Check your understanding: The IS-LM-BP model

EC 140

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A simplified discussion of the IS-LM-BP model.

IS-LM-BP

- Mundell-Fleming Model based on idea that capital flows must offset trade deficits for stable international reserves.
- Speed of capital flows depends on perceptions as captured by F.
- The same differences in interest rate between two countries can cause very different movement in international capital flows.
- Without perfect capital mobility, there are *unequal interest rates in countries even without capital controls.*
- From the SAM equation

$$Y = C + I + G + N_x \tag{1}$$

  Where G = *government expenditure* including government wages.
- The behavioral equation for C = *consumption* is

$$C = \bar{C} + c(1 - t)Y \tag{2}$$

  where $\bar{C}$ is autonomous consumption, c the marginal propensity to consume and t is the proportional tax rate.
- The behavioral equation for I = *investment* is

$$I = \bar{I} - bi \tag{3}$$

  where $\bar{I}$ is the autonomous level of investment and b is the effect of the interest rate, i, on the level of investment.
- The behavioral equation for N_x *net exports* or the trade balance is

$$N_x = Ee_r^{\gamma} - e_r mY \tag{4}$$

  where the autonomous component in the trade balance is $\bar{E}$ and the real exchange rate is

$$e_r = ep^*/P \tag{5}$$

  where e is the nominal exchange rate, p^*, the foreign price and P is the domestic price level (GDP deflator). The marginal propensity to import is m. The responsiveness of exports to real exchange rate is given by γ.

- The *LM* curve balances the supply and demand for money in the portfolio of wealth held by the private sector. It is given by

$$kY - h(i - i^*) = M_s/P \tag{6}$$

  where k is the *transaction coefficient* and h is the speculative coefficient. The foreign interest rate is denoted i^*. The money supply is M_s and p is the price level.

- The *BP* curve captures the balance of payments in the model. It is the sum of the current account balance and the capital account balance. The equation is satisfied when the *change in reserves is zero*

$$N_x + F(i - i^*) = 0 \tag{7}$$

  where F is the capital flow parameter.

Fixed exchange rates

- In fixed exchange rates, the money supply is endogenous. If there is an inflow of capital or an increase in exports, then the money supply will increase and vice-versa. Therefore equation 9 *floats*, that is the i, Y equilibrium is determined by the combination of the *IS* and *BP* curves. With i and Y known, the supply of money, M_s/P is determined by the *LM* equation.

- In *fixed* exchange rates, the model consists of the 7 equations, 1-7. The variable list is $V(Y, C, I, N_x, e_r, M_s, i)$. The parameter list is $P(\bar{C}, c, t, G, \bar{I}, b, \bar{E}, \gamma, e, p^*, P, m, i^*, k, h)$.

Flexible exchange rates

- In *flexible* exchange rates, the model consists of the same 7 equations, but with e now as variable and M_s as a parameter. The variable list is $V(Y, C, I, N_x, e_r, e, i)$. The parameter list is $P(\bar{C}, c, t, G, \bar{I}, b, \bar{E}, \gamma, e, p^*, P, m, i^*, k, h, M_s)$.

- With *perfect capital mobility* the *BP* curve drops out and we have $i = i^*$

IS, LM and BP curves

The IS curve

- IS Curve: *combinations of income and the interest rate such that savings equals investment.*

- In other words, for a given level of income, what is the level of interest that makes investment equal to the sum of savings?

- This is the locus of equilibria in the *goods market*.
- The IS curve is the *reduced form* of equations above. It is obtain by substituting upward:

$$Y = \frac{\bar{A} - bi + N_x}{[1 - c(1-t)]} = \alpha(\bar{A} - bi + N_x)$$

where $\bar{A} = \bar{C} + \bar{I} + G$ is a catch-all parameter, and the "simple Keynesian multiplier", or

$$\alpha = \frac{1}{[1 - c(1-t)]}$$

- To get the graphical definition of the IS curve

$$i = -\frac{Y}{\alpha b} + \bar{A}/b + N_x/b \quad (8)$$

Here the slope of the IS curve is $-1/\alpha b$ and the intercept is $\bar{A}/b + N_x/b$.

The LM curve

- To get the graphical LM curve, solve i in the last equation for i.

$$i = \frac{k}{h}Y - M_s/P + i^* \quad (9)$$

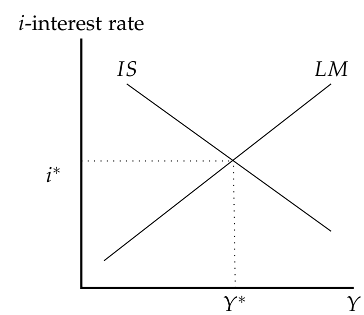

Figure 1: IS-LM

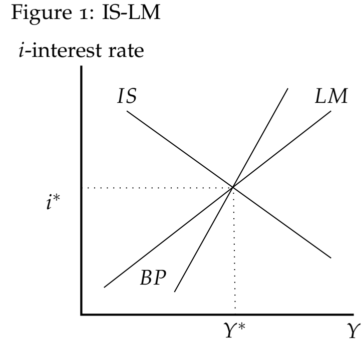

Figure 2: IS-LM-BP

BP curve

- If the interest rates are the same, then the capital account surplus is zero.

$$e_r m/FY - Ee_r^{\gamma}/F + i^* = i$$

where the slope is $e_r m/F > 0$ and the intercept is $-Ee_r^{\gamma}/F + i^*$ which may be of either sign.

Solving the Model-fixed exchange rates

- With *fixed* exchange rates, solve the IS and the BP together then let the LM curve determine the real value of the money supply. The IS curve is

$$Y = \alpha\bar{A} - \alpha bi + \alpha N_x$$

The BP curve is

$$N_x + F(i - i^*) = 0$$

Solving for the rate of interest i

$$i = i^* - N_x/F$$

and substituting this term into the IS

$$Y = \alpha\bar{A} - \alpha b i^* + \alpha b N_x / F + \alpha N_x$$

Clearing the fraction

$$YF = \alpha\bar{A}F - \alpha b i^* F + \alpha b N_x + \alpha N_x F$$

Combining the last two terms

$$YF = \alpha\bar{A}F - \alpha b i^* F + \alpha(b + F)N_x$$

Substituting the definition of net exports

$$Y = \alpha F\bar{A}F - \alpha b i^* F + \alpha(b + F)(\bar{E}e_r^\gamma - e_r mY)$$

Combining terms on Y

$$YF + \alpha(b + F)e_r mY = \alpha\bar{A}F - \alpha b i^* F + \alpha(b + F)\bar{E}e_r^\gamma$$

$$Y = \frac{\alpha[\bar{A}F - bi^* F + (b + F)\bar{E}e_r^\gamma]}{[F + \alpha(b + F)e_r m]}$$

Plug Y back into the BP equation to get i.

- Plug i and Y back into the LM equation to M_s/P

Solving the Model-flexible exchange rates

- With *flexible exchange rates*, multiply the BP by α to get

$$\alpha N_x = -\alpha F(i - i^*)$$

- Next substitute into the IS curve to get an expression in Y and i

$$Y = \alpha\bar{A} - \alpha b i - \alpha F(i - i^*)$$

Combine terms with i

$$Y = \alpha\bar{A} - \alpha(b + F)i + \alpha F i^*$$

- From the LM curve

$$kY - h(i - i^*) = M_S/P$$

$$i = (k/h)Y - M_S/Ph + i^*$$

and substitute into the IS curve

$$Y = \alpha\bar{A} - \alpha(b + F)(k/h)Y + \alpha(b + F)M_S/Ph - \alpha(b + F)i^* + \alpha F i^*$$

simplifying

$$[1 + \alpha(b + F)(k/h)]Y = \alpha[\bar{A} + (b + F)M_S/Ph - bi^*]$$

$$Y = \frac{\alpha[\bar{A} + (b + F)M_S/Ph - bi^*]}{[1 + \alpha(b + F)(k/h)]}$$

- Substitute this Y into the LM curve to determine i.
- Substitute the i, Y combination into the BP to get e_r