

Chapter 6 : Framework for Open-Economy Business Cycle

EE312 1/2020 (for Section 046401)

Read: Froyen Ch.14-15

September 2020

Contents

1 Foreign sector and IS-LM-BP Framework	2
1.1 Open-Economy IS cuve	2
1.2 Open-Economy LM curve : same as closed-economy case, but it will be affected by BP position.	2
1.3 The BP line	3
1.4 Exchange rate on IS curve	5
2 The Mundell-Fleming model	6
3 Policy Effectiveness	8
3.1 Policy Effectiveness under the fixed exchange rate regime	8
3.2 Policy effectiveness under flexible exchange rate regime	12
4 Shocks and Propogations	13
4.1 Domestic Real Shocks	14
4.2 Domestic Financial Shocks	14
4.3 External Real Shocks	14
4.4 External Financial Shocks	15
4.5 Required policy response to shocks	15
4.6 Evaluation: flexible ER regime	17

1 Foreign sector and IS-LM-BP Framework

- Three interconnected markets
 1. Goods Market = IS
 2. Money Market = LM
 3. International Transation = BP

Equilibrium takes place for (r, Y) that satisfy equilibrium in all three markets

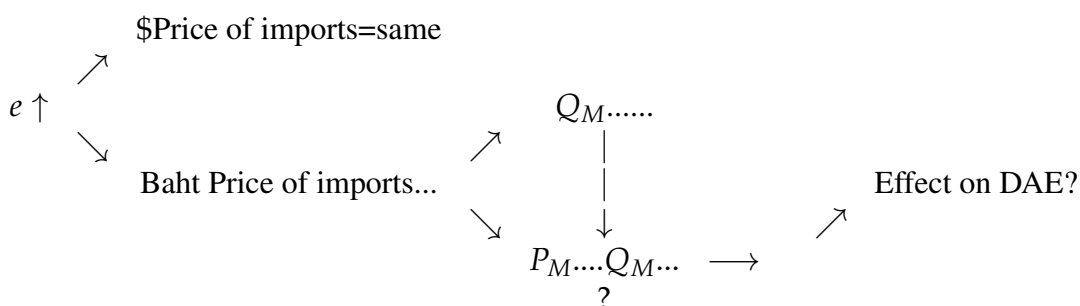
- $X - M$ and F (net capital flow) have **no direct** effect on the money market (and LM curve).
- Net exports $(X - M)$ is part of aggregate expenditure (DAE and IS curve).
 - An increase in $(X - M)$ raises DAE and shifts IS right.
 - Exports are determined by foreign income (Y^f) and exchange rate (e) .
 - Imports are determined by domestic income (Y) and exchange rate (e) .

1.1 Open-Economy IS cuve

$$\begin{aligned}
 C + S + T &= C + I + G + (X - M) = Y \\
 S + T &= I + G + (X - M) \\
 S + T + M &= I + G + X \\
 &=
 \end{aligned}$$

Where $\frac{\partial M}{\partial Y} \dots 0$; $\frac{\partial M}{\partial e} \dots 0$, when $|\epsilon_M^d| > 1$

and $\frac{\partial X}{\partial Y} \dots 0$; $\frac{\partial X}{\partial e} \dots 0$



- $e \uparrow \Rightarrow$ If $|\epsilon_M^d| > 1 \Rightarrow P_M Q_M \dots$ and $X \dots \Rightarrow$ DAE $\dots \Rightarrow$ IS $\dots$

1.2 Open-Economy LM curve : same as closed-economy case, but it will be affected by BP position.

1.3 The BP line

1.3.1 Developing BP line

- Combinations of the real interest rate and output which keep the balance of payments in equilibrium.
- The balance of payments is in equilibrium when Balance of Payments = 0.

$$BP = X - M + F$$

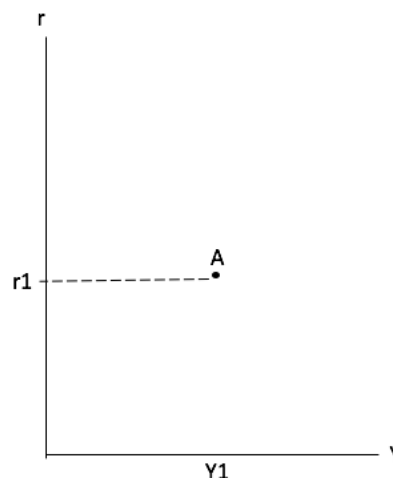
$$= X(Y^f, e) - M(Y, e) + F(r - r^f)$$

- where $\frac{dF}{dr} > 0$, given r^f .
- Small open economy: the country's economic activity has no influence on the world prices of goods.

BP equation : $X - M + F = 0$; where $\frac{dF}{dr} > 0$, given r^f .

$r \uparrow \Rightarrow$ Net Capital Inflow $F(r, r^f) \dots \dots \Rightarrow (X - M) + F = BP = 0 \Rightarrow M \text{ must} \dots \leftarrow Y \dots$

- On BP : $X(Y^f, e) - M(Y, e) + F(r, r^f) = 0$, BP is equal to zero.
- Above BP : $X(Y^f, e) - M(Y, e) + F(r, r^f) \dots \dots 0$, BP $\dots \dots$
 - the same X-M as A (with same Y_1)
 - $r > r^*$, has more F.
 - So at B, $BP > 0$.
- Below BP : $X(Y^f, e) - M(Y, e) + F(r, r^f) \dots \dots 0$, BP $\dots \dots$



1.3.2 Slope of BP line

- The slope of BP line depends on the sensitivity of capital flow (F) with respect to the domestic interest rate (r), given the foreign rate (r^f).

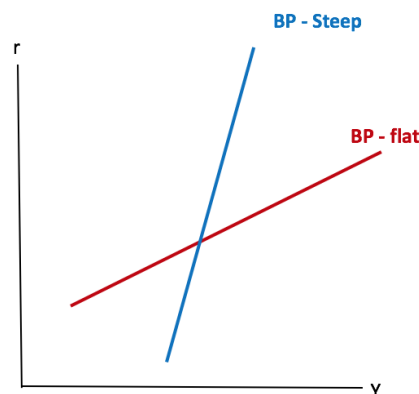
– Sensitivity = degree of capital mobility

– High degree of capital mobility

$r \uparrow \Rightarrow \text{Net Capital Inflow } F(r, r^f) \uparrow \dots \Rightarrow (X - M) + F = BP = 0 \Rightarrow M \text{ must } \uparrow \dots \Rightarrow Y \uparrow \dots \Rightarrow \text{BP is } \dots$

– Low degree of capital mobility

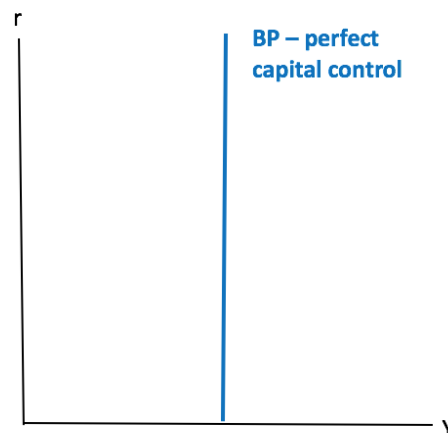
$r \uparrow \Rightarrow \text{Net Capital Inflow } F(r, r^f) \uparrow \dots \Rightarrow (X - M) + F = BP = 0 \Rightarrow M \text{ must } \uparrow \dots \Rightarrow Y \uparrow \dots \Rightarrow \text{BP is } \dots$



- High sensitivity = high degree of capital mobility = flat BP.
- Low sensitivity = low degree of capital mobility = steep BP.

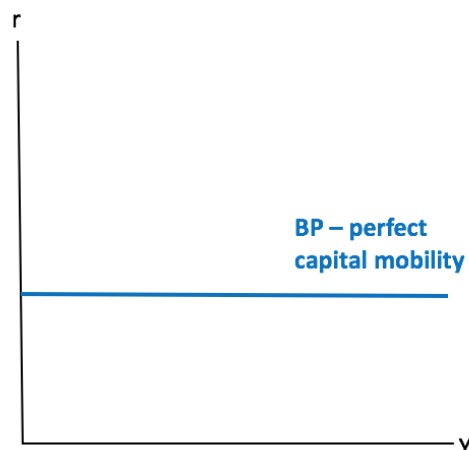
• Perfect capital control : BP is vertical

- Whenever $r > r^f \Rightarrow \dots \Rightarrow r \dots$
- Whenever $r < r^f \Rightarrow \dots \Rightarrow r \dots$
- At A, $BP = 0$.
- At B, $BP \dots 0$, infinite capital inflow
- At C, $BP \dots 0$, infinite capital outflow



• Perfect capital mobility : BP is horizontal

- Whenever $r > r^f \Rightarrow \text{infinite capital } \dots \Rightarrow \dots \text{ domestic bonds} \Rightarrow r \dots \text{ until } \dots$
- Whenever $r < r^f \Rightarrow \text{infinite capital } \dots \Rightarrow \dots \text{ domestic bonds} \Rightarrow r \dots \text{ until } \dots$
- On BP, $BP = 0$.
- Above BP, $BP \dots 0$, infinite capital inflow
- Below BP, $BP \dots 0$, infinite capital outflow



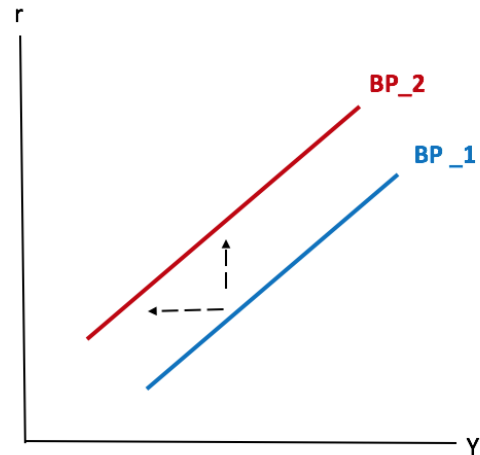
1.3.3 Shifting BP line

BP equation : $X - M + F = 0$; where $\frac{dF}{dr} > 0$, given r^f .

$r \uparrow \Rightarrow$ Net Capital Inflow $F(r, r^f)$ $\Rightarrow (X - M) + F = BP = 0 \Rightarrow M$ must..... $\Rightarrow Y$

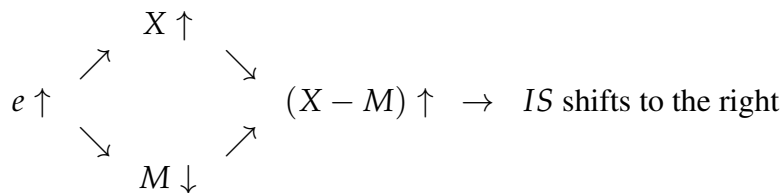
Leftward Shift

- *** higher r^f , Y for all r , or r for all Y . ***
- lower Y^f , Y for all r , or r for all Y .
- lower $REER = \frac{eP^*}{P}$, or import for all Y and export,
 Y for all r , r for all Y .



1.4 Exchange rate on IS curve

- Higher exchange rate (rising e):
 - The \$ price of exports is lower; more foreign demand for exports — exports (X) increases.
 - The domestic price of imports is higher; less demand for imports (assuming $|\varepsilon_M^d| > 1$) — imports (M) falls.
 - DAE increases; IS curve shifts right.



2 The Mundell-Fleming model

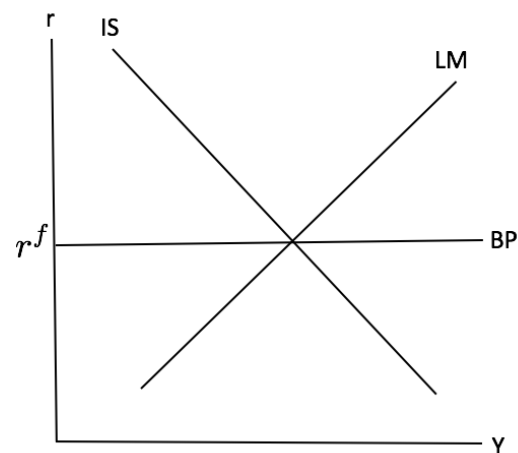
- Robert A. Mundell (1963), “Capital mobility and stabilization policy under fixed and flexible exchange rates,” Canadian J of Economics and Political Science 29, 475-85.
- Marcus J. Fleming (1962), “Domestic financial policies under fixed and under floating exchange rates,” IMF Staff Papers 9, 369-79.

A small-open economy and the shape of BP line

- The economy has no impact on the world.
- Perfect capital mobility; no barrier to capital movement.
- Assume price is constant.
- The domestic real interest rate is the same as the world rate ($r = r^f$).
- Any deviation causes huge capital movement. If $r > r^f$, huge capital inflow. If $r < r^f$, huge capital outflow.

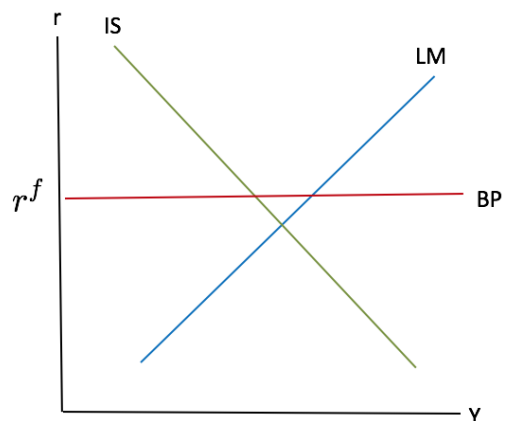
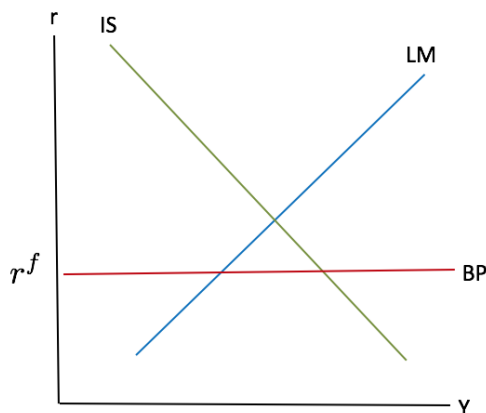
Notions of equilibrium concepts

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



- Internal Equilibrium : BP 0

- Internal Equilibrium : BP 0



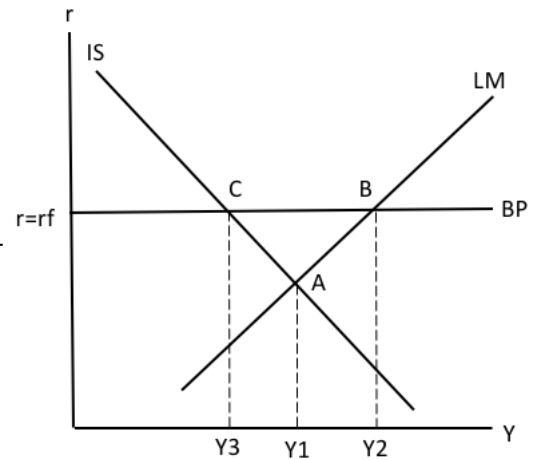
- **Given the Internal equilibrium, how does the economy reach the GE? Mechanism?**

- Answer depends on the choice of exchange rate regime.

- Under the fixed exchange rate, nominal exchange rate is fixed.
 - * The adjustment mechanism will work through money supply.
- Under the flexible exchange rate, nominal exchange rate is flexible.
 - * “e” will directionally move to clear the imbalance of BP.

● **Internal/External balance conflict :**

- Y_1 is desirable, but $BP < 0$; CB is losing FX reserves.
- Y_2 is too high (inflation) and Y_3 is too low (unemployment) although $BP = 0$.

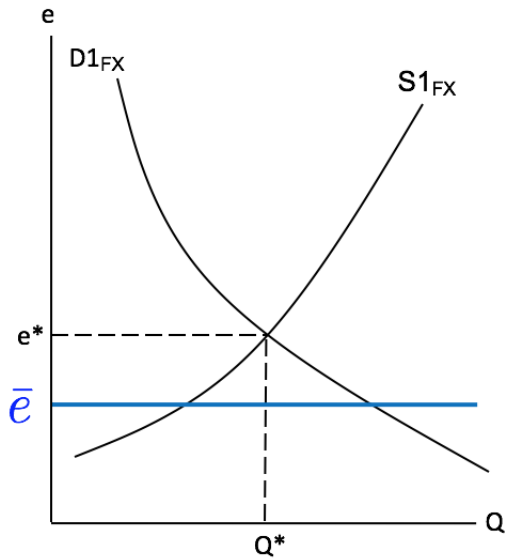


3 Policy Effectiveness

3.1 Policy Effectiveness under the fixed exchange rate regime

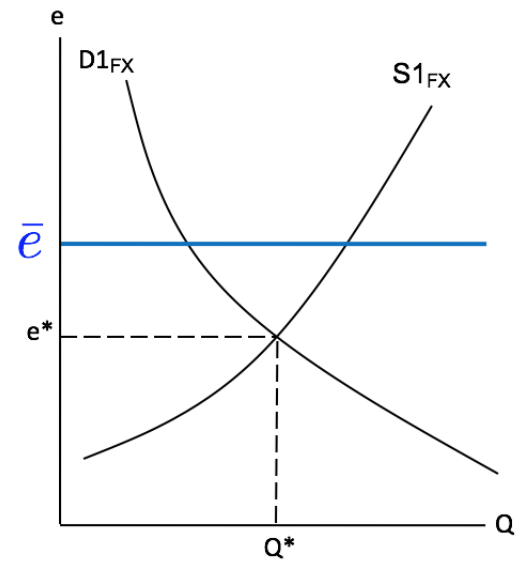
- Exchange Rate Market and Money Supply

Official rate e^f under e^*

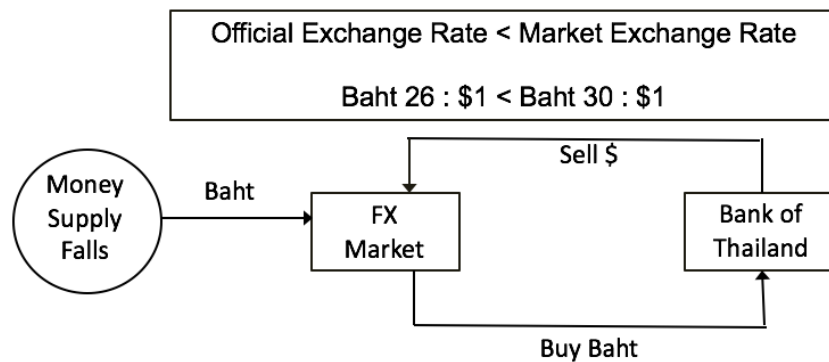


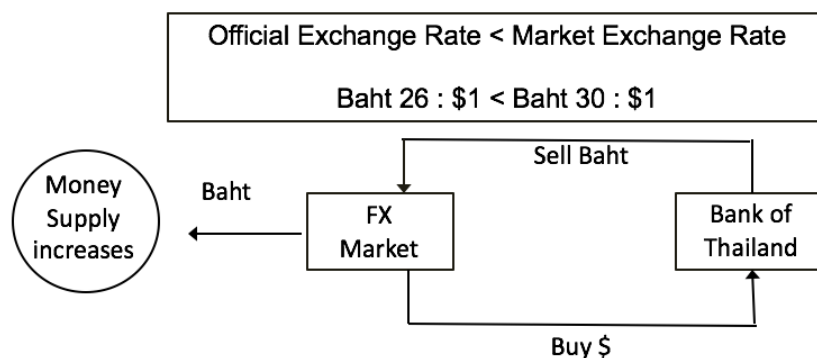
- Domestic currency is overvalued.
- Excess D for FX ; $BP < 0$.
- Central bank must sell FX to keep e^f .
- Domestic money supply falls.

Official rate e^f above e^*



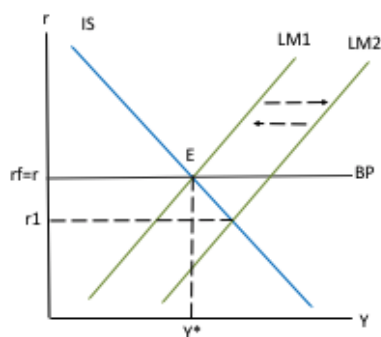
- Domestic currency is undervalued.
- Excess Supply for FX ; $BP < 0$.
- Central bank must buy FX to keep e^f .
- Domestic money supply rises.





$\bar{e} < e^*$,	Excess Demand	Central Bank sells FX	Money Supply ↓	BOP deficits
$\bar{e} > e^*$,	Excess Supply	Central Bank buys FX	Money Supply ↑	BOP Surplus

3.1.1 Monetary Policies under fixed exchange rate



- Initially the economy is at E. All three markets are clear. $\bar{e} = e^*$, real money supply is constant.
- Monetary policy: The central bank expands the money supply (LM shifts right).
- Domestic interest rate drops below the world rate (r^f) — huge capital outflow and $BP < 0$.
- More demand for FX; market exchange rate (e) tends to rise above the official rate.
- At new e^* , there is Excess Demand for FX
- The central bank must sell FX and buy domestic currency — the money supply decreases..
- LM shifts left.
- The domestic interest rate returns to $r = r^f$.
- $BP = 0$ at the same initial output (Y^*).

Notice:

1. Sterilization policy

- The central bank may prevent the contraction of the money supply by putting the domestic currency back into circulation.
- Buying bonds from the public.
- Forcing domestic interest rate below r^f with larger output ($Y > Y^*$).
- But the CB will keep losing FX — limited FX reserves.

2. Loss of money supply control

- The central bank cannot pursue an independent monetary policy under the fixed exchange rate regime.
 - If it increases M_s , the nominal exchange rate rises, forcing it to sell foreign currency and reduce M_s .
 - If it decreases M_s , e drops, forcing it to buy foreign currency and increase M_s .
- An independent monetary policy is self-defeating.

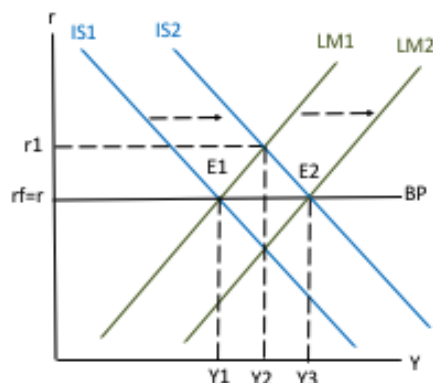
3. Impossible trinity

- Trilemma: it is impossible to conduct all three policies at the same time:
 - (1) The fixed exchange rate system
 - (2) Free capital movement
 - (3) Independent monetary policy

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

Monetary policy is ineffective under fixed exchange rate.

3.1.2 Fiscal policy with fixed ER



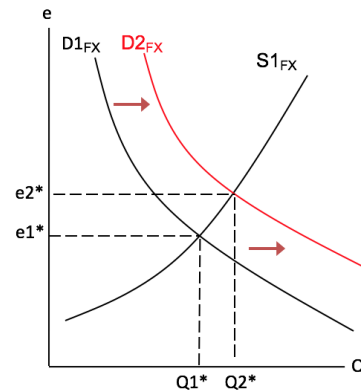
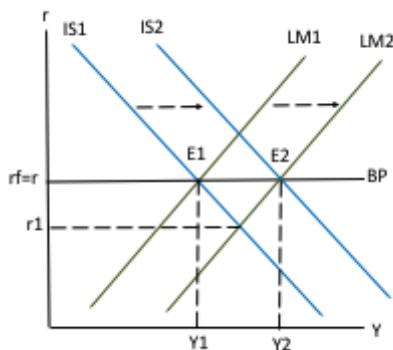
- Initially the economy is at E . All three markets are clear. $\bar{e} = e^*$, real money supply is constant.

- Government increases spending (G). IS shifts right.
- Aggregate expenditure and output increase ($AE = Y$), inducing more money demand (M^d).
- Domestic interest rate rises above r^f , causing huge capital inflow ($BP > 0$).
- More supply of FX forces the market exchange rate to fall below the official rate.
- Central bank buys FX and sells domestic currency. Money supply increases.
- LM shifts right.
- The domestic interest rate returns to $r = r^f$. $BP = 0$ at the same initial output (Y^*).

Fiscal policy is effective under fixed exchange rate.

3.2 Policy effectiveness under flexible exchange rate regime

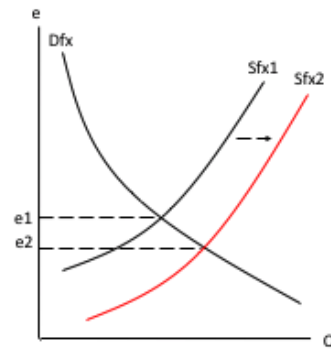
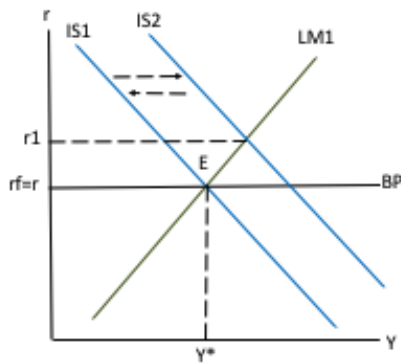
3.2.1 Monetary Policies under flexible exchange rate



- Initially the economy is at E. All three markets are clear. $e = e1^*$, real money supply is constant.
- Monetary policy: The central bank expands the money supply (LM shifts right).
- Domestic interest rate falls below r^f . Huge capital outflow ($BP < 0$); more demand for FX and nominal exchange rate (e) rises.
- Net exports ($X-M$) and AE increase (IS shifts right).
- Output increases from $Y1$ to $Y2$.
- Higher income raises money demand.
- Domestic interest rate rises to r^f .
- At E2, $BP = 0$ with higher income and higher exchange rate.
- More demand for FX**
 - Easy-money policy causes $BP < 0$ and more demand for FX.
 - The domestic currency depreciates.

Monetary policy is effective under flexible exchange rate regime.

3.2.2 Fiscal Policies under flexible exchange rate



- Initially the economy is at E. All three markets are clear. $e = e1^*$, real money supply is constant
- Government increases spending (G). IS shifts right.
- Aggregate expenditure (AE) and output (Y) increase.
- Money demand rises, raising domestic interest rate above r^f .— huge capital inflow and $BP > 0$.
- More supply of FX; exchange rate falls. Net exports and AE decrease. Output drops back; money demand falls.
- Domestic interest rate falls to r^f . $BP = 0$ at the same level of income (Y^*).
- Exchange rate is lower (appreciation of domestic currency).
- Higher G results in $BP > 0$ and more supply of FX.
- The domestic currency appreciates.

Fiscal policy is ineffective under flexible exchange rate regime.

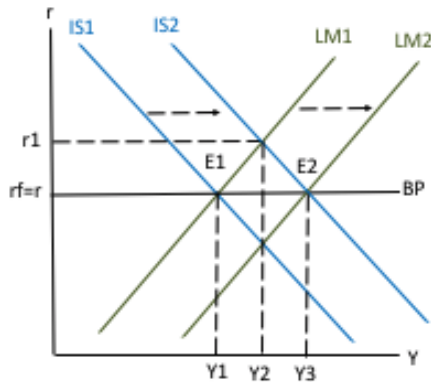
4 Shocks and Propagations

- Shocks :
 - Domestic shocks
 - Real shocks (IS)
 - Financial shocks (LM)
 - External shocks
 - Real shocks (IS)
 - Financial shocks (BP)

4.1 Domestic Real Shocks

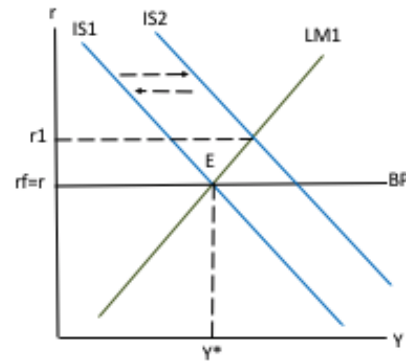
- IS shifts to the right : example , an improvement in business sentiment

Fixed Exchange Rate



Amplified/Insulated

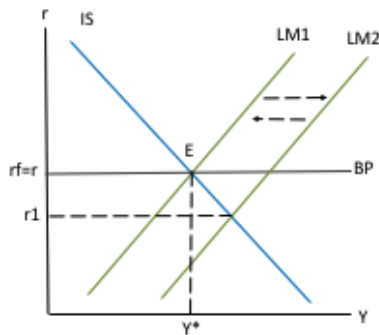
Flexible Exchange Rate



Amplified/Insulated

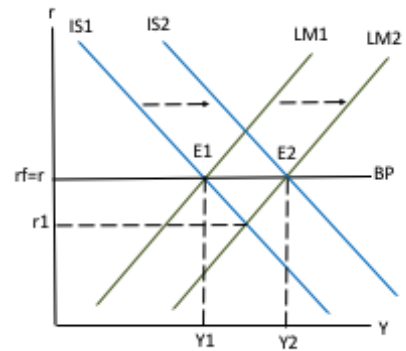
4.2 Domestic Financial Shocks

Fixed Exchange Rate



Amplified/Insulated

Flexible Exchange Rate

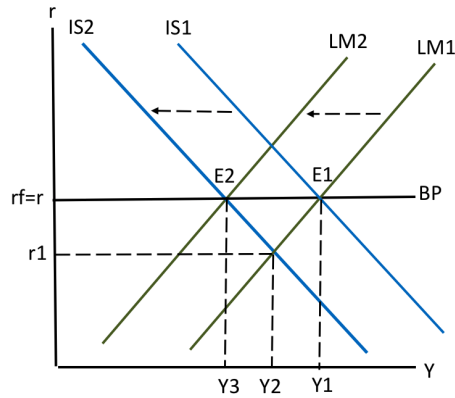


Amplified/Insulated

4.3 External Real Shocks

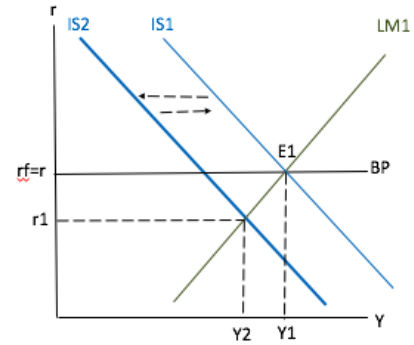
- World recession (falling world output) reduces foreign demand for exports (X).
 - Net exports ($X-M$) and DAE fall; IS shifts left.
 - Output drops and money demand decreases.
 - Domestic interest rate drops below r^f ; huge capital outflow and $BP < 0$.
 - More demand for FX; central bank sells FX and buys domestic currency.

Fixed Exchange Rate



Amplified/Insulated

Flexible Exchange Rate

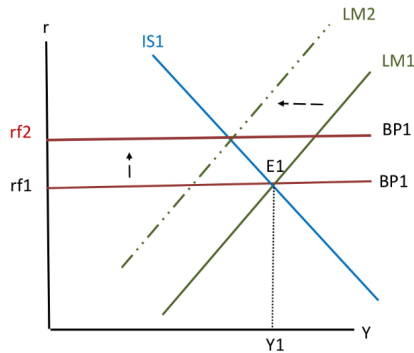


Amplified/Insulated

4.4 External Financial Shocks

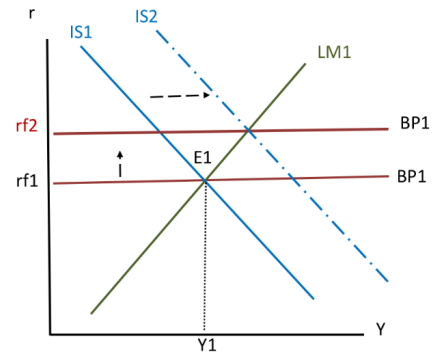
- Fed raises FED fund rate

Fixed Exchange Rate



Amplified/Insulated

Flexible Exchange Rate



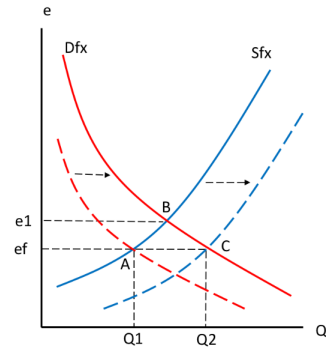
Amplified/Insulated

4.5 Required policy response to shocks

- When $r < r^f$ and $BP < 0$, government increases spending, shifting IS back to $Y1$.
- But how to know the magnitude of falling $X-M$ and DAE

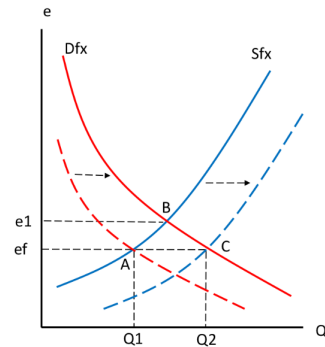
4.5.1 Official rate e^f under e^*

- More D_{fx} ; $BP < 0$; $e^f < e^1$
- Central bank must sell FX to keep e^f .
- Domestic money supply falls.
- Loss of official reserves = Q_1Q_2 .



Currency devaluation

- The shock is so large that FX losses are huge against limited FX reserves.
- Central bank devalues the currency to prevent FX reserves loss.



Cost of devaluation

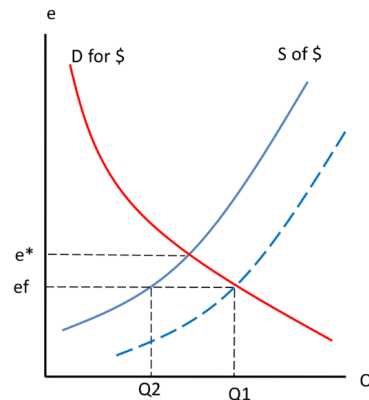
- Currency devaluation might reduce a current account deficit in the short run.
- Future shocks may cause the CA deficit to resume.
- The CA deficit is caused by real factors: Excessive government spending — spending cut.
- Costs of devaluation — foreign debt!

4.6 Evaluation: flexible ER regime

- Policy independence: Central bank can pursue internal policy independently.
- The FX market clears and $BP = 0$ by flexible FX adjustment.
- Insulation from real foreign shocks.
- External shocks affect the exchange rate w/o effects on domestic output.

4.6.1 Real foreign shock affects FX market

- Net exports drop. AE and Y are falling.
- M_d decreases; $r < r_f$, capital outflows and $BP < 0$.
- Less supply of FX; e rises.
- Net exports increase; IS_2 returns to IS_1 and Y_1 .



4.6.2 Criticism: Flexible ER

- Exchange rate risk and uncertainty in trade
 - FX Hedging is costly.
 - FX speculation exists.
- Exchange rate fluctuations:
 - Resources move in/out export sectors constantly.
 - Rising exchange rate means higher domestic inflation (rising import prices).
 - Falling exchange rate reduces competitive exports.

Fixed Exchange Rate Regime	Flexible Exchange Rate Regime
* No exchange rate risk, no FX hedging in trade. * No currency speculation.	* Policy independence * The FX market clears and $BP = 0$ * Insulation from real foreign shocks
* Potential conflict between internal and external balances. * No insulation from external shocks $\Rightarrow$ required policy response to shocks $\Rightarrow$ loss of foreign exchange reserve $\Rightarrow$ cost of devaluation	* Exchange rate risk and uncertainty in trade * FX Hedging is costly. * FX speculation exists. * Exchange rate fluctuations : Resources move in/out export sectors constantly. // Rising exchange rate means higher domestic inflation (rising import prices)// Falling exchange rate reduces competitive exports.