Third TA Session: Open Economy under Fleming (1962)

Macroeconomics 2

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Highlights

- Mundell-Fleming model of open economy
  - Monetary policy in fixed exchange rate regime
  - Monetary policy in floating exchange rate regime

Primer on Open Economy

- Most macro models we assume to this point assume closed economy
- Closed economy assumes no external market for goods and capital
- This assumption is unrealistic if talking about country-level dynamic
- Think of both closed economy and small open economy as two different extremes; both are useful as stepping stones to more intricate macro models

Key Features of **Small** Open Economy

- Private expenditure (on consumption and investment) varies directly with disposable income and inversely with the interest rate
- Interest rate varies directly with income-velocity of circulation of money
- Country in question is small enough such that $r = r^*$ (interest rate determination does not impact global interest rate)
- Wages are assumed to remain constant in LCU (i.e. supply of domestic outputs are perfectly elastic. This is key to the model)
- Emphasis on **small** here
  - Is it realistic for us to assume that change in Federal Reserve's interest rate would not affect global interest rate?
  - Similarly, effect of changes in US' and China's balance of payment positions is non-negligible

Basic Setup

- Based on Fleming's 1962 paper
- Consider the following setup

$$Y \equiv X + S + B \tag{1}$$
$$Z \equiv X + S \tag{2}$$
$$V \equiv \frac{Y}{M} \tag{3}$$
$$N \equiv Y - T \tag{4}$$
$$T = T(Y), \qquad 0 < T_y < 1 \tag{5}$$
$$X = X(N, R), \qquad X_r < 0, 0 < X_n(1 - T_y) < 1 \tag{6}$$
$$R = R(V), \qquad R_v > 0 \tag{7}$$
$$B = B(Z, F), \qquad 0 < -B_z < 1, B_f > 0 \tag{8}$$
$$C = \tag{9}$$

Fiscal Policy under Fixed Exchange Rate (1)

- Rewrite the systems of equations, with focus on dY

$$\begin{aligned} Y &= X(N, R(V)) + S + B(Z, F) \\ dY &= \frac{\partial Y}{\partial X} dX + \frac{\partial Y}{\partial S} dS + \frac{\partial Y}{\partial B} dB \end{aligned} \tag{10}$$

- Now, we need to focus on each component (dX, dS, dB) in the equation (9)

$$\begin{aligned} dX &= X_n dN + X_r dR \\ &= X_n(1 - T_y)dY + X_r \left(\frac{R_v}{M} dY \right) \end{aligned} \tag{11}$$

Fiscal Policy under Fixed Exchange Rate (2)

$$
\begin{aligned}
dB &= B_z dZ \\
&= B_z \left\{ X_n(1-T_y)dY + X_r \left(\frac{R_v}{M} dY \right) + dS \right\}
\end{aligned} \tag{12}
$$

- Rearranging equation (10) and (11) into equation (9), we obtain the $\left(\frac{dY}{dS}\right)_{00}$ in Fleming (1962)

$$
\begin{aligned}
\left[1 + B_z\right] dS &= \left[1 - (1+B_z) \left\{ X_n(1-T_y) + \frac{X_r R_v}{M} \right\} \right] dY \\
\left(\frac{dY}{dS} \right)_{00} &= \frac{1 + B_z}{1 - (1+B_z)\left\{ X_n(1-T_y) + \frac{X_r R_v}{M} \right\}} > 0
\end{aligned} \tag{13}
$$

Fiscal Policy under Fixed Exchange Rate (3)

Impact of fiscal policy on taxation under fixed exchange rate

$$dT = T_y dY$$

$$\left(\frac{dT}{dS}\right)_{00} = \frac{T_y(1 + B_z)}{1 - (1 + B_z)\left\{X_n(1 - T_y) + \frac{X_r R_v}{M}\right\}} < 1 \tag{14}$$

Fiscal Policy under Fixed Exchange Rate (4)

Impact of fiscal policy on private consumption under fixed exchange rate

$$
\begin{aligned}
dX &= X_n dN + X_r dR \\
&= \left(X_n(1 - T_y) + \frac{X_r R_v}{M} \right) dY
\end{aligned}
$$

$$
\frac{dX}{dS} = \left(X_n(1 - T_y) + \frac{X_r R_v}{M} \right) \frac{1 + B_z}{1 - (1 + B_z)\left\{ X_n(1 - T_y) + \frac{X_r R_v}{M} \right\}} \tag{15}
$$

Multiplying (14) by the factor of $\dfrac{\frac{1}{(1+B_z)\left(X_n(1-T_y)+\frac{X_r R_v}{M}\right)}}{\frac{1}{(1+B_z)\left(X_n(1-T_y)+\frac{X_r R_v}{M}\right)}}$, we obtain

$$
\left(\frac{dX}{dS} \right)_{00} = \frac{1}{\frac{1}{(1+B_z)\left(X_n(1-T_y)+\frac{X_r R_v}{M}\right)} - 1} \tag{16}
$$

Fiscal Policy under Fixed Exchange Rate (5)

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Impact of fiscal policy on total consumption under fixed exchange rate[1]

$$
\begin{aligned}
dZ &= \frac{\partial Z}{\partial X} dX + \frac{\partial Z}{\partial S} dS \\
\left(\frac{dZ}{dS}\right)_{00} &= \frac{\partial Z}{\partial X}\frac{dX}{dS} + \frac{\partial Z}{\partial S} \\
&= \frac{(1+B_z)\left\{X_n(1-T_y) + \frac{X_r R_v}{M}\right\}}{1-(1+B_z)\left\{X_n(1-T_y) + \frac{X_r R_v}{M}\right\}} + 1 \\
&= \frac{1}{1-(1+B_z)\left\{X_n(1-T_y) + \frac{X_r R_v}{M}\right\}} > 0 \qquad (17)
\end{aligned}
$$

[1] Notice the tiny difference between the result in (16) and the result in Fleming (1962). I am not entirely sure which part did I get wrong but I have reworked the algebra around 5 times and still end up with the same result

Fiscal Policy under Floating Exchange Rate

- Let us revisit equation (9)-(12) but with a slight tweak; now $dB + dC = 0$, $dM = 0$, but $dF \neq 0$

$$\begin{aligned} dX &= X_n dN + X_r dR \\ &= X_n(1 - T_y)dY + X_r\left(\frac{R_v}{M}dY\right) \end{aligned} \tag{18}$$

$$dB = -dC = -C_r\left(\frac{R_v}{M}dY\right) \tag{19}$$

$$\begin{aligned} dS &= \left[1 - X_n(1 - T_y) - (X_r - C_r)\left(\frac{R_v}{M}\right)\right] dY \\ \left(\frac{dY}{dS}\right)_{10} &= \frac{1}{1 - X_n(1 - T_y) - (X_r - C_r)\frac{R_v}{M}} \end{aligned} \tag{20}$$

Monetary Policy under Fixed Exchange Rate Regime (I)

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- Rewrite the systems of equations, with focus on dY

$$\begin{aligned} Y &= X(N, R(V)) + \boxed{S} + B(Z, F) \\ dY &= \frac{\partial Y}{\partial X} dX + \frac{\partial Y}{\partial B} dB \end{aligned} \tag{21}$$

- Now, we need to focus on each component (dX, dS, dB) in the equation (9)

$$\begin{aligned} dX &= X_n dN + X_r dR \\ &= X_n(1 - T_y) dY + X_r \left(\frac{R_v}{M} dY - \frac{R_v Y}{M^2} dM \right) \end{aligned} \tag{22}$$

Monetary Policy under Fixed Exchange Rate (2)

$$\begin{aligned} dB &= B_z dZ \\ &= B_z \left\{ X_n(1 - T_y)dY + X_r \left(\frac{R_v}{M} dY - \frac{R_v Y}{M^2} dM \right) \right\} \end{aligned} \tag{23}$$

- Rearranging equation (22) and (23) into equation (21), we obtain the $\left(\frac{dY}{dM}\right)_{01}$ in Fleming (1962)

$$\frac{[1 + B_z](X_r R_v)}{M} dM = \left[1 - (1 + B_z) \left\{ X_n(1 - T_y) + \frac{X_r R_v Y}{M} \right\} \right] dY$$

$$\left(\frac{dY}{dM} \right)_{01} = -\frac{X_r R_v Y}{M} \left[\frac{1}{\frac{1}{1+B_z} - X_n(1 - T_y) + \frac{X_r R_v}{M}} \right] \tag{24}$$

Monetary Policy under Floating Exchange Rate

- Let us revisit equation (21)-(24) but with a slight tweak; now $dB + dC = 0$, $dS = 0$, but $dF \neq 0$

$$\begin{aligned} dX &= X_n dN + X_r dR \\ &= X_n(1 - T_y)dY + X_r \left(\frac{R_v}{M} dY - \frac{R_v Y}{M^2} dM \right) \end{aligned}$$

$$dB = -dC = -C_r \left(\frac{R_v}{M} dY - \frac{R_v Y}{M^2} dM \right) \tag{25}$$

$$\frac{R_v Y(C_r - X_r)}{M^2} dM = \left[1 - X_n(1 - T_y) + (C_r - X_r)\left(\frac{R_v}{M}\right) \right] dY$$

$$\left(\frac{dY}{dM}\right)_{11} = \frac{R_v Y(C_r - X_r)}{M^2} \left[\frac{1}{1 - X_n(1 - T_y) + (C_r - X_r)\frac{R_v}{M}} \right] \tag{26}$$

Discussions: Difference Between Fixed and Floating Exchange Rate

$$\left(\frac{dY}{dM}\right)_{11} - \left(\frac{dY}{dM}\right)_{01} = \frac{R_v Y}{M^2}\left[\frac{C_r - X_r}{1 - X_n(1-T_y) + (C_r - X_r)\frac{R_v}{M}} + \frac{1}{\frac{1}{1+B_z} - X_n(1-T_y) + \frac{X_r R_v}{M}}\right] > 0 \tag{27}$$

- Effect of monetary policy is more effective (in the sense that the effect size is higher) under floating exchange rate regime relative to fixed exchange rate regime
- Intuition