Chapter 5 Review Questions

1. A bond promises to pay £250 in one year's time.

a. What will the interest rate on the bond at current market prices £185, £200 and £230 respectively?

$r = \frac{(250 - X)}{X}$ for X = 185, 200 and 230.

$r = \frac{(250 - 185)}{185} = 0.351$ or 35.1%

$r = \frac{(250 - 200)}{200} = 0.25$ or 25%

$r = \frac{(250 - 230)}{230} = 0.087$ or 8.7%

b. What is the price of the bond at interest rates of 5%, 7.5% and 10%?

$r = \frac{(250 - X)}{X}$

$rX = 250 - X$

$(1 + r)X = 250$

$X = \frac{250}{(1 + r)}$

$X = \frac{250}{1.05} = 238.095$

$X = \frac{250}{1.075} = 232.558$

$X = \frac{250}{1.1} = 227.273$

c. What is the relationship between bond prices and interest rates?
There is an inverse relationship between bond prices and interest rates

2. Compute the money multiplier when the required reserve assets ratio is 3% and the public decides to hold 15% of its money in cash. What actions could the central bank undertake to raise the money supply by £100 million?

The money multiplier in this case is:

$$\frac{M}{H} = \frac{cr + 1}{cr + rr}$$

If $cr = 0.15$ and $rr = 0.03$

$$\frac{M}{H} = \frac{0.15 + 1}{0.15 + 0.03} = \frac{1.15}{0.18} = 6.39$$

$$\Delta M = 6.39 * \Delta H$$

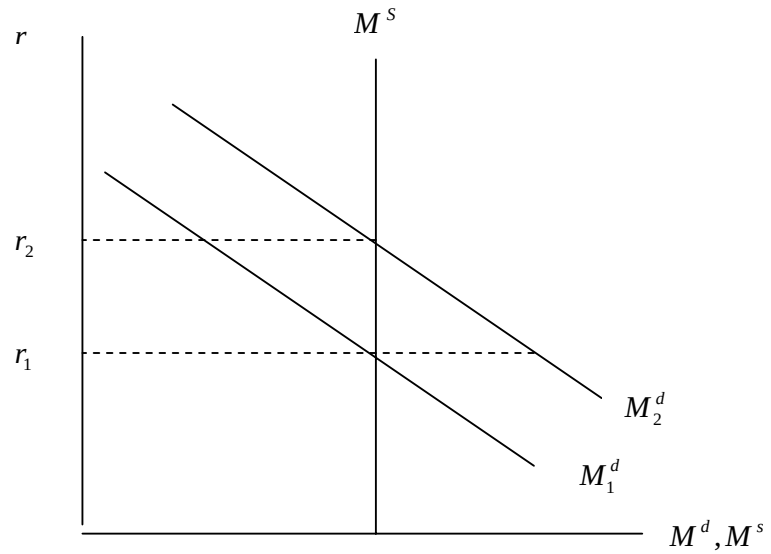
If $\Delta M = 100{,}000{,}000$ then,

$$\Delta H = 100{,}000{,}000 / 6.39 = 15{,}649{,}452.27$$

This would require an increase in the high powered money stock of £15.65 million. This could be done by open market operations through buying this value of bonds from the general public, the cash will then be deposited in the banking system increasing the high powered money stock by the sufficient amount.

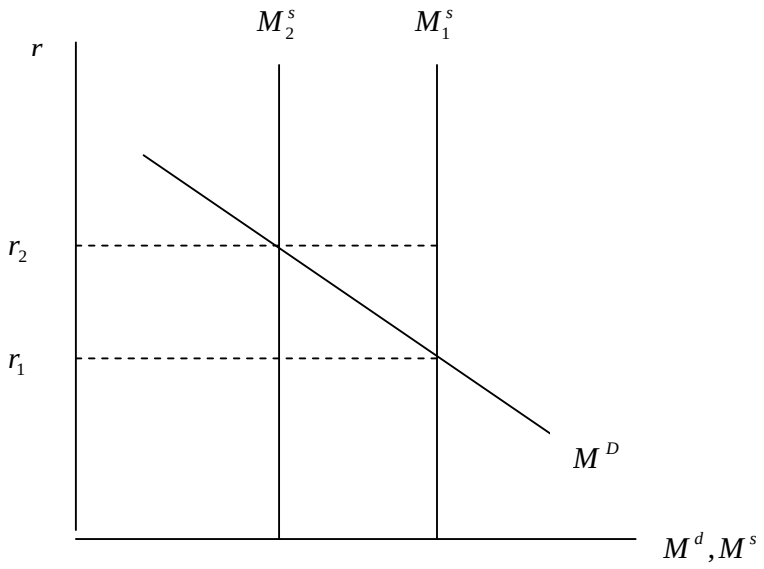
3. Explain how the following will affect the equilibrium level of interest rates.

a. An increase in the cost of using ATMs



An increase in the cost of using ATMS raises the cost of liquidating bank deposits, which increases desired money holdings at all levels of income. As a result the money demand curve shifts outwards. There is now an excess demand for money at the interest rate r_1. In order to increase money holdings people sell bonds, which causes bond prices to fall. A fall in bond prices leads to an increase in interest rates to r_2, where money demand and supply are equalised.

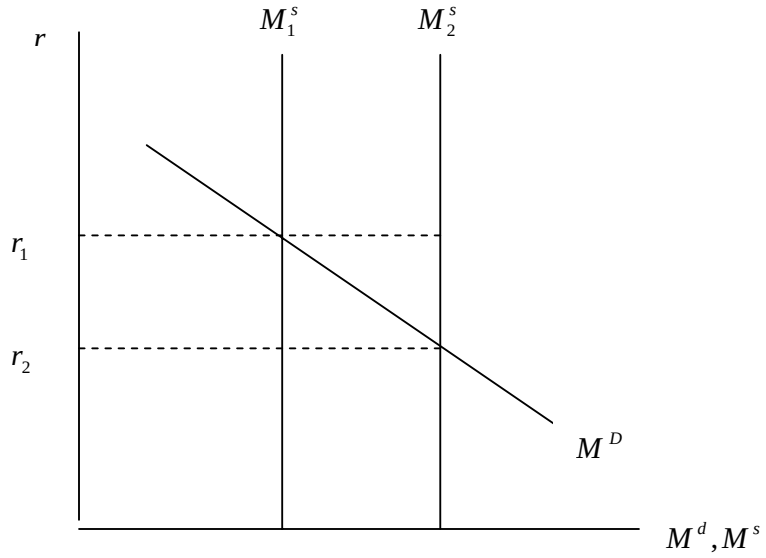
b. A requirement for banks to deposit a proportion of reserves in non-interest bearing accounts at the central bank.



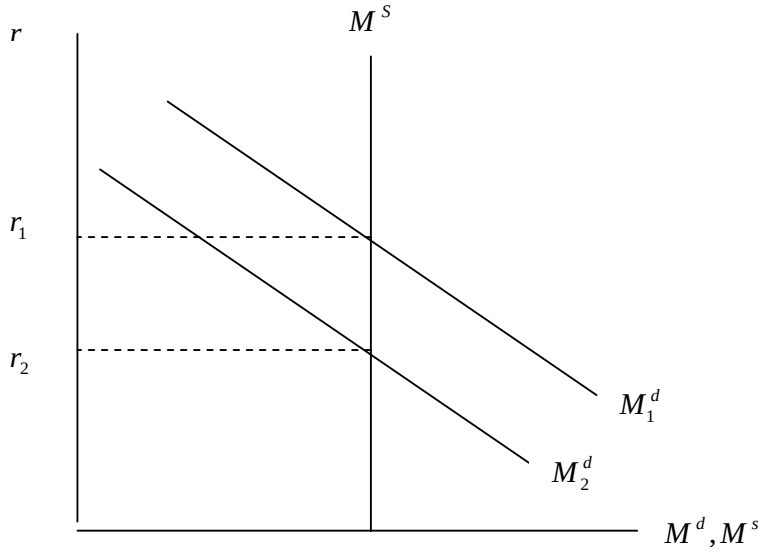
This central bank directive leads to a fall in the high powered money stock and hence a multiplied fall in the money supply. Again, at the existing interest rate there is now excess demand for money, which leads to bond sales and upward pressure on the equilibrium interest rate.

c. The government runs a substantial budget surplus and repurchases bonds from the private sector.

The government pays for bonds with cash which the private sector deposits in banks. As a result, the monetary base increases and banks extend credit leading to an increase in the money supply. At the existing interest rate there is now an excess supply of money. In order to reduce money holdings the private sector purchases bonds, this drives up bond prices and pushes interest rates downwards. As interest rates fall the demand for money increases until demand and supply are equalised.



d. A fall in consumer confidence



Lower consumer confidence would be expected to reduce household expenditure, and therefore the transactions demand for money. The demand for money is lower at each level of income and the money demand curve shifts inwards. At the existing interest rate there is an excess supply of money, which is run down by making bond purchases. An increase in the demand for bonds raises bond prices and pushes interest rates downwards. The demand for money now increases to remove the excess supply in the market.

More advanced problems

4. The demand for money is given by:

$M_d = 0.5Y - 2000r$

a. If the income level is Y = 1000, and the interest rate is r = 10%, what is the demand for money?

$$M_d = 0.5(1000) - 2000(0.1) = 500 - 200 = 300$$

b. What is the equilibrium level of interest rates when the supply of money is equal to 200?

$$200 = 0.5(1000) - 2000r$$

$$r = \frac{300}{2000} = 0.15 \text{ or } 15\%$$

c. What happens to the equilibrium rate of interest following

- An increase in the money supply to 400?

If $M^S = 400$

$$400 = 0.5(1000) - 2000r$$

$$r = \frac{100}{2000} = 0.05 \text{ or } 5\%$$

The interest rate falls because excess money balances are used to buy bonds that bids up bond prices and forces down interest rates.

- An increase in income to 1500?

If $Y = 1500$

$$200 = 0.5(1500) - 2000r$$

$$r = \frac{550}{2000} = 0.275 \text{ or } 27.5\%$$

Higher income leads to higher money demand. Bonds are cashed in and bond prices fall, as a consequence interest rates rise.

5. An individual has take home pay of £15,000 per year and spends all of it at a uniform rate over the course of a year. He pays for everything in cash, and earns 10% interest on his bank account. However, long queues at the cash machine mean that each visit to the machine costs £10 in lost wages.

a. How many times does the individual go to the bank and how much is withdrawn at each visit?

Amount taken out each time = $\frac{Y}{N}$

Average money holdings = $\frac{Y}{2N}$

Time between trips to the bank = $\frac{1}{N}$

Therefore, the total costs of making N trips to the bank are:

$$TC = r\frac{Y}{2N} + Nc$$

The optimal number of trips to the bank can be found as follows:

$$\frac{dTC}{dN} = -r\frac{Y}{2N^2} + c = 0$$

$$N^2 = \frac{rY}{2c}$$

$$N^* = \sqrt{\frac{rY}{2c}}$$

Therefore, the optimal average money holdings are:

$$M^* = \frac{Y}{2N^*} = \sqrt{\frac{Yc}{2r}}$$

Substituting in for the parameters $Y = £15{,}000$, $r = 0.1$, $c = 10$

$$N^* = \sqrt{\frac{0.1*15{,}000}{2*10}} = 8.66$$

8.66 trips are made to the bank each year, so each time 15,000/8.66 = £1732.00 is withdrawn. Therefore, average money holdings are:

$$M^* = \frac{15000}{2*8.66} = £866.05$$

b. How would the answers to part (i) change if:

- a new cash machine opens which reduces queuing times meaning the cost of each withdrawal falls to £5?

If $c = 5$

The optimal number of bank trips is:

$$N^* = \sqrt{\frac{0.1*15{,}000}{2*5}} = 12.25$$

Each time, 15,000/12.25 = £1224.49 is withdrawn. Average money holdings are:

$$M^* = \frac{15000}{2*12.25} = £612.37$$

This shows that the demand for money increases when the cost of liquidating financial assets rises.

- to encourage saving the bank increases its interest rate to 15% per annum?

If $r = 0.15$

The optimal number of bank trips is:

$$N^* = \sqrt{\frac{0.15*15{,}000}{2*10}} = 10.61$$

Each time 15,000/10.61 = £1413.76 is withdrawn and average money holdings are:

$$M^* = \frac{15000}{2*10.61} = £706.88$$

Therefore, the demand for money falls as interest rate rise.

- a strengthening economy sees the individual's take home pay rise to £20,000?

If Y = £20,000

The optimal number of bank trips is:

$$N^* = \sqrt{\frac{0.1*20{,}000}{2*10}} = 10$$

Each time 20,000/10 = 2000 is withdrawn and average money holdings are:

$$M^* = \frac{20000}{2*10} = £1000.00$$

This example shows that the demand for money is positively related to the level of income.

6. The real interest rate rises from 3% to 5% whilst the nominal interest remains unchanged at 7%. Explain how this scenario arose and what are the implications for the demand for money?

The nominal interest rate represents the money cost of transferring income or money over time. On the other hand the real interest rate signals the cost of transferring real commodities such as goods and services intertemporally. This requires the interest rate to be adjusted for the differences in price levels between the two periods, which is proxied by the rate of inflation.

$$r_t = i_t - \pi_t$$

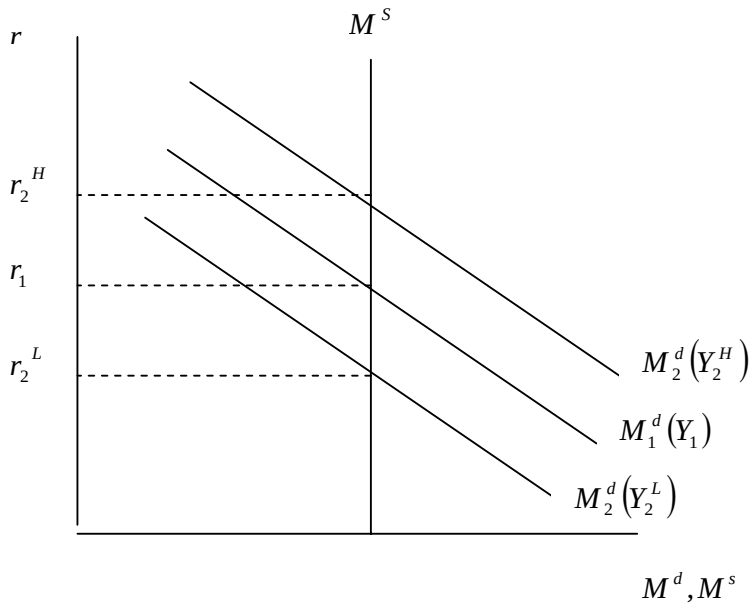
If real interest increase from 3% to 5% but nominal rates stay at 7% it must be because inflation falls from 4% to 2%.

The demand for money is determined by the nominal interest rate. Therefore, as this remains at 7% there will be no change to the demand for money.

Money and bonds are substitute assets. The return on bonds is the real interest rate $r_t = i_t - \pi_t$. Money is an asset that pays no interest, but its real value can be eroded by inflation, so the return on money is $-\pi_t$. The willingness to substitute from money to bonds depends on the relative rate of return on each. If the nominal interest rate is 7%, and the inflation rate is 4%, then the rate of return on bonds is 3% and the rate of return on money is -4%, hence the difference is 7% or the nominal interest rate. If inflation falls to 2%, then the respective rates of return are 5% and -2%, so the difference remains equal to the nominal exchange rate at 7%.

7. Why might the slope of the yield curve be a good predictor of future GDP? How might the term structure of interest rates be important for investment and the servicing of government debt?

The term structure of interest rates describes the per-period interest rate on bonds of different maturities. If the rate of return on long term bonds exceeds that on short term bonds it implies that future interest rates are expected to rise above the current interest rate. In this case, the yield curve would be upward sloping because as the maturity of the bonds increase the interest rate paid will also increase. When short term rates exceed long term rates the opposite is true. Here, the yield curve is downward sloping or 'inverted'- an indication that interest rates are anticipated to be lower in the future.



The slope of the yield curve may be an indicator of future GDP. If the economy is expected to expand the demand for money will rise putting upward pressure on future interest rates. As a result, long term rates will exceed short term rates and the yield curve will be upward sloping.

Suppose though that the economy was expected to enter a recession. In this scenario the future demand for money will fall pushing downward pressure on future interest rates. Consequently, long term rates will fall below short term rates and the yield curve will invert.

There is an element of qualification required here. It is normal for the yield curve to be upward sloping, because investing in long term bonds is riskier than investing in short term bonds- because the period to maturity is longer. Therefore, yields on long term bonds tend to exceed those on short term bonds as a matter of cause due to the presence of a risk premium. However, movements in the yield curve may still be informative about the future path of GDP.

In terms of investment, and financing government debt the term structure could be important. If long term rates exceed short term rates, then firms wishing to borrow to invest, or the government wishing to borrow so as to run a budget deficit would wish to sell bonds of a short maturity. This is because the interest rate would be lower in the short term. If the situation was reversed, and long term rates were below short rates, firms and the government would market more long term debt.