

MUNDELL - FLEMING MODEL OF INCOME DETERMINATION

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- **Describes the Income Determination and Effectiveness of Monetary and Fiscal Policy for a Small Open Economy using a Simple Keynesian Model**
- **Important Assumptions:** Small Open Economy
 - price of foreign goods in foreign currency (P^*) and world interest rate r_w are exogenous
 - import demand of domestic country is a function of her own income

- **Other Assumptions:**

- price of domestic goods in domestic currency (P) is exogenous
- expected inflation is zero \Rightarrow nominal interest rate (i) = real interest rate (r)
- expected depreciation of domestic currency is zero

- **Dornbusch model of Exchange Rate Overshooting:** Dynamic version of the Mundell-Fleming model

- analyzed the Income Determination for a small open economy under Rational Expectation with Endogenous Expected Inflation Rate and Expected Depreciation of Domestic Currency

Goods Market Equilibrium

IS Curve

- **Consumption:** depends positively on real income y with $mpc = \beta$

$$c = \beta y, 0 < \beta < 1$$

- **Investment:** depends negatively on real interest rate r

$$I = -\gamma r, 0 < \gamma < 1$$

- **Government Expenditure:** exogenous

$$g > 0$$

Goods Market Equilibrium

IS Curve

- **Export:** depends positively on real exchange rate $p = \frac{sP^*}{P}$,
 - s : nominal exchange rate defined as amount of domestic currency that can fetch one unit of foreign currency

$$X = \eta_1 p, 0 < \eta_1 < 1$$

- **Import:** depends positively on real income y and negatively on real exchange rate p

$$M = -\tilde{\eta}_2 p + \tilde{\eta}_3 y,$$

- **Assumption:** Net export depends positively on real exchange rate and negatively on real income, and **Marshall-Lerner condition holds**

$$NX = X - pM = \eta_1 p - \eta_2 y, 0 < \eta_2 < 1$$

Goods Market Equilibrium

IS Curve

- **Equation of IS for Open Economy:**

$$y = \beta y - \gamma r + g + \eta_1 p - \eta_2 y \quad (1)$$

- **Slope of Open Economy IS:**

$$\left(\frac{\partial r}{\partial y} \right)_{IS, Open} = - \left(\frac{1 - \beta + \eta_2}{\gamma} \right) < 0,$$

- **Slope of Closed Economy IS:** No Export and Import

$$\Rightarrow \eta_1 = \eta_2 = 0$$

$$\left(\frac{\partial r}{\partial y} \right)_{IS, Closed} = - \left(\frac{1 - \beta}{\gamma} \right) < 0$$

Goods Market Equilibrium

IS Curve

- **Comparison of the Slope of Open and Closed Economy IS:**

$$\frac{\left(\frac{\partial r}{\partial y}\right)_{IS, Open}}{\left(\frac{\partial r}{\partial y}\right)_{IS, Closed}} = \frac{1 - \beta + \eta_2}{1 - \beta} = 1 + \frac{\eta_2}{1 - \beta} > 1$$

- **Open Economy IS is steeper than Closed Economy IS**

Goods Market Equilibrium

IS Curve

- **Comparison of the Slope of Open and Closed Economy IS:** write equation (1) as

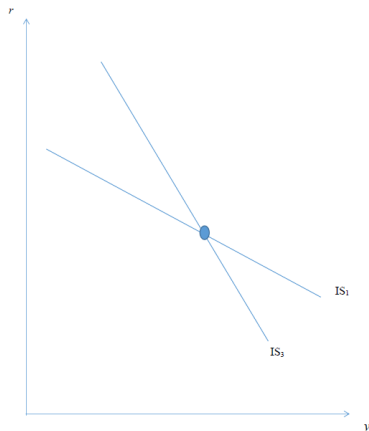
$$0 = -(1 + \eta_2 - \beta)y - \gamma r + g + \eta_1 p \quad (2)$$

- **Unit increase in real income (y) reduces the RHS of equation (2) by $(1 + \eta_2 - \beta)$ for open economy and $(1 - \beta)$ unit for closed economy with $(1 + \eta_2 - \beta) > (1 - \beta)$.**
 - **higher reduction of RHS is due to the extra leakage through import induced by a rise in real income**
- Investment has to increase more for the open economy than that of the closed economy to keep the goods market in equilibrium \Rightarrow **Real interest rate has to fall more for the open economy than that of the closed economy to keep the goods market in equilibrium.**

Goods Market Equilibrium

IS Curve

- IS_1 : Closed Economy IS
- IS_3 : Open economy IS



Money Market Equilibrium

LM Curve

- **LM curve for both Open and Closed Economy:**

$$M - P = l_1 y - l_2 r, \quad l_1 > 0, l_2 > 0 \quad (3)$$

- **Slope of LM:**

$$\left(\frac{\partial r}{\partial y} \right)_{LM} = \frac{l_1}{l_2} > 0$$

Balance of Payment

BP Curve

- **Balance of Payment (BOP) Identity:** Current Account (CA) plus Capital Inflow (KI) equals to change in Net Foreign Asset of Central Bank (ΔNFA_{CB})

$$CA + KI = \Delta NFA_{CB}$$

- **Current Account:** Trade Balance/Net Export (NX) plus Interest Income from Net Foreign Assets ($r_w B$) evaluated at world interest rate r_w

$$CA = \eta_1 p - \eta_2 y + r_w B$$

- Current Account depends positively on p and r_w and negatively on y
- **Capital Inflow (KI):** depends positively on the domestic and foreign interest rate differential ($r - r_w$)

$$KI = \theta (r - r_w), \theta > 0$$

Balance of Payment

BP Curve

- **Balance of Payment (BOP) Equilibrium:** Current Account (CA) plus Capital Inflow (KI) equals to change in Net Foreign Asset of Central Bank (ΔNFA_{CB})

$$\begin{aligned} BP &= CA + KI = 0 \\ &= \eta_1 p - \eta_2 y + r_w B + \theta (r - r_w) = 0 \end{aligned} \quad (4)$$

- BOP equilibrium $\Rightarrow BP = 0 \Rightarrow \Delta NFA_{CB} = 0 \Rightarrow$ Net Foreign Asset of Central Bank unchanged

Balance of Payment

BP Curve

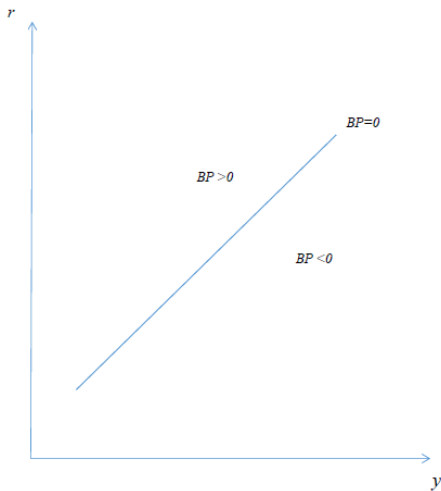
- Slope of $BP = 0$ curve

$$\left(\frac{\partial r}{\partial y} \right)_{BP=0} = \frac{\eta_2}{\theta} > 0$$

Balance of Payment

BP=0 Curve for Imperfect Capital Mobility

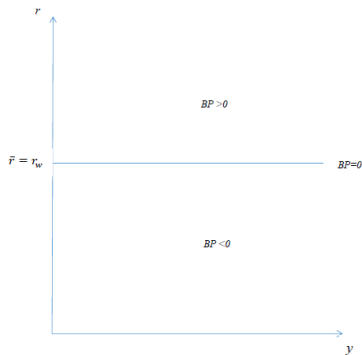
- $\theta > 0 \Rightarrow \left(\frac{\partial r}{\partial y} \right)_{BP=0} > 0$



Balance of Payment

BP=0 Curve for Perfect Capital Mobility

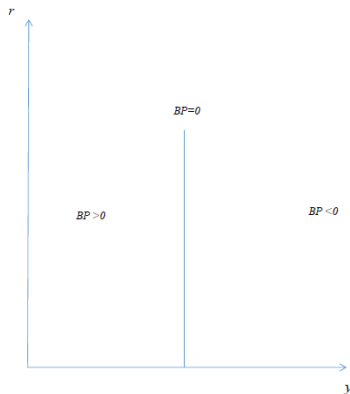
- $\theta \rightarrow \infty \Rightarrow \left(\frac{\partial r}{\partial y} \right)_{BP=0} = 0$



Balance of Payment

BP=0 Curve for No Capital Mobility

- $\theta \rightarrow 0 \Rightarrow \left(\frac{\partial r}{\partial y} \right)_{BP=0} \rightarrow \infty$



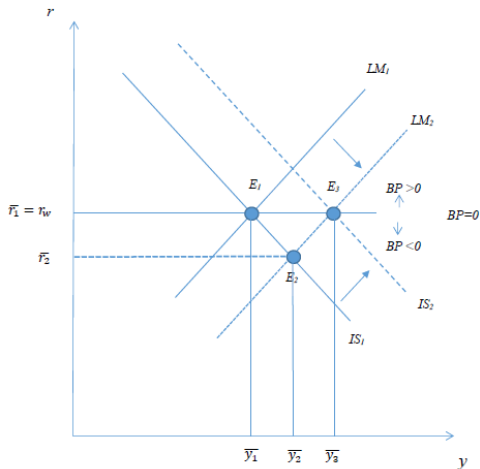
- **Interest rate Parity Condition:** Assets have Identical Return Internationally

$$r - r_w = s' - s \quad (5)$$

- r : domestic interest rate, r_w : foreign interest rate
- s' : future nominal exchange rate, s : spot nominal exchange rate

Effectiveness of Monetary Policy

Perfect Capital Mobility and Flexible Exchange Rate



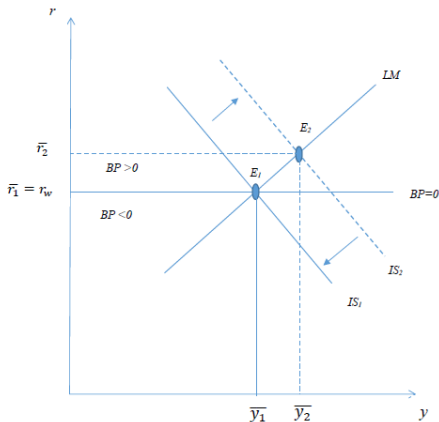
Effectiveness of Monetary Policy

Perfect Capital Mobility and Flexible Exchange Rate

- **Initial Equilibrium E_1 :** intersection among IS_1 , LM_1 and $BP = 0$
 - money supply M_1 , domestic interest rate $\bar{r}_1 = r_w$, real income \bar{y}_1 and BOP in equilibrium
- **Temporary Equilibrium E_2 :** intersection between IS_1 and LM_2 with BOP in deficit
 - money supply $M_2 > M_1$, domestic interest rate $\bar{r}_2 < \bar{r}_1 = r_w$, real income $\bar{y}_2 > \bar{y}_1 \Rightarrow$ capital outflow and reduction in net export due to import rise \Rightarrow BOP deficit (from equation (4))
 - people would like to buy dollar denominated assets \Rightarrow domestic currency/exchange rate depreciates (from the interest rate parity condition given in equation (5)) \Rightarrow net export rises
 - shifts IS curve from IS_1 to IS_2
- **Final Equilibrium E_3 :** intersection among IS_2 , LM_2 and $BP = 0 \Rightarrow$ with $\bar{y}_3 > \bar{y}_2 > \bar{y}_1 \Rightarrow$ **completely effective monetary policy**

Effectiveness of Fiscal Policy

Perfect Capital Mobility and Flexible Exchange Rate



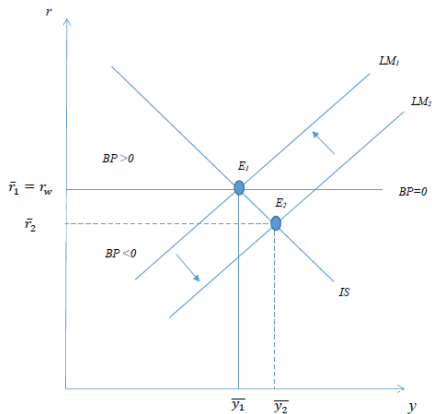
Effectiveness of Fiscal Policy

Perfect Capital Mobility and Flexible Exchange Rate

- **Initial Equilibrium E_1 :** intersection among IS_1 , LM and $BP = 0$
 - government spending g_1 , domestic interest rate $\bar{r}_1 = r_w$, real income \bar{y}_1 and BOP in equilibrium
- **Temporary Equilibrium E_2 :** intersection between IS_2 and LM with BOP in surplus
 - government spending $g_2 > g_1$, domestic interest rate $\bar{r}_2 > \bar{r}_1 = r_w$, real income $\bar{y}_2 > \bar{y}_1 \Rightarrow$ import rises and net export falls
 - capital inflow rises due to interest rate rise and it dominates the reduction in net export due to income rise \Rightarrow BOP surplus (from equation (4))
 - people would like to buy rupee denominated assets \Rightarrow domestic currency/exchange rate appreciates (from interest rate parity condition given in equation (5)) \Rightarrow net export falls \Rightarrow IS curve shifts back to its original position (from IS_2 to IS_1)
- **Final equilibrium $E_1 \Rightarrow$ completely ineffective fiscal policy**

Effectiveness of Monetary Policy

Perfect Capital Mobility and Fixed Exchange Rate



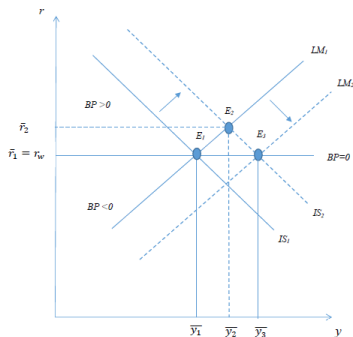
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 - people would like to buy dollar denominated assets \Rightarrow puts pressure on domestic currency/exchange rate to depreciate (from interest rate parity condition given in equation (5))
 - central bank buy domestic currency and sell foreign currency to maintain fixed exchange rate $\Rightarrow \Delta NFA_{CB}$ falls \Rightarrow money supply falls from M_2 to $M_1 \Rightarrow$ shifts LM back from LM_2 to LM_1
- **Final equilibrium $E_1 \Rightarrow$ completely ineffective monetary policy**

Effectiveness of Fiscal Policy

Perfect Capital Mobility and Fixed Exchange Rate



Effectiveness of Fiscal Policy

Perfect Capital Mobility and Fixed Exchange Rate

- **Initial Equilibrium E_1 :** intersection among IS_1 , LM_1 and $BP = 0$
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Effectiveness of Fiscal Policy

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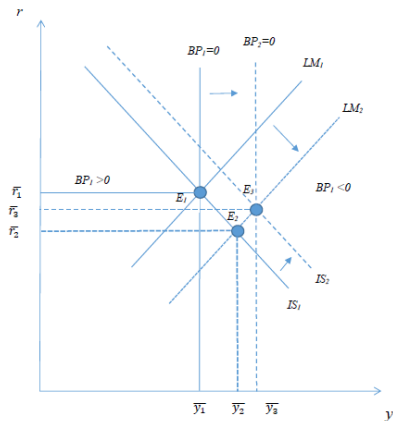
- **Temporary Equilibrium E_2 :** intersection between IS_2 and LM_1 with BOP in surplus
 - government spending $g_2 > g_1$, domestic interest rate $\bar{r}_2 > \bar{r}_1 = r_w$, real income $\bar{y}_2 > \bar{y}_1$
 - capital inflow due to interest rate rise dominates the reduction in net export due to income rise \Rightarrow BOP surplus (from equation (4))
 - people would like to buy more rupee denominated asset \Rightarrow puts pressure on domestic currency/exchange rate to appreciate (from interest rate parity condition given in equation (5))
 - central bank sells domestic currency and buy foreign currency to maintain fixed exchange rate $\Rightarrow \Delta NFA_{CB}$ rises \Rightarrow money supply rises from M_1 to $M_2 \Rightarrow$ shifts LM curve from LM_1 to LM_2
- **Final Equilibrium E_3 :** intersection among IS_2 , LM_2 and $BP = 0 \Rightarrow$ with $\bar{y}_3 > \bar{y}_2 > \bar{y}_1 \Rightarrow$ **completely effective fiscal policy**

- Interest Rate Parity condition given in equation **(5)** does not hold
- $\theta = 0 \Rightarrow BP = 0$ curve is vertical
- Closed capital market \Rightarrow purchase/sell of foreign capital not allowed but purchase/sell foreign currency allowed $\Rightarrow B = 0$ but $\Delta NFA_{CB} \neq 0$
- From equation **(4)**, BOP equilibrium \Rightarrow

$$BP = \eta_1 p - \eta_2 y = 0$$

Effectiveness of Monetary Policy

No Capital Mobility and Flexible Exchange Rate



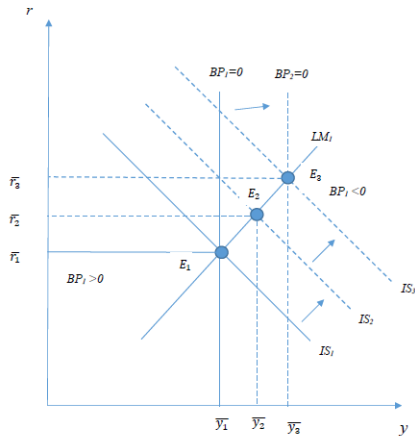
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- **Temporary Equilibrium E_2 :** intersection between IS_1 and LM_2 with BOP in deficit
 - money supply $M_2 > M_1$, domestic interest rate $\bar{r}_2 < \bar{r}_1$, real income $\bar{y}_2 > \bar{y}_1 \Rightarrow$ import rises, net export falls and BOP deficit (from equation (4))
 - everybody would like to hold foreign currency \Rightarrow domestic currency/exchange rate depreciates \Rightarrow net export rises
 - IS curve shifts from IS_1 to IS_2 and $BP_1 = 0$ shifts to $BP_2 = 0$ (as exchange rate is a shifter of both IS and $BP = 0$ curve)
- **Final Equilibrium E_3 :** intersection among IS_2 , LM_2 and $BP_2 = 0$ with $\bar{y}_3 > \bar{y}_2 > \bar{y}_1 \Rightarrow$ **effective monetary policy**

Effectiveness of Fiscal Policy

No Capital Mobility and Flexible Exchange Rate



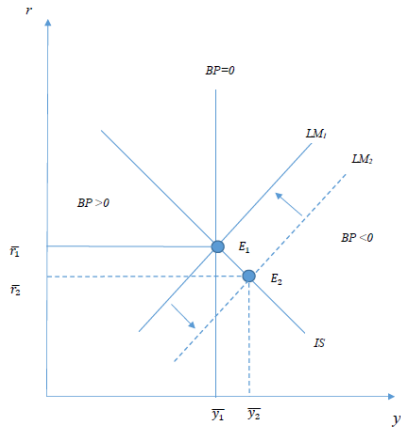
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 - everybody would like to hold foreign currency \Rightarrow domestic currency/exchange rate depreciate and net export rises
 - IS curve shifts from IS_2 to IS_3 and $BP_1 = 0$ curve shifts to $BP_2 = 0$ as exchange rate is a shifter of both IS and $BP = 0$ curve
- **Final equilibrium E_3 with $\bar{r}_3 > \bar{r}_2 > \bar{r}_1$ and $\bar{y}_3 > \bar{y}_2 > \bar{y}_1 \Rightarrow$ effective fiscal policy**

Effectiveness of Monetary Policy

No Capital Mobility and Fixed Exchange Rate



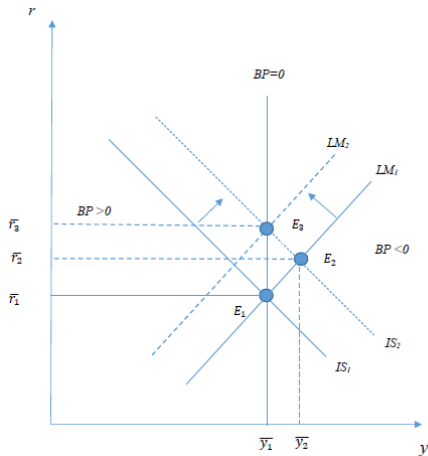
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- **Final equilibrium $E_1 \Rightarrow$ completely ineffective monetary policy**

Effectiveness of Fiscal Policy

No Capital Mobility and Fixed Exchange Rate



Effectiveness of Fiscal Policy

No Capital Mobility and Fixed Exchange Rate

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