Activity 1

- Suppose the government estimates the households' propensity to consume in equation (2.5) to be equal to 0.9. What is the effect on income of an increase in public spending by 100?
- How much should the government cut taxes in order to increase income by the same amount?
- Calculate the balanced budget expansion required in order to increase income by the same amount.
- Suppose the government raises its revenue by levying a tax on consumers' income at the rate τ. Write the new linear consumption function and describe the effect of income taxes on the equilibrium in the goods market.

Activity 2

Consider an economy described by the following equations:
Aggregate consumption: $C = 400 + 0.2(Y - T)$;
Aggregate investment: $I = 120 - 10i$;
Government sector: $G = T = 100$.

- Derive the aggregate demand function;
- Calculate the equilibrium level of income.
- What is the effect of an increase in the interest rate on the equilibrium level of income?

Activity 4

Consider a money market in which money demand is described by the following equation:
$\frac{M^d}{P} = 100 + Y - 50i$.
Assume that the equilibrium level of income is $Y = 100$, the price level is $P = 1$, and the current level money supply is $M^s = 100$.

- Calculate and describe graphically the money market equilibrium.
- Suppose the economy is hit by a adverse real shock that reduces income to $Y = 80$. Illustrate (both numerically and graphically) the effect of the shock on the money market equilibrium.
- Illustrate (both numerically and graphically) the central bank response to the shock, if its objective is to keep money supply constant over time.
- Illustrate (both numerically and graphically) the central bank response to the shock, if its objective is to keep the interest rate constant over time.

Solutions to Activities

Activity 1

- The public spending multiplier is: $1/(1-c_1)=1/(1-0.9)=10$. Thus the increase in income is ten times larger than the increase in public spending: $\Delta Y = 10 \times 100 = 1000$.
- The tax multiplier is smaller than the public spending multiplier and equal to $c_1/(1-c_1)=0.9/(1-0.9)=9$. Since $\Delta Y = c_1/(1-c_1)\Delta T$, in order to increase income by 1000, the government should cut taxes by about $\Delta T = \dfrac{\Delta Y}{c_1/(1-c_1)} = \dfrac{1000}{0.9} \cong 1111$.
- The balanced budget multiplier, which is the sum of the spending and tax multipliers, is equal to 1: $1/(1-c_1)+c_1/(1-c_1)=1$. Thus, increasing output by 1000 requires both government spending and tax revenue to increase by the same amount, 1000.
- With proportional taxes the consumption function is equal to $C = c_0 + c_1(1-\tau)Y$ and the equilibrium level of income is $Y = \{1/[1-c_1(1-\tau)]\}(c_0 + \bar{I} + \bar{G})$. Therefore, tax policy affects the slope of the demand function and the magnitude of the multiplier, and the effect of an increase in autonomous spending on income is larger than the smaller the tax rate.

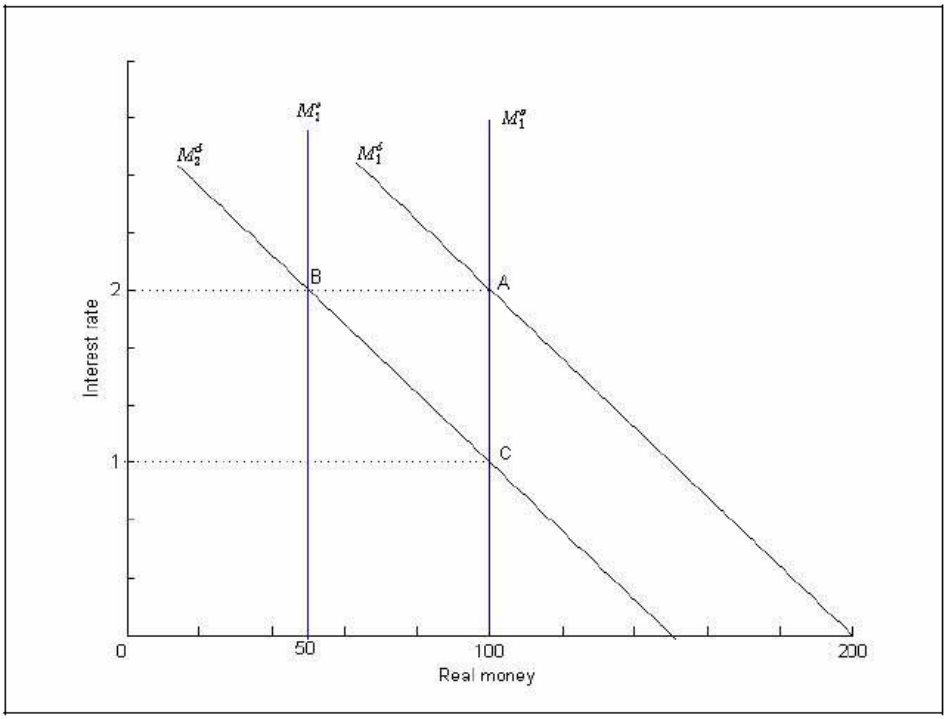
Activity 2

- The aggregate demand is given by: $Z = (400 - 0.2 \times 100 + 120 - 10i + 100) + 0.2Y = 400 - 10i + 0.2Y$.

- The equilibrium level of income is obtained as:
  $Y^* = 400 - 10i + 0.2Y^* \Rightarrow Y^* = \dfrac{1}{1-0.2}(400 - 10i) = 1.25 \times (400 - 10i)$.
- The equilibrium level of income is negatively related to the interest rate:
  $\dfrac{\partial Y^*}{\partial i} = \dfrac{1}{1-0.2} \times (-10) = -12.5$,
  which shows that, if the interest rate increases by 1 per cent, then income reduces by 12.5.

Activity 4

- The equilibrium interest rate is calculated by solving equation (2.11) for the interest rate as:
  $100 = 100 + 100 - 50i \Rightarrow i = 2$, which corresponds to point A in the graph below.
- The fall in income reduces money demand, thus causing the money market to be in disequilibrium at the original interest rate $i = 2$, which corresponds to point B in the graph below.
- If the central bank wants to keep money supply constant, then it should not respond to the demand shock. In this case the new equilibrium interest rate is: $100 = 100 + 50 - 50i \Rightarrow i = 1$, which corresponds to point C in the graph below.
- If the central bank wants to keep the interest rate constant, then it should respond to the shock by reducing money supply, so that the interest rate remains equal to 2. The level of money supply that achieves this objective is: $M = 100 + 50 - 50 \times 2 = 50$ and the new money market equilibrium is in point B in the graph below.



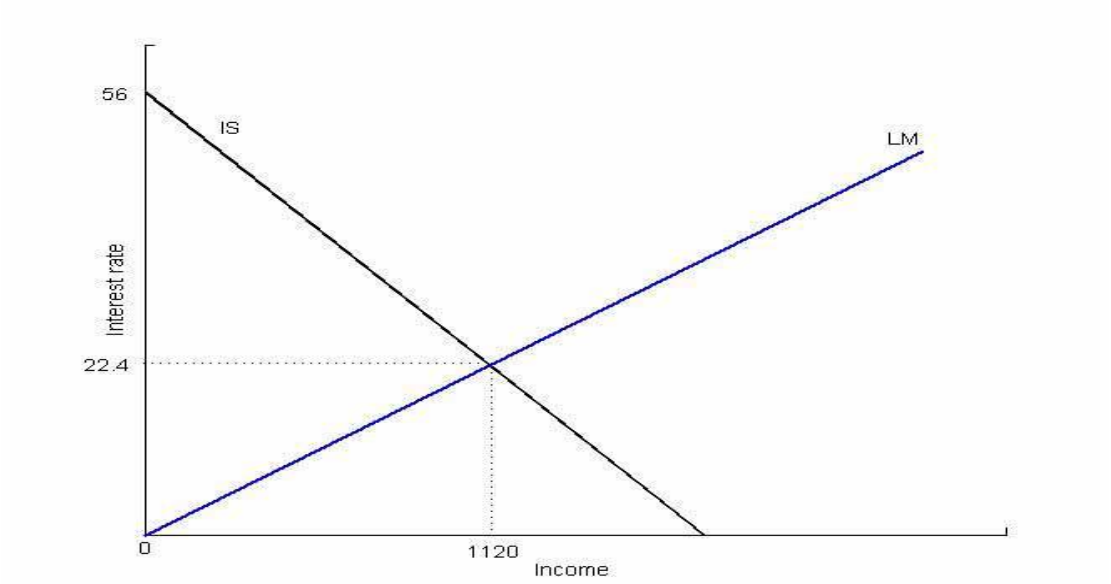
Activity 6

Consider an economy in which the price level is equal to one unit and the goods and money market are described by the following equations:
Aggregate consumption: $C = 400 + 0.2(Y - T)$;
Aggregate investment: $I = 80 + 0.5Y - 10i$;
Government sector: $G = T = 100$.
Money demand: $M^d = 100 + Y - 50i$
Money supply: $M^s = 100$

- Derive the IS and the LM curve.
- Calculate the equilibrium level of income and interest rate, and plot a graph of the equilibrium of the economy.
- Compute the equilibrium level of consumption and investment.

Activity 6

- The IS curve is computed by solving the closed economy income identity for the interest rate as follows:
  $Y^* = 400 + 0.2Y^* - 0.2 \times 100 + 80 + 0.5Y^* - 10i^* + 100$;
  $0.3Y^* = 560 - 10i^*$;
  $i^* = 56 - 0.03Y^*$.
  The LM curve is computed by solving the money market equilibrium condition for the interest rate as follows:
  $100 = 100 + Y^* - 50i^*$;
  $i^* = 0.02Y^*$.
- The equilibrium level of income and interest rate are computed by solving the IS-LM system:
  $$\begin{cases} i^* = 56 - 0.03Y^* \\ i^* = 0.02Y^* \end{cases} \Rightarrow \begin{cases} Y^* = 1120 \\ i^* = 22.4 \end{cases}.$$
  To draw the graph, note that both IS and LM curves must pass through the equilibrium point. In addition, the IS curve intercepts the vertical axis when $Y^* = 0 \Rightarrow i^* = 56$, whereas the LM curve passes from the origin of the income – interest rate space.
- In equilibrium, consumption equals $C^* = 400 + 0.2 \times 1120 - 20 = 604$; whereas investment equals $I^* = 80 + 0.5 \times 1120 - 10 \times 22.4 = 416$.


56
IS
LM
Interest rate
22.4
0
1120
Income

Activity 7

Consider the economy described in the previous activity. Suppose that the government increases public spending from 100 to 200 with no change in taxes.

- Compute the new equilibrium level of output, under the assumption that the central bank keeps the interest rate constant at $i=22.4$.
- Compute the new equilibrium level of output, under the assumption that the central bank keeps money supply constant at $M=100$.
- Compute the fiscal policy multiplier, in each of the two cases above, and discuss your result. [Hint: the multiplier is the increase in Y divided by the increase in G].

Activity 7

Note that, following the fiscal expansion, the IS curve becomes:

$Y^* = 400 + 0.2Y^* - 20 + 80 + 0.5Y^* - 10i^* + 200;$

$0.3Y^* = 660 - 10i^*;$

$i^* = 66 - 0.03Y^*.$

- The new equilibrium level of output is obtained by solving the IS-LM system, with the additional requirement that the interest rate is constant:

$$\begin{cases} i^* = 66 - 0.03Y^* \\ i^* = 22.4 \end{cases} \Rightarrow \begin{cases} Y^* \cong 1453.3 \\ i^* = 22.4 \end{cases}.$$

- The new equilibrium level of output is computed by solving the new IS-LM system, which includes the new IS equation and the original LM equation, since that is computed so that money supply is fixed at $m=100$. This yields:

$$\begin{cases} i^* = 66 - 0.03Y^* \\ i^* = 0.02Y^* \end{cases} \Rightarrow \begin{cases} Y^* = 1320 \\ i^* = 26.4 \end{cases}.$$

- Under the assumption of a constant interest rate, the fiscal policy multiplier is given by: $\frac{\Delta Y}{\Delta G} = \frac{1453.3 - 1120}{100} \cong 333.3$. In contrast, under the assumption of constant money supply, the fiscal policy multiplier is equal to: $\frac{\Delta Y}{\Delta G} = \frac{1320 - 1120}{100} = 200$. Fiscal policy is more effective in the first case because, by expanding money supply to keep the interest constant, the central bank neutralises the crowding out effect on investment from the fiscal expansion.