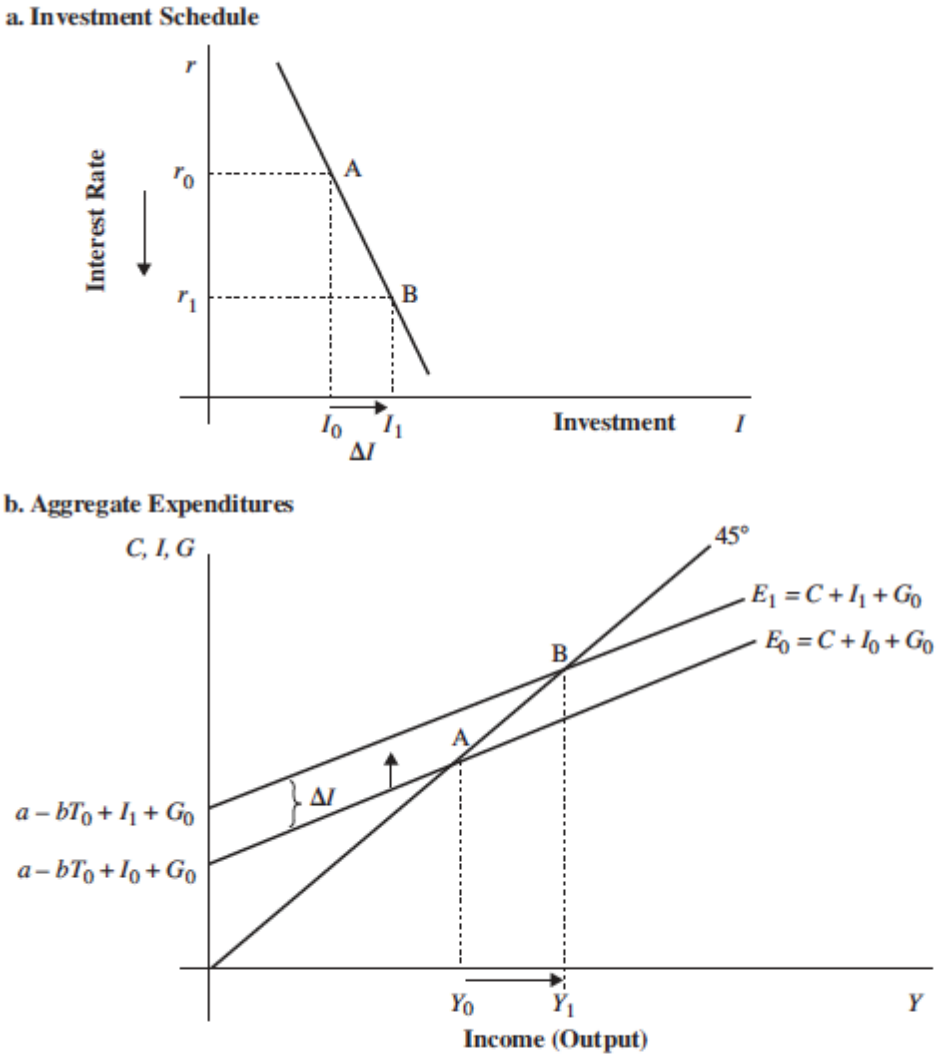
LECTURE NOTES

Chapter 6: The Keynesian System (II): Money, Interest, and Income

1. Money in the Keynesian System

- Interest rates and aggregate demand
    - AD components affected
        - Investment
        - Durable goods
        - Government spending (i.e. infrastructure investment)
    - If interest rate falls, then investment increases. Because investment is an autonomous component of *Y*, output increases.
        - AD increases by ΔI
        - Y increases by $\Delta Y = \frac{1}{1-b}\ \Delta I \rightarrow \Delta Y > \Delta I$
        - See Figure 6-1

FIGURE 6-1 Effect of a Decrease in the Interest Rate on Investment and Equilibrium Income

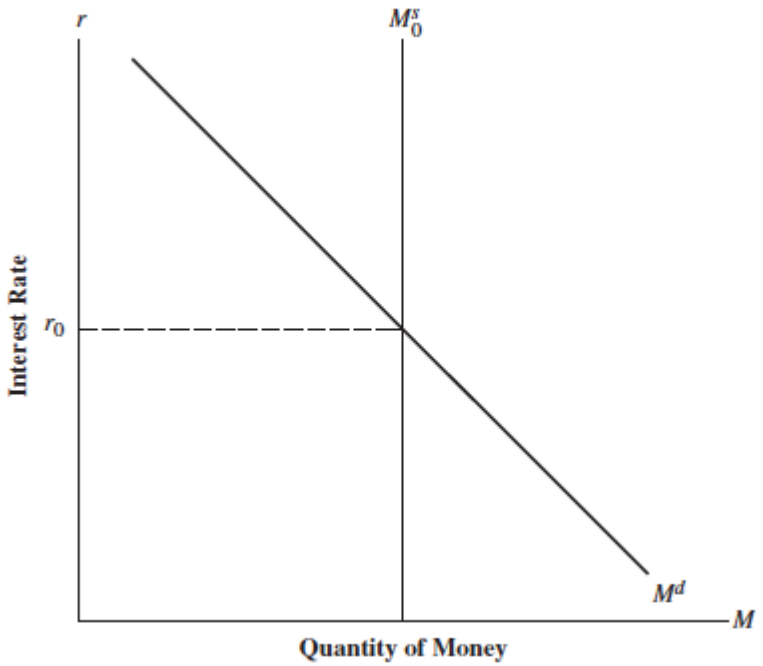


In part *a*, as the interest rate decreases from r_0 to r_1, investment increases from I_0 to I_1. In part *b*, this increase in investment, ΔI, shifts the aggregate expenditure schedule up because the intercept is larger, from $E_0 = C + I_0 + G_0$ to $E_1 = C + I_1 + G_0$. Income increases from Y_0 to Y_1.

2. The Keynesian Theory of the Interest Rate

- Important simplification: Wealth (Wh) can be divided into two groups, (1) money (M) and (2) al nonmoney assets and nonmoney asseta are bonds (B).
    - $Wh = M + B$
    - Money is a short-term liquid asset
    - Bonds are long-term less liquid assets
    - Note that there are no consumption goods
- Money demand (how much money to hold with respect to bonds) depends on the *liquidity preference*
    - Liquidity preference determines *M* when *W* is fixed. Therefore, it indirectly determines *B* as well
- Money supply
    - Exogenously fixed by the monetary authority (i.e. the central bank)
- How to allocate wealth between *M* and *B*?
    - Recall that the price of the bond: $P_B = \sum_{t=1}^{T} \frac{CF_t}{(1+i)^t}$ or $P_B = \frac{CF}{i}$ if the bond is a "perpetuity bond"
    - Then, there exists and interest rate *i* that equilibrates the demand and supply of bonds
    - Example 1: Excess of money supply
        - Economic agents sell the money and buy bonds
        - The price of bonds rise
        - Interest rate falls
    - Example 2: Shortage of money supply
        - Economic agents buy money by selling bonds
        - The price of bonds fall
        - Interest rates rise
    - Therefore, by construction
        - The equilibrium interest rate is the one that equilibrates supply of and demand for bonds, and
        - The equilibrium interest rate is the one that equilibrates supply of and demand for money
- VERY IMPORTANT: INTEREST RATE IS NOT THE PRICE OF MONEY
    - If individual A lends 10 units of *x* (apples) to individual B with the condition that one year after he should return 11 units, there is a 10% interest rate but no money involved
    - If interest rate is not the price of apples, then it is neither the price of money
    - Interest rate is the price of time (credit), whether this comes in the form of money or apples.
    - Interest rates is not a monetary phenomenon, it is a time (preference) phenomenon

FIGURE 6-2 Determination of the Equilibrium Interest Rate



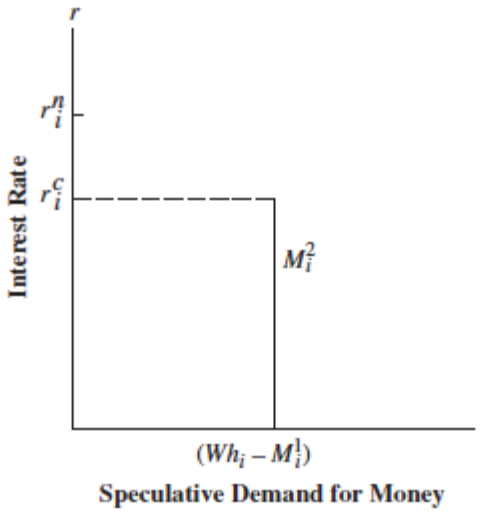
In the Keynesian system, the equilibrium interest rate (r_0) is the interest rate that equates money supply and money demand.

3. The Keynesian Theory of Money Demand

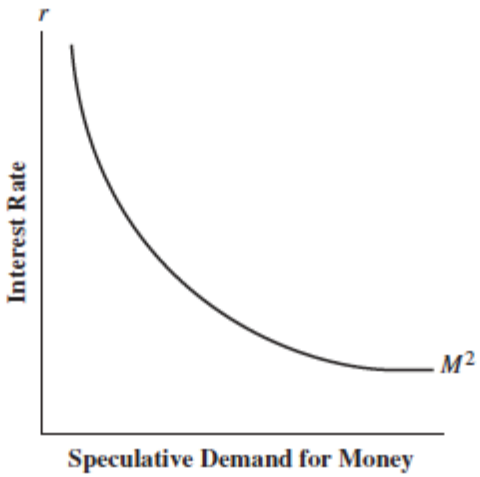
- Three motives to hold money:
    - (1) Transactions demand
        - Cash-in-advance (CIA) requirements to perform transactions
        - Higher income implies more transactions and therefore a higher demand to hold money
        - For large amounts, interest rates is inversely related to money demand (short-term investment in bonds)
    - (2) Precautionary demand
        - For a "rainy day" (unexpected medical or repair bills, etc.)
    - (3) Speculative demand
        - If interest rates are expected to rise and if the capital loss is larger than gain from interest rates, then sell bonds and buy money
        - If interest rates are expected to fall and if the capital gain is larger than the utility loss from holding cash, then buy bonds to re-sell when capital gains are high enough
        - Keynes assumes economic agents work with a given level of what is considered to be a normal interest rate (r^n). When the market interest rate deviates from the "normal interest rates", then there are changes in money demand due to speculation
        - There is a critical interest rate level (r^C) at which capital gains > interest rate gains
        - Because economic agents have different considerations of what is r^n and therefore r^c money demand changes "smoothly" with changes in r (Figure 6-3)
        - Liquidity trap:
            - If *r* is low enough, then the $r^c > r$ for all economic agents.
            - At this point, any increase in money supply is hold as money demand
            - Nothing goes to investment/consumption through bonds
- Total demand for money
    - Positively related to income
    - Negatively related to interest rates
    - $M^d = L(Y, r)$
    - $M^d = c_0 + c_1 Y - c_2 r, \;\; c_1, c_2 > 0$
    - In Classical macroeconomics money demand is function only of income: $M^d = L(Y)$
    - The fact that you can graph decreasing quantity of money demand against the interest rate does not make the interest rate the price of money similarly to the fact being able to graph a lower quantity demanded of an inferior income rises does not make income the price of the inferior good (see Figure 6-4)

FIGURE 6-3 Individual and Aggregate Speculative Demand Schedules for Money

a. Individual Speculative Demand for Money

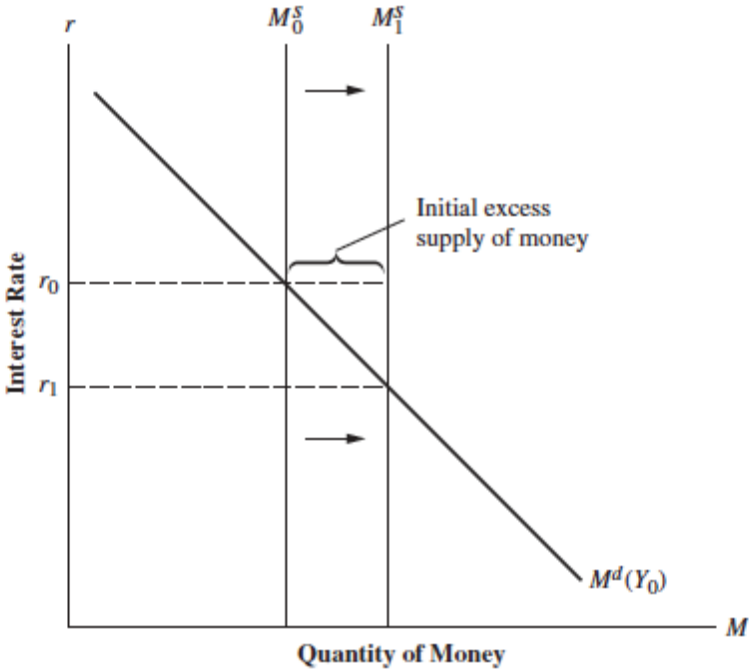


b. Aggregate Speculative Demand for Money



The individual's speculative demand for money is shown in part *a*. At any interest rate above the critical rate (r_i^c), the speculative demand for money is zero. Below the critical interest rate, the individual shifts to money. Part *b* shows the aggregate speculative demand for money schedule (M^2). As the interest rate becomes lower, it falls below the critical rate for more individuals, and the speculative demand for money rises.

FIGURE 6-4 Equilibrium in the Money Market

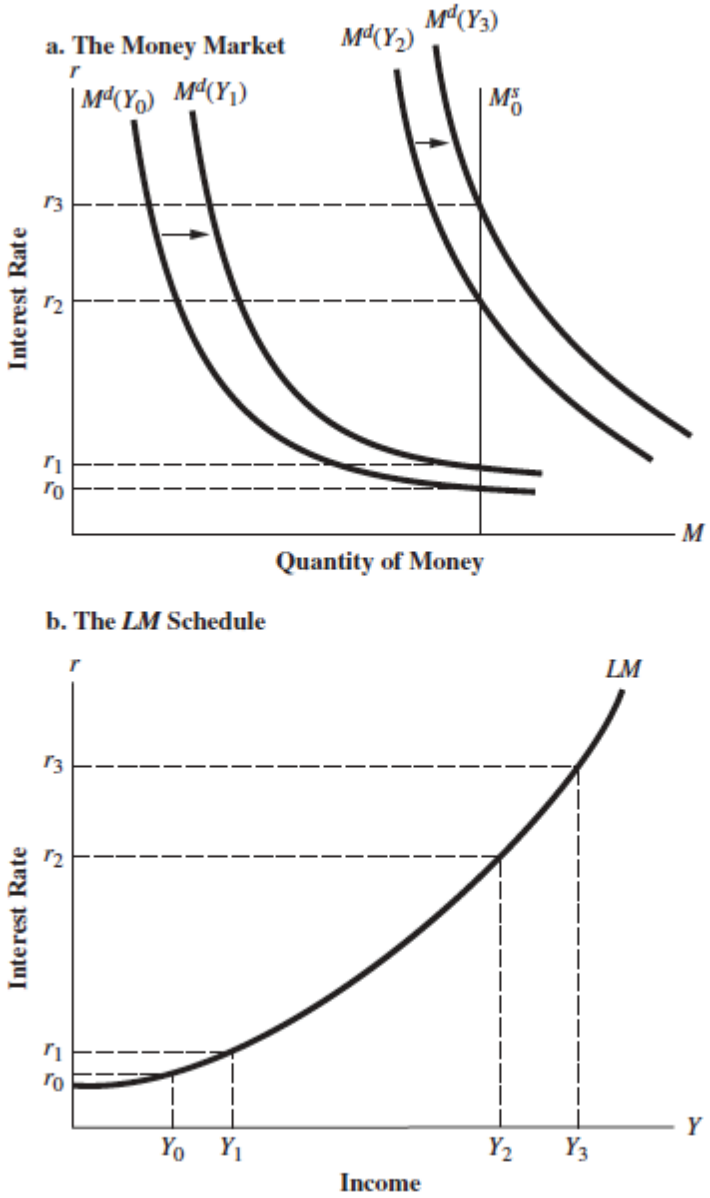


An increase in the money supply from M_0^s to M_1^s causes an initial excess supply of money. The interest rate falls from r_0 to r_1 to restore equilibrium in the money market.

4. The IS-LM Model

- Two markets:
    - Money market (LM)
    - Commodity (goods) market (IS)
    - Both markets should be in equilibrium
    - Relationship between *r* and *Y*
- Money Market Equilibrium: The LM Schedule
    - $M_0^S = M^d$ (equilibrium condition)
    - $M_0^S = M^d = c_0 + c_1 Y - c_2 r, \quad c_2: elasticity\ of\ M^d to\ r \rightarrow \frac{\Delta M^d}{\Delta r} = -c_2$
    - $r = \frac{c_0 + c_1 Y - M_0^S}{c_2} = \left(\frac{c_0}{c_2} - M_0^S\right) + \frac{c_1}{c_2} Y$
    - $LM(r, Y)$ is upward sloping
    - Level change only
        - $c_0\ and\ M_0^S$
    - Slope change only
        - c_1
    - Level and slope change
        - c_2
        - Liquidity trap: The lower the interest rate, the larger c_2. If c_2 is large enough changes in r do not produce a change in *Y* (see Figure 6-8)
        - If $c_2 = 0$ then M^d depends only on income and Keynesian money demand is similar to money demand in Keynesian macroeconomics
    - Intuition:
        - 1st: Income increases
        - 2nd: Money demand for transaction increases
        - 3rd: Sell of bonds increases (to buy money)
        - 4th: Price of bonds fall
        - 5th: Interest rates rise

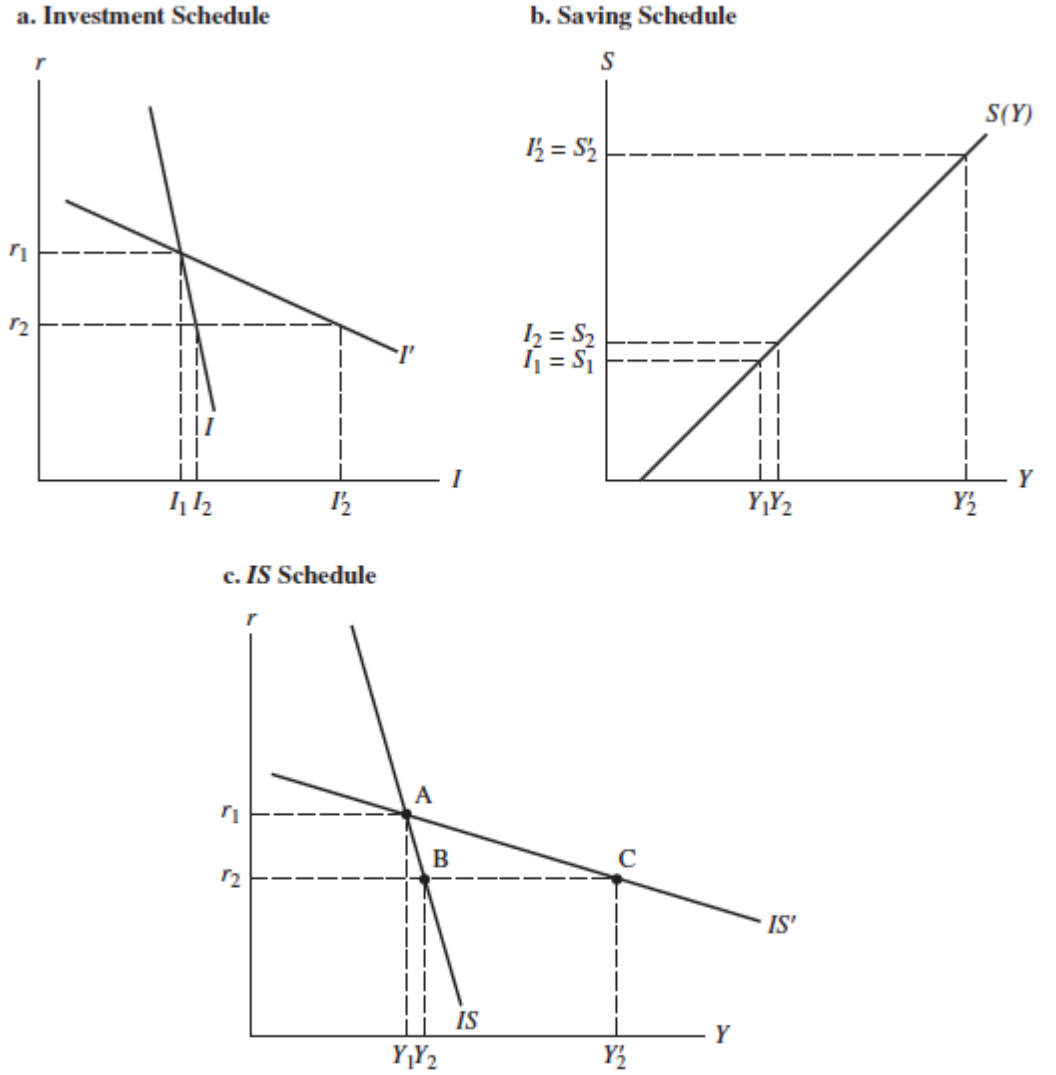
FIGURE 6-8 Liquidity Trap



At very low levels of income, Y_0 and Y_1, equilibrium in the money market in part *a* occurs at points along the flat portion of the money demand schedule where the elasticity of money demand is extremely high. Consequently, the *LM* schedule in part *b* is nearly horizontal over this range. At higher income levels, such as Y_2 and Y_3, money market equilibrium is at steeper points along the money demand schedules $M^d(Y_2)$, $M^d(Y_3)$, and the *LM* schedule becomes steeper.

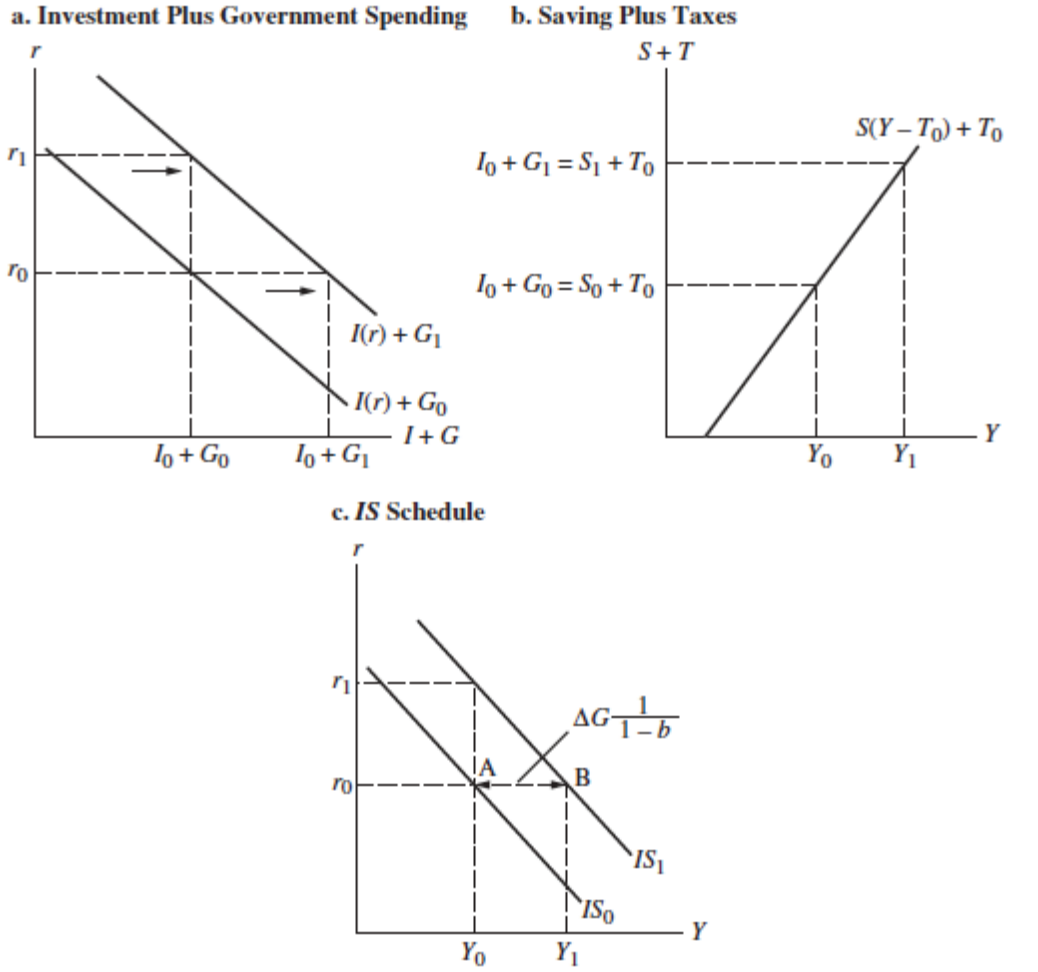
- Product Market Equilibrium: The IS Schedule
    - Equilibrium conditions
        - $Y = C + I + G$ [income equals aggregate demand]
        - $I + G = S + T$ [simplification: assume no government sector: *I* = *S*]
        - Let $I(r) = S(Y)$. Investment depends on *interest rates* but savings depend on income
        - Then there is a combination of *r* and *Y* that makes $I(r_0) = S(Y_0)$
        - Higher income implies higher savings. Higher savings imply lower interest rates. Lower interest rates imply higher investments. Therefore there is an inverse relationship between *r* and *Y* in the IS schedule
    - Slope
        - Depends on the sensitivity of investment to changes in the interest rate
    - Level
        - Depends on autonomous expenditures (a, I, G, and T)
        - $\frac{\Delta Y}{\Delta G} = \frac{\Delta Y}{\Delta I} = \frac{\Delta Y}{\Delta a} = \frac{1}{1-b}$
        - $\frac{\Delta Y}{\Delta T} = -\frac{b}{1-b}$

FIGURE 6-12 Interest Elasticity of Investment and the Slope of the *IS* Schedule



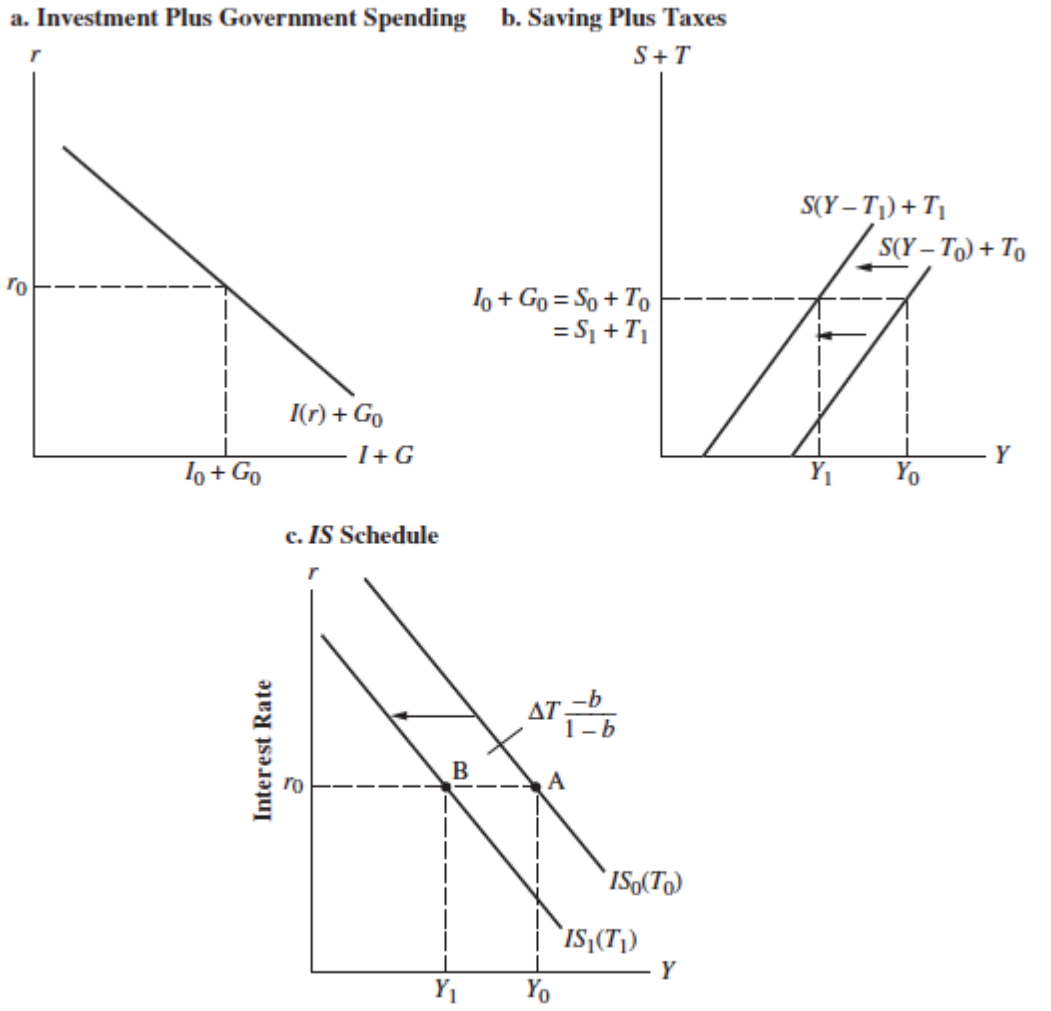
Where the investment schedule is steep (I) in part *a*, a fall in the interest rate will increase investment by a small amount. In part *b*, therefore, only a small increase in saving and, hence, income is required to restore product market equilibrium. Therefore, the *IS* schedule in part *c* (*IS* in this case) will be steep. Where the investment schedule is relatively flat (I'), investment will increase by a greater amount with a fall in the interest rate. Saving, and therefore income, must then increase by a greater amount; the *IS* schedule for this case (IS') will be relatively flat.

FIGURE 6-14 Shift in the *IS* Schedule with an Increase in Government Spending



At interest rate r_0, an increase in government spending increases the total of investment plus government spending from $I_0 + G_0$ to $I_0 + G_1$ in part *a*. To maintain the condition $I + G = S + T$, with a fixed level of taxes, saving must rise from S_0 to S_1, which requires income to be Y_1 instead of Y_0 in part *b*. At interest rate r_0, the equilibrium point in the product market is point B instead of point A. An increase in government spending shifts the *IS* schedule to the right from IS_0 to IS_1 in part *c*.

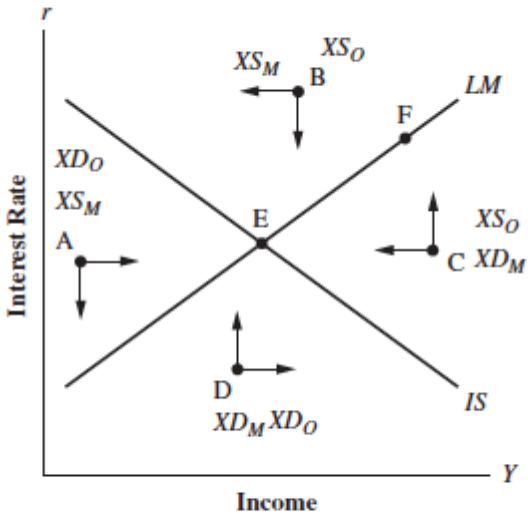
FIGURE 6-15 Shift in the *IS* Schedule with an Increase in Taxes



An increase in taxes shifts the $S + T$ schedule to the left in part *b*. At interest rate r_0, which fixes $I_0 + G_0$, with higher taxes, saving, and therefore income must be lower to maintain the condition $I + G = S + T$. After the tax increase, an income level of Y_1 (point B) rather than Y_0 (point A) clears the product market for interest rate r_0. The *IS* schedule shifts leftward from IS_0 to IS_1 in part *c*.

- The IS and LM Schedules Combined
    - Remember: IS and LM are <u>not</u> demand and supply lines, but <u>equilibrium points</u> in two different markets
    - Where IS and LM cross each other there is general equilibrium
    - Disequilibriums:
    - Consider disequilibria (see Figure 6-17):
        - (1) Consider points *above* the LM schedule: Interest rate is too high. The price of bonds is expected to rise. Economic agents sell money and buy bonds reducing the interest rate level
        - (2) Consider points *below* the LM schedule: *Inverse case than above*
        - (3) Consider points *above* the IS schedule: Output exceeds AD. Inventories increase beyond the desired level $(I_r > I)$. Investment falls until output matches AD
        - (4) Consider points *below* the IS schedule: *Inverse case than above*

FIGURE 6-17 Adjustment to Equilibrium in the *IS–LM* Model



At points such as A, B, C, and D, there are either excess supplies or demands in the money and product markets and therefore pressures for the interest rate and output to change. At point F, the product market is out of equilibrium, and there is pressure for output to change. Only at point E are both the money and product markets in equilibrium.

5. Model Example

- LM schedule
  - $M^d = c_0 + c_1 Y - c_2 r$
  - $M_0^S = M^d$
  - $r_{LM} = \frac{c_0 - M_0^S}{c_2} - \frac{c_1}{c_2} Y$
- IS schedule
  - (1) $S = -a + (1-b) Y_D$
  - (2) $I = \bar{I} - d \cdot r, \quad d > 0$
  - (3) $S + T = I + G$
  - Replace (1) and (2) in (3) and do some math…
  - $-a + (1-b)(Y - T) + T = \bar{I} - d \cdot r + G$
  - $r_{IS} = \frac{a - bT + \bar{I} + G}{d} - \frac{1-b}{d} Y$
- In equilibrium
  - $r_{LM} = r_{IS}$
  - $\frac{c_0 - M_0^S}{c_2} - \frac{c_1}{c_2} Y = \frac{a - bT + G}{d} - \frac{1-b}{d} Y$
  - $Y^* = \left[\frac{a - bT + \bar{I} + G}{d} - \frac{c_0 - M_0^S}{c_2}\right] \left(\frac{1-b}{d} - \frac{c_1}{c_2}\right)^{-1}$
- Then
  - $r^* = r_{LM}(Y^*)$
  - $r^* = \frac{c_0 - M_0^S}{c_2} - \frac{c_1}{c_2} \cdot \left[\frac{a - bT + \bar{I} + G}{d} - \frac{c_0 - M_0^S}{c_2}\right] \left(\frac{1-b}{d} - \frac{c_1}{c_2}\right)^{-1}$
- Shocks (try it your-self)
  - $\frac{\Delta Y}{\Delta G} = \frac{1}{(1-b) + d\left(\frac{c_1}{c_2}\right)}$
  - $\frac{\Delta Y}{\Delta T} = \frac{-b}{(1-b) + d\left(\frac{c_1}{c_2}\right)}$
  - $\frac{\Delta Y}{\Delta M_0^S} = \frac{d}{(1-b)c_2 + d \cdot c_1}$