PART 2

ECS301D: STUDY UNIT 2

CH4: Understanding interest rates

In principle, explain the rationale of discounting future cash flows. Then explain the meaning of the formula

4.1 pp.67-68 – May 2009 exam. **(5)**

The concept of present value is based on the commonsense notion that a dollar paid to you one year from now is less valuable to you than a dollar paid to you today. The dollar you have today can be deposited into a savings account that earns interest, and you will then have more than a dollar in one year.

In the formula *PV* = present value, *CF* = cash flow, *i* = interest rate and *n* = number of years. Intuitively, if you are promised $1 of cashflow for certain e.g. ten years from now, this dollar would not be as valuable to you as $1 is today because if you had the $1 today, you could invest it and end up with more than $1 in 10 years.

SC A FD

4.2 pp.70-78 **(12)**

Simple loan: The lender provides the borrower with an amount of funds, which must be repaid to the lender at the maturity date along with an additional payment for the interest.

$$PV = \frac{CF}{(1+i)^n}$$

Fixed-payment loan: The lender provides the borrower with an amount of funds, which must be repaid by making the same payment every period (such as a month), consisting of part of the principal and interest for a set number of years.

$$LV = \frac{FP}{(1+i)} + \frac{FP}{(1+i)^2} + \frac{FP}{(1+i)^3} + \cdots + \frac{FP}{(1+i)^n}$$

Coupon bond: The owner of the bond is paid a fixed interest payment every year until the maturity date, upon which a specified final amount is also paid.

$$P = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \frac{C}{(1+i)^3} + \cdots + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}$$

Discount bond: A discount bond is bought at a price below its face value (at a discount), and the face value is repaid at the maturity date. A discount bond does not make interest payments.

$$i = \frac{F - P}{P}$$

Explain the difference between the YTM of a bond and the return on a bond.

This is the interest rate that equates the present value of cash flow payment received from a debt instrument to its value today

4.3 **pp.73-84** Nov 20 exam **(5)**

Yield to maturity is the interest rate that equates the present value of cash flow payments received from a debt instrument with its value today.

calculate

yearly coupon payment, face value of the bond

price of coupon bond $P = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \frac{F}{(1+i)^2}$

Return on a bond is the total return on a bond by an investor over a specific time period t to t+1.

NB Coupon Payment, Price of the bond at time $t+1$, Price of the bond at time t

$$R = \frac{C + P_{t+1} - P_t}{P_t}$$

Return from holding the bond from time t to time $t+1$

The return can also be split into two components, current yield ($i_c = \frac{C}{P_t}$) and the rate of capital gain ($g = \frac{P_{t+1} - P_t}{P_t}$).

(coupon payment), price of the bond at time t

4.4 **p.87** Distinguish between the nominal & real (i) rate. **(3)**

The interest rate as quoted in the media is the nominal interest rate. The real interest rate is the nominal interest rate adjusted for expected inflation.

Specifically, $i_r = i_n - \pi^e$ nominal interest rate, expected inflation, real interest rate

where i_r = real interest rate, i_n = nominal interest rate, π^e = expected inflation rate.

CH5: The Behaviour of interest rates

→ Briefly explain how (4) major factors affect the demand for an asset within the demand & supply of assets framework...

5.1 **pp.93-95** **(8)**

Wealth: Holding everything else constant, an increase in wealth raises the quantity demanded of an asset.

Expected returns: An increase in an asset's expected return relative to that of an alternative asset, holding everything else unchanged, raises the quantity demanded of the asset.

Risk: Holding everything else constant, if an asset's risk rises relative to that of alternative assets, its quantity demanded will fall.

Liquidity: The more liquid an asset is relative to alternative assets, holding everything else unchanged, the more desirable it is, and the greater will be the quantity demanded.

→ Explain why the price of a bond & its (i) are inversely related. Use a 1-year discount bond which pays a face value (F) of R1000,00 as an example. **(4)**

⇒ May 2010 exam

5.2 **pp.96-97**

The lower the price of a bond the higher the interest rate (or yield to maturity)

$$i = \frac{F - P}{P}$$

$$i = \frac{F - P}{P} = \frac{1000 - 950}{950} = 0.053 = 5.3\%$$

$$i = \frac{F - P}{P} = \frac{1000 - 900}{900} = 0.111 = 11.1\%$$

SED

Derive a bond demand curve (P of bond VS quantity demanded) & a bond supply curve, and indicate how the equilibrium P for the bond is determined. Explain which of these curves can be respectively associated with the lenders & borrowers of funds (8)

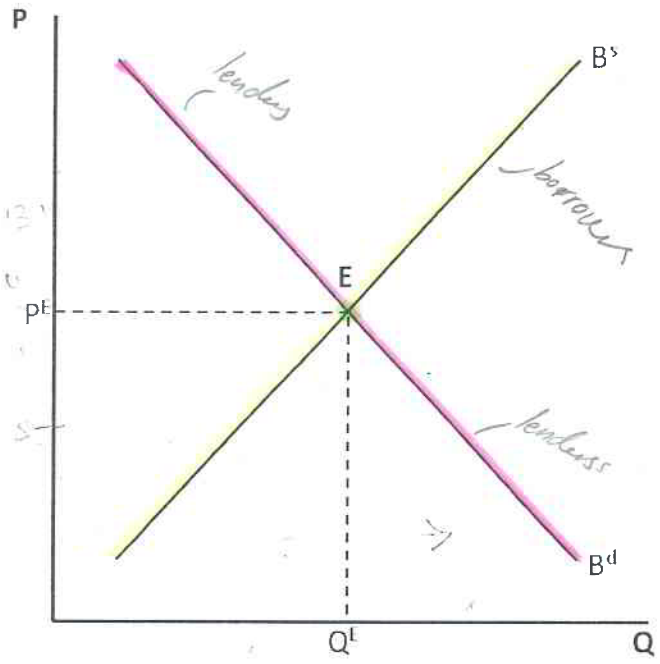
5.3 pp.96-99 **(8)**

May 2010 exam

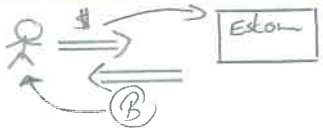
Demand for bonds: The demand for bonds is associated with the lenders of funds: by buying bonds they are supplying funds to the sellers of bonds. As the price of bonds decrease, the interest rate on bonds will increase. A higher interest rate on bonds implies a higher expected return on bonds; thus, according to the theory of asset demand, the quantity demanded of bonds will increase. Subsequently, the bond demand curve will be downward-sloping.

Supply of bonds: The supply of bonds is associated with borrowers of funds: by supplying bonds they are borrowing funds from the buyers of bonds. Again, as the price of bonds decrease, the interest rate on bonds will increase. At the higher interest rate it is more costly for companies to borrow by issuing bonds; therefore the quantity supplied of bonds will decrease. Subsequently, the bond supply curve is upward-sloping.

Equilibrium: Market equilibrium occurs when the amount that people are willing to buy (demand) equals the amount that people are willing to sell (supply).



• E_M = willing to buy (demand) = willing to sell (supply)



$P_B \downarrow \Rightarrow i_r B \uparrow \Longrightarrow ROR_B(\text{expected}) \uparrow \therefore Qd_B \uparrow$ ... Dcurve (down slope)

Supply of (B)

• supply (B) borrowing funds from

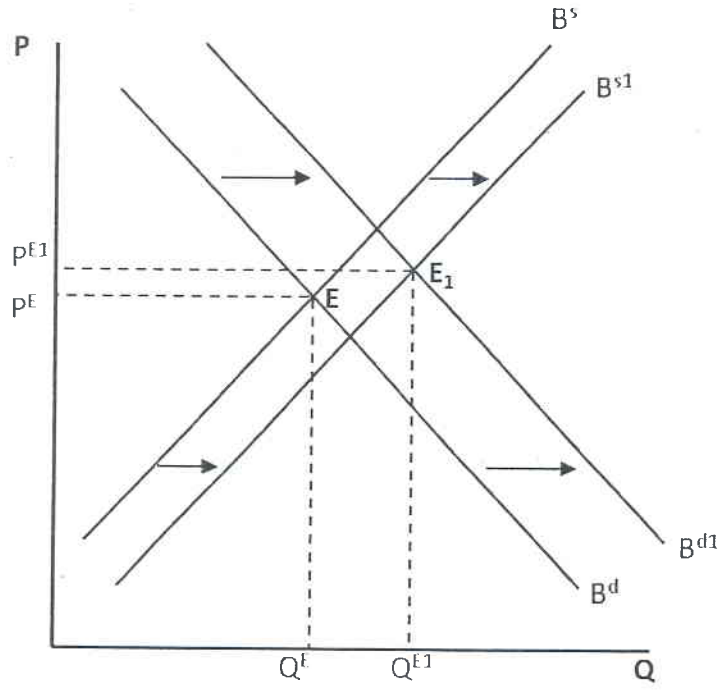
$P_B \downarrow \Rightarrow i_r(B) \uparrow \Longrightarrow \text{Costly}(P+) \therefore Qs(B) \downarrow$ ... (upward slope) Scurve

Use the framework from 5.3 above to predict how the demand for and supply of bonds is affected (provide reasons) by each of the following factors (also, if possible predict the equilibrium P, Q as well as the equilibrium i)...

5.4 pp.96-108

See 5.3 for derivation of the supply and demand curves.

Business cycle expansion: In a business cycle expansion income and wealth rises. According to the theory of asset demand, an increase in income or wealth will increase the demand for bonds, leading to a rightward shift in the demand curve. In addition, business will be more willing to borrow, because they are likely to have many profitable investment opportunities for which they need financing. As a result the bond supply curve will shift to the right. The equilibrium quantity will increase, but the change in equilibrium price (and therefore the interest rate) will depend on the magnitude of the shifts in the supply- and demand curves. The equilibrium price will either increase, decrease, or stay the same. In the graph below it is assumed that the demand curve shifts more than the supply curve and as a result the equilibrium price will increase and equilibrium interest rate will decrease.



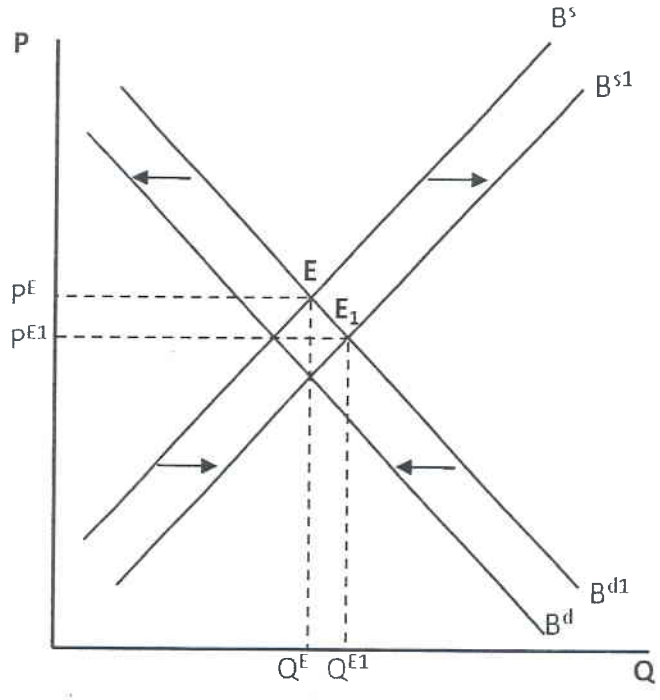
Increase in public's propensity to save: If households save more, wealth will increase. This will lead to an increased demand for bonds, and a rightward shift of the demand curve. Equilibrium price and quantity will increase and the equilibrium interest rate will fall.

↑Qd_B ↑D_B + right shift (Dcurve) P_E↑ : Q↑ : i_E↓

Higher expected future interest rates: Higher expected interest rates in the future lower the expected return for long-term bonds due to a fall in the price of the bond. Subsequently the demand curve will shift to the left, equilibrium price and quantity will fall and the equilibrium interest rate will increase.

↓ ROR_B } Dcurve (left shift) ...
↓ P_B
P_E↓ Q↓ → i_E ↑

Increase in the expected inflation rate: Since bond payments are fixed in nominal terms, an increase in the expected inflation rate will reduce the real return on bonds. As a result the demand for bonds will decrease and the demand curve will shift to the left. At the same time, an increase in the expected inflation rate will reduce the real cost of borrowing (suppliers of bonds are borrowers of funds). Subsequently the supply of bonds will increase and the supply curve will shift to the right. The equilibrium price of bonds will definitely fall, and therefore the equilibrium interest rate will rise. Depending on the magnitudes of the shifts in the supply- and demand curves, the equilibrium quantity can either increase, decrease, or stay the same. In the graph below it is assumed that the supply curve shifts more than the demand curve and as a result the equilibrium quantity increases.



Increase in the riskiness of bonds relative to other assets: An increase in the riskiness of bonds relative to other assets will cause the demand for bonds to fall. The demand curve will shift to the left, equilibrium price and quantity will decrease and the equilibrium interest rate will increase.

Increase in the government's budget deficit: Governments can issue bonds to finance budget deficits. If the budget deficit increases, the treasury will sell more bonds. Subsequently the supply of bonds will increase, the supply curve will shift to the right, equilibrium quantity will increase, the equilibrium price will decrease and the equilibrium interest rate will increase.

Explain Keyne's liquidity preference framework (LPF) that is its simplifying assumptions, the derivation of the demand curve & supply curve

5.5 **pp.111-113** May 2010 Exam **(8)**

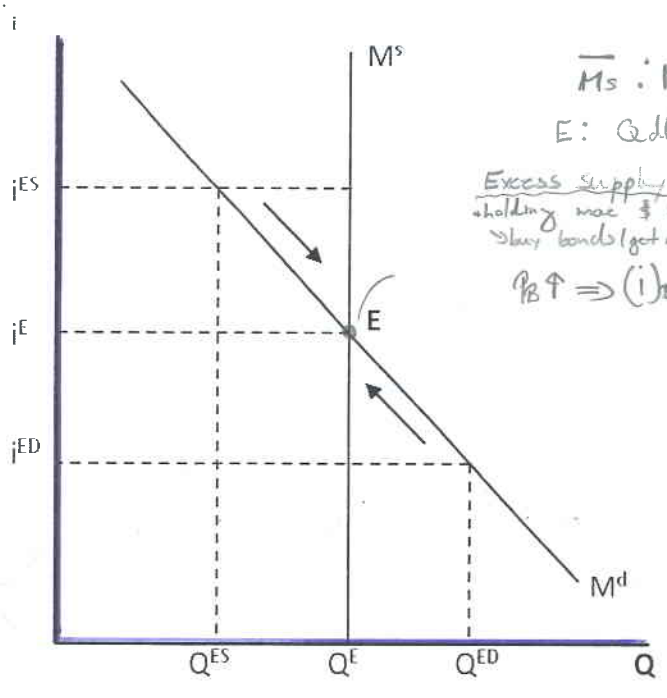
Keynes's liquidity preference framework determines equilibrium interest rates in terms of the supply of and demand for money. He assumed that there are only two categories of assets in which people store their wealth: money and bonds. As such, the quantity of money and bonds supplied must equal the quantity of money and bonds demanded.

Rewriting the equation yields

This tells us that if the market for money is in equilibrium ( ) the right-hand side of the equation equals zero, implying that the bond market is also in equilibrium ( ).

Keynes assumed that money has a zero rate of return. Bonds, the only alternative asset to money, has an expected return equal to the interest rate *i*. Therefore, as the interest rate rises (holding everything else constant), the expected return on money falls relative to the expected return on bonds, leading to a fall in the quantity of money demanded. Also, as the interest rate rises, the opportunity cost of holding money (interest that could have been earned holding bonds) increases, also leading to a fall in the quantity of money demanded.

It is also assumed that the money supply is controlled by a central bank at a fixed quantity. Therefore, the money supply curve is a vertical line. Equilibrium is where .



$\overline{Ms}$: Ms Curve (vertical line)

E: Qd(money) = Qs(money)

Excess supply of money
(holding more $ than desired
→ buy bonds / get rid of excess cash)

$P_B \uparrow \Rightarrow (i)_B \downarrow$

Excess supply of money means that people are holding more money than they desire, so they will try to get rid of their excess money balances by buying bonds. Subsequently, they will bid up the price of bonds, and as the bond price rises the interest rate will fall. Excess demand for

money means that people want to hold more money than they currently have. They will sell their only other asset – bonds – and subsequently the bond price will fall. As the price of bonds falls the interest rate will increase toward the equilibrium rate.

Excess

Explain how Keynes liquidity preference framework can be used to explain the effects of

5.6 pp.113-116 Use graphs Kubelo **(12)**

Increase in income: As income increases, people will want to hold more money as a store of value. People will also desire to carry out more transactions using money. A higher level of income therefore causes the demand for money to increase and the money demand curve will shift to the right, leading to an increase in the equilibrium interest rate.

Rise in the price level: When the price level rises, the same nominal quantity of money is no longer as valuable, as it cannot be used to purchase as many real goods and services as before. To restore their holdings of money in real terms to its former level, people will want to hold a greater nominal quantity of money. A rise in the price level will therefore cause the demand for money to increase. The money demand curve will shift to the right and the equilibrium interest rate will increase.

Increase in the money supply: An increase in the money supply – engineered by the central bank – will shift the money supply curve to the right, leading to a fall in the equilibrium interest rate.

However, while an increase in the money supply causes the interest rate to fall, it might have other effects on the economy that makes the interest rate rise. Because an increase in the money supply is an expansionary influence on the economy, it should raise national income and wealth. The *income effect* thus predicts that an increase in the money supply will lead to a rise in the interest rate in response to the higher level of income. An increase in the money supply can also cause the overall price level in the economy to rise. The *price-level effect* predicts a rise in the interest rate in response to the rise in the price level. Finally, the higher inflation rate that results from an increase in the money supply also affects interest rates by affecting the expected inflation rate. The *expected-inflation effect* also predicts a rise in interest rates in response to the rise in the expected inflation rate.

CH6 : The risk and term structure of (i)

Explain the meaning of the risk structure of (i). List & explain 3 factors which affect the risk structure of (i) using a supply of/demand & bonds framework... (15)

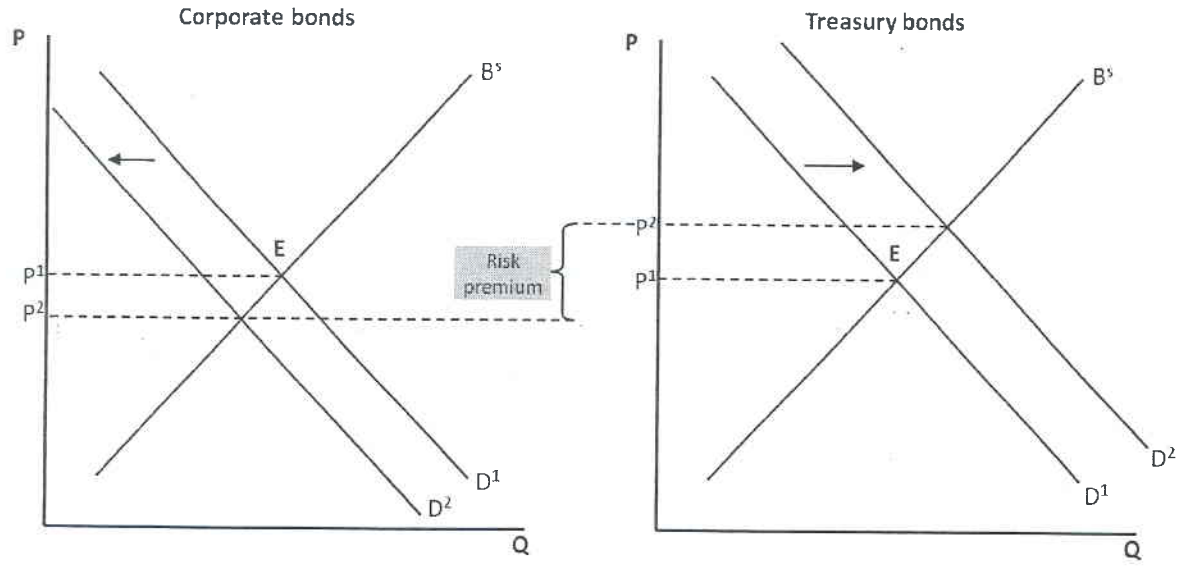
6.1 **pp. 127-134**

The risk structure of interest rates is the relationship among the different interest rates on bonds with the same term to maturity. Two important features of interest-rate behaviour for bonds of the same maturity are that interest rates on different categories of bonds differ from one another in any given year, and the spread between the interest rates varies over time.

The risk structure of interest rates can be affected by default risk, liquidity and income tax considerations.

Default risk: Default risk is the risk that the issuer of the bond is unwilling or unable to make interest payments as promised, or pay off the face value when the bond matures. Different categories of bonds have different levels of default risk. The risk premium is the spread between interest rates on bonds with default risk and default free bonds (both of the same maturity). The risk premium indicates how much more interest people must earn for them to be willing to hold the riskier bond.

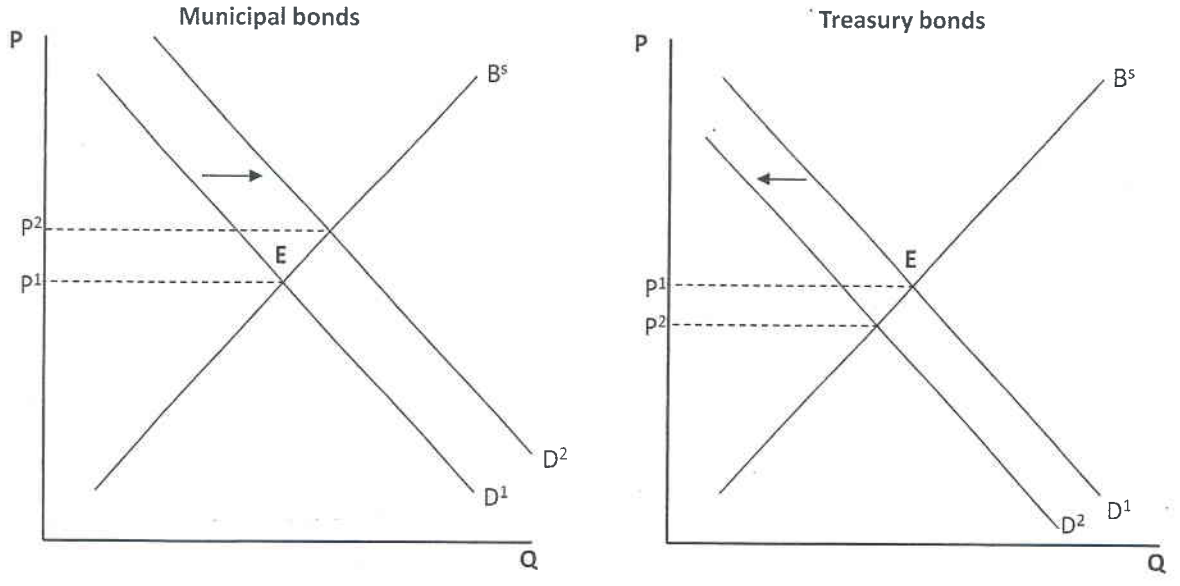
An increase in the risk of corporate bonds will shift the demand curve for corporate bonds to the left (because the expected return on these bonds has fallen). This will lead to a fall in the price of corporate bonds and an increase in the equilibrium interest rate on corporate bonds. At the same time, the expected return on default-free Treasury bonds increases relative to the expected return on corporate bonds, leading to a rightward shift in the demand curve for these bonds. Subsequently the price of Treasury bonds will increase and the interest rate will decrease. The difference between the interest rate on corporate bonds and the interest rate on default-free Treasury bonds represents the risk premium.



Liquidity: A liquid asset is one that can be quickly and easily converted into cash if the need arises. The more liquid an asset is the more desirable it is, ceteris paribus. Because Treasury bonds are so widely traded they are the easiest to sell and the cost of selling them is also quite low – they are therefore highly liquid. Corporate bonds are not as liquid, because fewer bonds per corporation are traded.

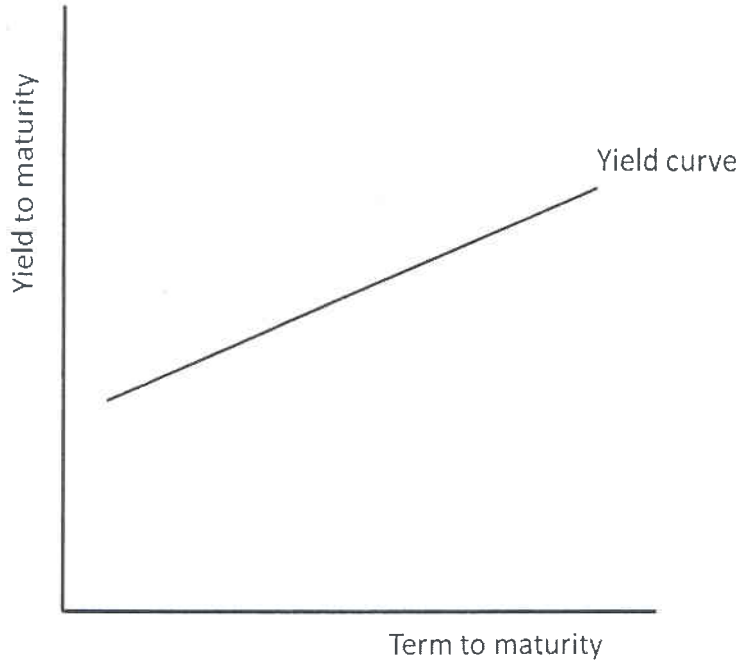
Consider a corporate bond that becomes less traded and therefore less liquid. Similar to the figure above, the demand for corporate bonds will therefore fall, the demand curve will shift to the left, the price will fall and the equilibrium interest rate will go up. The Treasury bonds are now relatively more liquid and demand will increase, leading to a rightward shift in the demand curve for Treasury bonds, an increase in price and a fall in the equilibrium interest rate on Treasury bonds.

Income tax considerations: Consider the following graphs, where we have identical default-free municipal and treasury bonds. If the municipal bonds are given a tax advantage (say interest payments are exempted from income tax), the after-tax return on municipal bonds relative to treasury bonds will increase. Subsequently the demand for municipal bonds will increase, the demand curve will shift to the right, the price will increase and the equilibrium interest rate will drop. At the same time, Treasury bonds will become less desirable than municipal bonds, resulting in a fall in demand for Treasury bonds. The demand curve will shift to the left, the price will decrease and the interest rate will increase.



6.2 **pp. 127-135** **(10)**

The relationship among interest rates on bonds with different terms to maturity is called the term structure of interest rates. The yield curve is a plot of the yields on bonds with differing terms to maturity but the same characteristics (risk, liquidity and tax considerations). Normally long-term interest rates will be higher than short-term interest rate due to increased risk and uncertainty over the long term. Therefore the normal yield curve slopes upward.



The three empirical facts of the yield curve are:

(i) Interest rates on bonds of different maturities move together over time

(ii) When short-term interest rates are low, yield curves are likely to have an upward slope; when short-term interest rates are high, yield curves are more likely to slope downward.

(iii) Yield curves almost always slope upward.

Explain the assumptions & predictions of the expectations theory & how well it explains the 3 empirical observations of the yield curve (+)

6.3 pp. 137-139 **(9)**

The expectations theory proposes that the interest rate on a long-term bond will equal an average of the short-term interest rates that people expect to occur over the lifetime of the long-term bond. The key assumption behind this theory is that buyers of bonds do not prefer bonds of one maturity over another, so they will not hold any quantity of a bond if its expected return is less than that of another bond with a different maturity.

The expectations theory explains fact 1, which states that interest rates on bonds with different maturities move together over time. Historically, short-term interest rates have had the characteristic that if they increase today, they will tend to be higher in the future. Hence a rise in short-term rates will raise people's expectations of future short-term rates. Because long-term rates are the average of expected future short-term rates, a rise in short-term rates will also raise long-term rates, causing short- and long-term rates to move together.

The expectations theory also explains fact 2, which states that yield curves tend to have an upward slope when short-term interest rates are low and are inverted when short-term interest rates are high. When short-term interest rates are low, people generally expect them to rise to some normal level in the future, and the average of future expected short-term rates is high relative to the current short-term rate. Therefore, long-term interest rates will be substantially higher than current short-term rates, and the yield curve would then have an upward slope. The converse is true when short-term interest rates are high.

According to the expectations theory the yield curve is equally likely to slope upward or downward, and it therefore cannot explain fact 3 which states that yield curves normally slope upward.

→Explain the assumptions & predictions of the segmented market theory & how well it explains the 3 empirical observations of the yield curve

6.4 pp. 139-140 **(7)**

The segmented markets theory sees markets for different-maturity bonds as completely separate and segmented. The interest rate for each bond with a different maturity is then determined by the supply and demand for that bond, with no effects from expected returns on other bonds with other maturities. The key assumption of this theory is that bonds of different maturities are not substitutes at all, so the expected return from holding a bond of one maturity has no effect on the demand for a bond of another maturity.

Typically the demand for long-term bonds is relatively lower than that for short-term bonds, so long-term bonds will therefore have lower prices and higher interest rates. Hence the yield curve will typically slope upward (explaining fact 3 which states that yield curves normally slope upward). However, because this theory views the market for bonds of different maturities as completely segmented, there is no reason for a change in interest

rates on a bond of one maturity to affect the interest rates on a bond of another maturity. Therefore it cannot explain fact 1 which states that interest rates on bonds with different maturities move together over time. Secondly, because it is not clear how demand and supply for short- versus long-term bonds change with the level of short-term interest rates, the theory cannot explain why yield curves tend to slope upward when short-term interest rates are low and to be inverted when short-term interest rates are high (fact 2).

6.5 pp. 140-142

The liquidity premium theory of the term structure states that the interest rate on a long-term bond will equal an average of the short-term interest rates expected to occur over the life of the long-term bond, plus a liquidity premium that responds to supply and demand conditions for that bond (see the formula in the textbook, chapter 6). The key assumption of this theory is that bonds of different maturities are substitutes, and as such the expected return on one bond does influence the expected return on another bond with a different maturity. It therefore allows investors to prefer one maturity bond over another. In other words, bonds of different maturities are assumed to be substitutes but not perfect substitutes. Since short-term bonds bear less risk than long-term bonds investors tend to prefer holding short-term bonds. To compensate for these risks, investors must be offered a positive liquidity premium to induce them to hold longer-term bonds. This liquidity premium rises with the term to maturity of the bond (as risk increases).

The preferred habitat theory is closely related to the liquidity premium theory, as investors have a preference for bonds of a particular maturity. In order to hold bonds of different maturity investors need to earn a higher return on these bonds. Since investors usually prefer short-term bonds they will need to be compensated for holding longer-term bonds.

These theories explain fact 1, which states that interest rates on bonds with different maturities move together over time. A rise in short-term interest rates indicates that short-term interest rates will, on average, be higher in the future, and therefore the long-term interest rate will rise along with them. Fact 2 (yield curves tend to slope upward when short-term interest rates are low and to be inverted when short-term interest rates are high) are also explained: Because investors generally expect short-term interest rates to rise to some normal level when they are low, the average of future expected short-term interest rates will be high relative to the current short-term rate. With the additional boost of a positive liquidity premium, long-term interest rates will be substantially higher than current short-term rates, and the yield curve will slope upward. The converse is true if short-term rates are initially high. Finally, these theories also explain fact 3, which states that yield curves normally slope upward. Because the liquidity premium rises with a bond's maturity, long-term interest rates are usually higher than short-term interest rates, resulting in an upward-sloping yield curve.