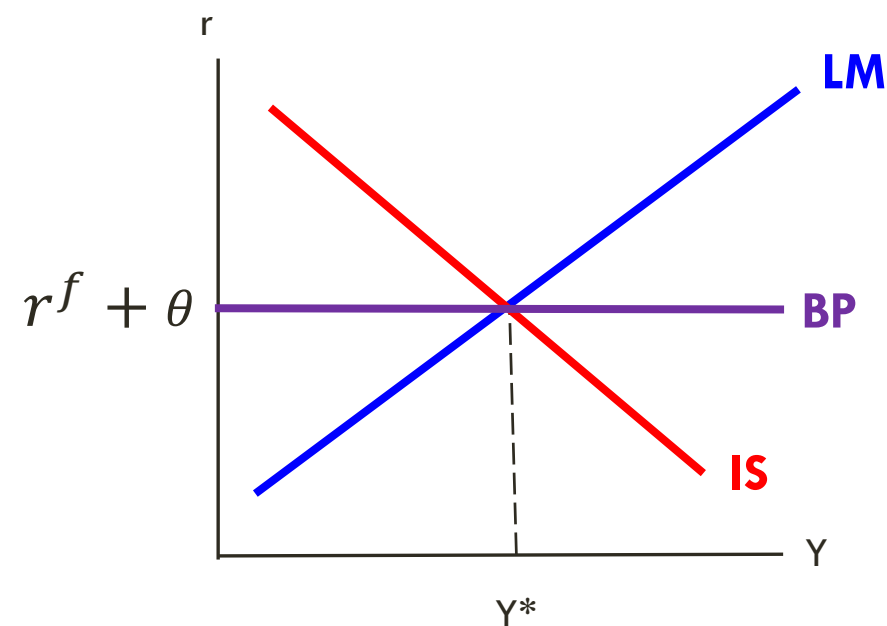
# EXTERNAL SHOCKS: IS SHOCKS

Case 6: Global GDP recession / flexible change rate



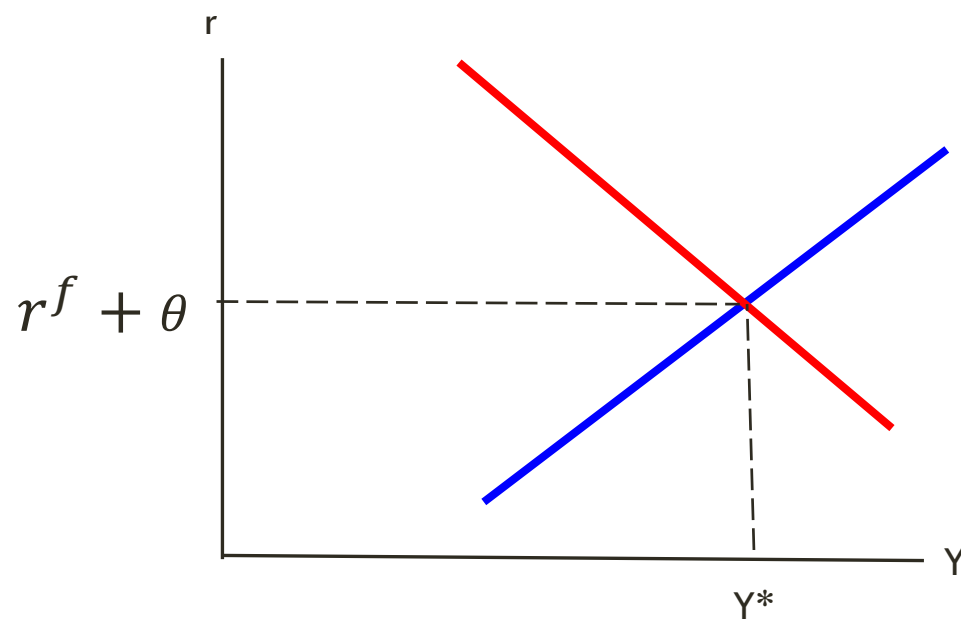
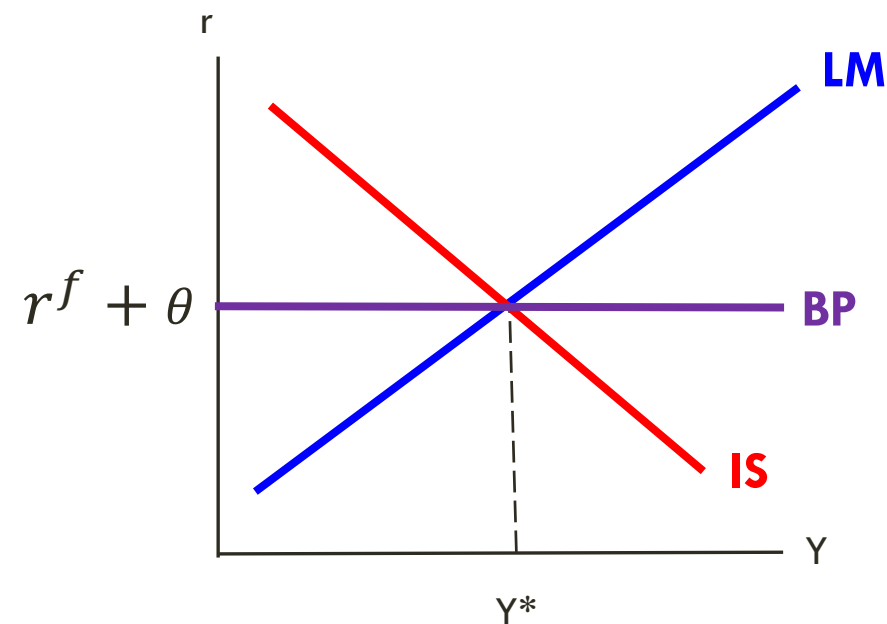
# EXTERNAL SHOCKS: BP SHOCKS

Case 7: Fed raises FED fund/ fixed exchange rate



# EXTERNAL SHOCKS: BP SHOCKS

Case 8: Fed raises Fed fund / flexible exchange rate



# HOW SHOCKS GET AMPLIFIED...

| Origin                | Fixed                | Flexible             |
|-----------------------|----------------------|----------------------|
| 1. Domestic shocks    |                      |                      |
| IS shocks             | Amplified (1)        | <b>Insulated (2)</b> |
| LM shocks (financial) | <b>Insulated (3)</b> | Amplified (4)        |
|                       |                      |                      |
| 2. External shocks    |                      |                      |
| IS shocks             | Amplified (5)        | <b>Insulated (6)</b> |
| BP shocks (financial) | Amplified (7)        | Amplified (8)        |

# POLICY UNDER OPEN- ECONOMY

# POLICY UNDER OPEN-ECONOMY

- Policy can be used to **fix the imbalances.**
  - CA deficits with too high unemployment → Fixing the imbalances
- Possible choices of policy include
  - Exchange rate policy
  - Fiscal policy and fiscal policy.
- **Policy effectiveness issue revisited.**

# EXCHANGE RATE POLICY

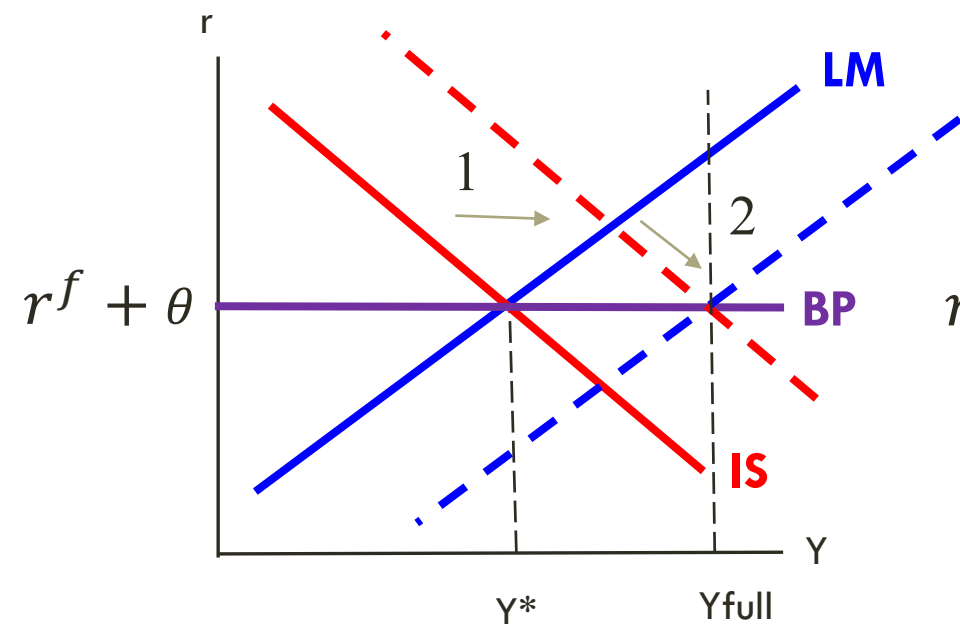
- Usable when country initially adopts the **fixed exchange rate regime**.
- The central bank sets the nominal exchange rate at a fixed (official) level
  - It stands ready to buy or sell foreign currency at the fixed rate using its foreign exchange reserves.
- Overvalue/undervalue currency can occur as the fundamental of macroeconomy has changed, and hence causing some imbalances.

# EXCHANGE RATE POLICY

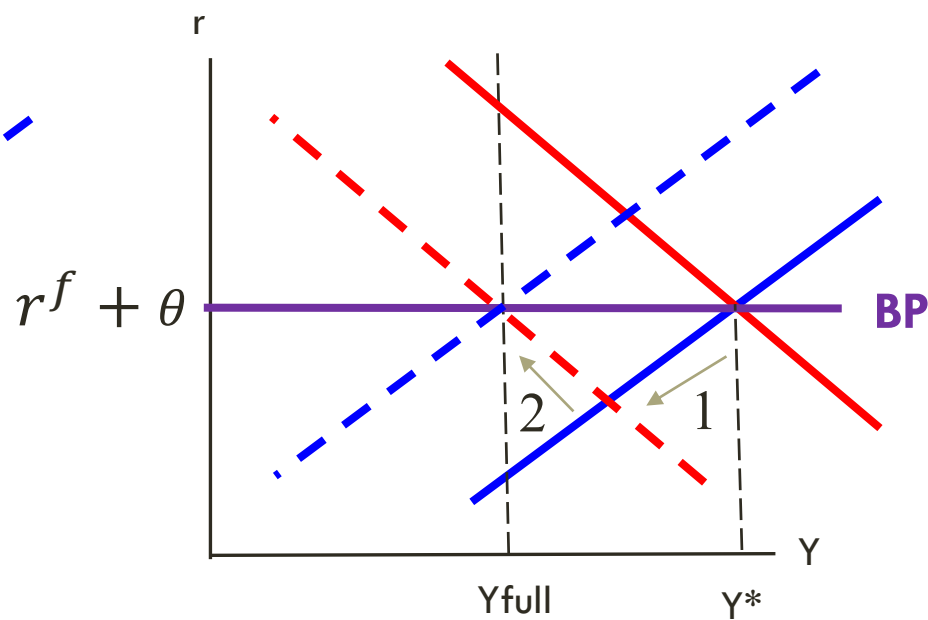
- Periodic realignments, e.g. **revaluation/devaluation**, can help fixing the imbalance through the so called “**expenditure-switching channel**”.
- Changing the **composition** of net exports, aggregate expenditure, and hence output.

# EFFECTS OF EXCHANGE RATE REALIGNMENT

Effect of devaluation



Effect of revaluation



# FISCAL AND MONETARY POLICY EFFECTIVENESS

- Unlike the closed-economy, effectiveness of fiscal and monetary policy also depends on the choices of exchange rate regime. (let alone the slope issue.)
- As we have seen before, propagation of shocks would vary across different exchange rate regimes, so the effect of policy as well.
- Policies under fixed exchange rate → policies under flexible exchange rate.

# POLICY EFFECTIVENESS

Perfect capital mobility world (BP horizontal)

| Policy          | Fixed exchange rate | Flexible exchange rate |
|-----------------|---------------------|------------------------|
| Fiscal policy   | Effective           | <i>Ineffective</i>     |
| Monetary policy | <i>Ineffective</i>  | Effective              |

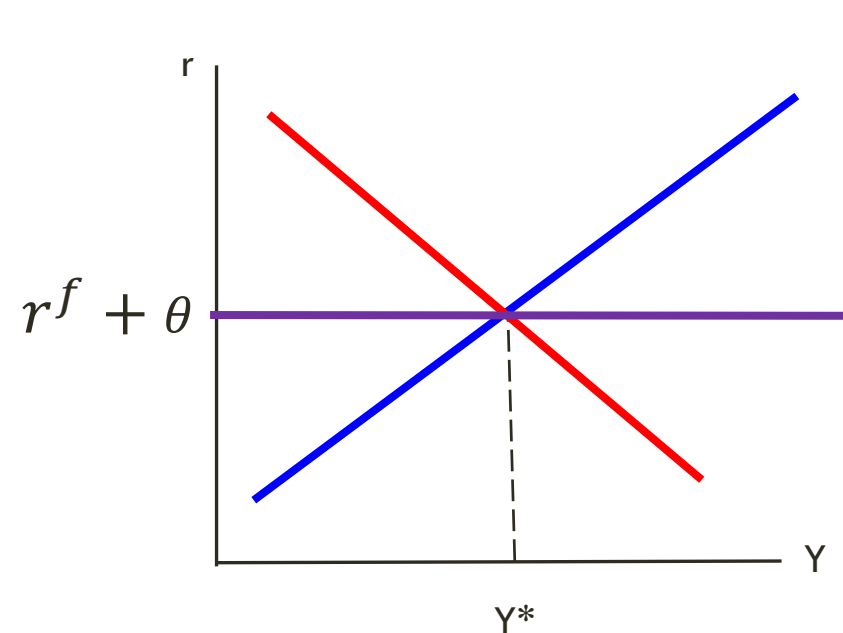
Imperfect capital mobility world (BP positive slope; **See Froyen / Assignment**)

| Policy          | Fixed exchange rate | Flexible exchange rate |
|-----------------|---------------------|------------------------|
| Fiscal policy   | ???                 | ???                    |
| Monetary policy | ???                 | ???                    |

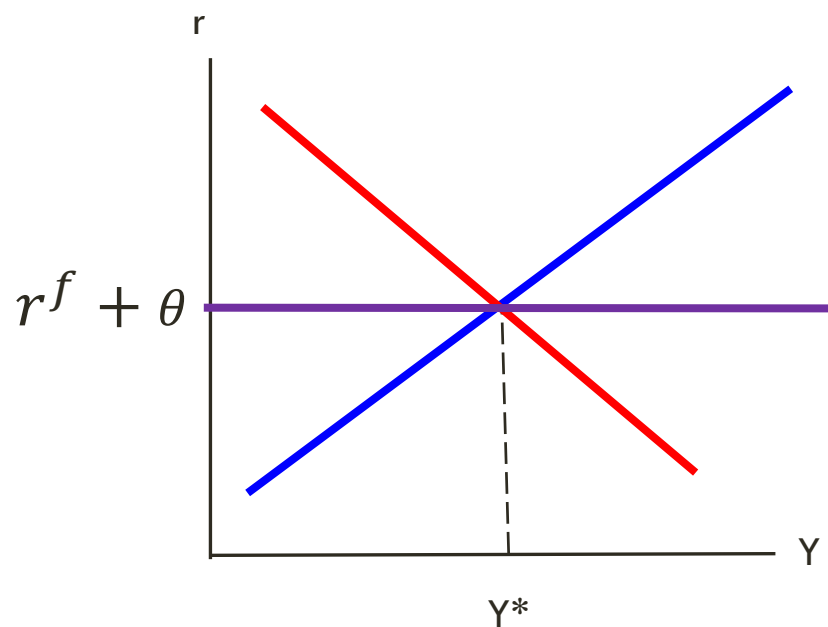
# FISCAL POLICY: PERFECT MOBILITY

Fiscal instruments:  $G$ ,  $T$

Changes in  $G$  (or  $T$ ) cause a shift in IS curve. (ex. expansionary fiscal policy)



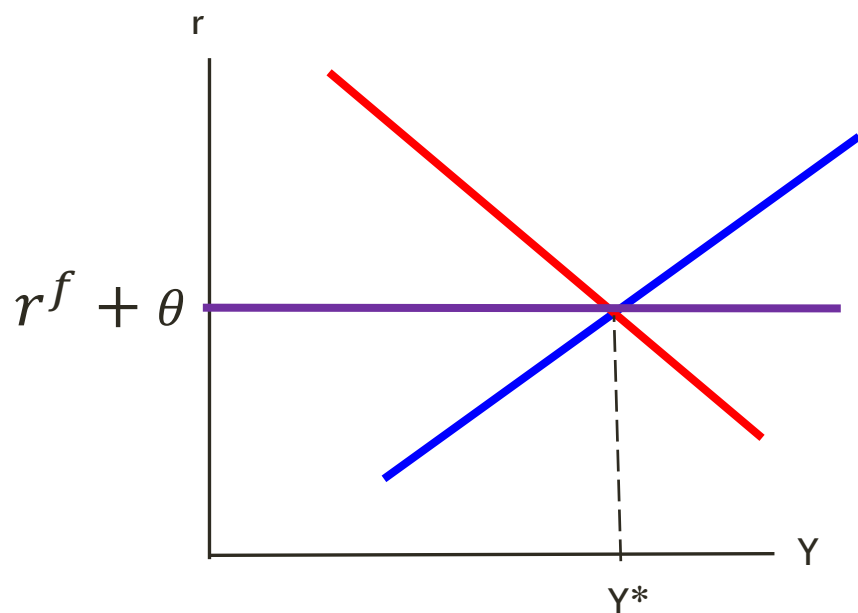
Fixed exchange rate



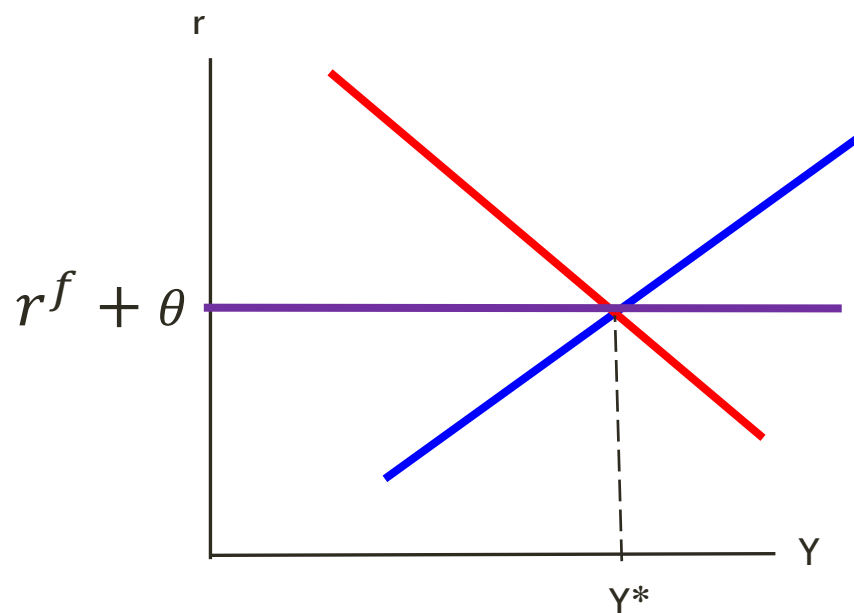
Flexible exchange rate

# MONETARY POLICY: PERFECT MOBILITY

Restrictive monetary policy



Fixed exchange rate



Flexible exchange rate

# CASE STUDY: IMPOSSIBLE TRINITY

- Designing macroeconomic landscape and policies were aimed at ensuring the “**Ideal conditions**”:
- **Stable exchange rate:** exchange is not volatile → **Fixed exchange rate**
  - **Stable/efficient financial sector:** enjoy benefit from world financial market → **Fully financial integration / capital mobility**
  - **Monetary stability:** having sovereign authority to control money supply and hence inflation → **having ability to control domestic interest and hence inflation.**

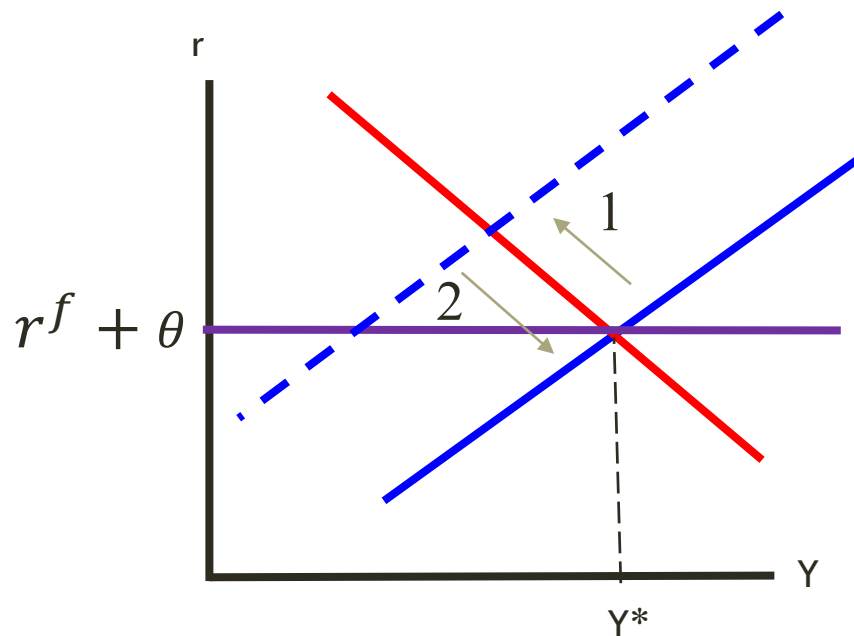
# CAN WE ACHIEVE ALL THREE?

➤ Can we really achieve all these? Are there any concerns?

- Robert A. Mundell (1963) “*theoretically*” showed a long time ago that these three choices of control are **not feasible at the same time**
  - Getting two out of three!
- However, policymakers thought that they could resist the natural force by the management so called ***sterilization policy***
  - Practical experiences had showed that they failed!

# CAN WE ACHIEVE ALL THREE?

Sterilization policy at work: suppose an emerging market country is running a surplus BOP, due to a high interest rate policy



Fixed exchange rate

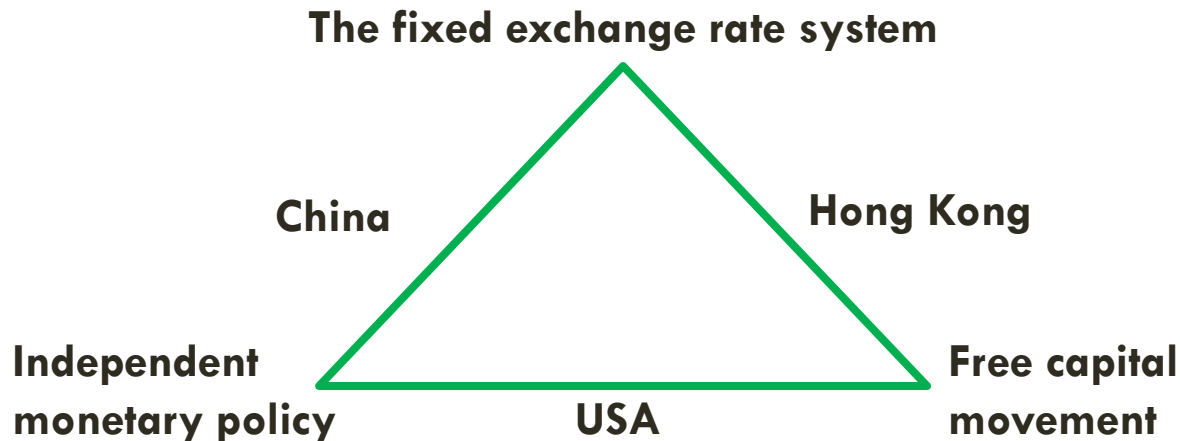
- At (1), we have  $BOP > 0$ .
- To fixed exchange rate, money supply will rise.
- To prevent the economy moving from (1) back to (2), central bank simultaneously conducts OMO sale, to counteract and prevent money supply from rising.

# STERILIZATION POLICY

- The central bank may prevent the expansion of the money supply by draining domestic currency back from the circulation.
  - Selling bonds to the public; keep the interest rate high
  - As the domestic interest rate remains above  $r^f + \theta$ , CB will have to keep accumulating FX --- rising FX reserves.
- Sounds good, but **policy is actually costly**.
  - Most central banks keep their foreign reserve in terms of hard-currency government bond.
    - CB is swapping **high-return assets** for **low-return assets**.
  - In many cases, CB needs to issue **CB's bond** to absorb the liquidity; incurring cost!
- At the end, an independent monetary policy is **self-defeating**;

# IMPOSSIBLE TRINITY

- **Trilemma: it is impossible to conduct all three policies at the same time; Mundell (1963)**



- **Ex:** Mexican peso crisis (1994-95), **Asian financial crisis (1997-98)**, Argentinian financial collapse (2001-2002).