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REVISION NOTES
Strategic Financial Management

Interest Rate Risk Management

INTEREST RATE RISK MANAGEMENT

What is meant by Interest Rate Risk

Interest rate risk refers to the risk that a business is exposed due to changes in interest rates. Interest rate movements affect different types of entities differently. For example a company with a high capital expenses and low margins would see its profits margins shrink in case of an upward move of interest rates.

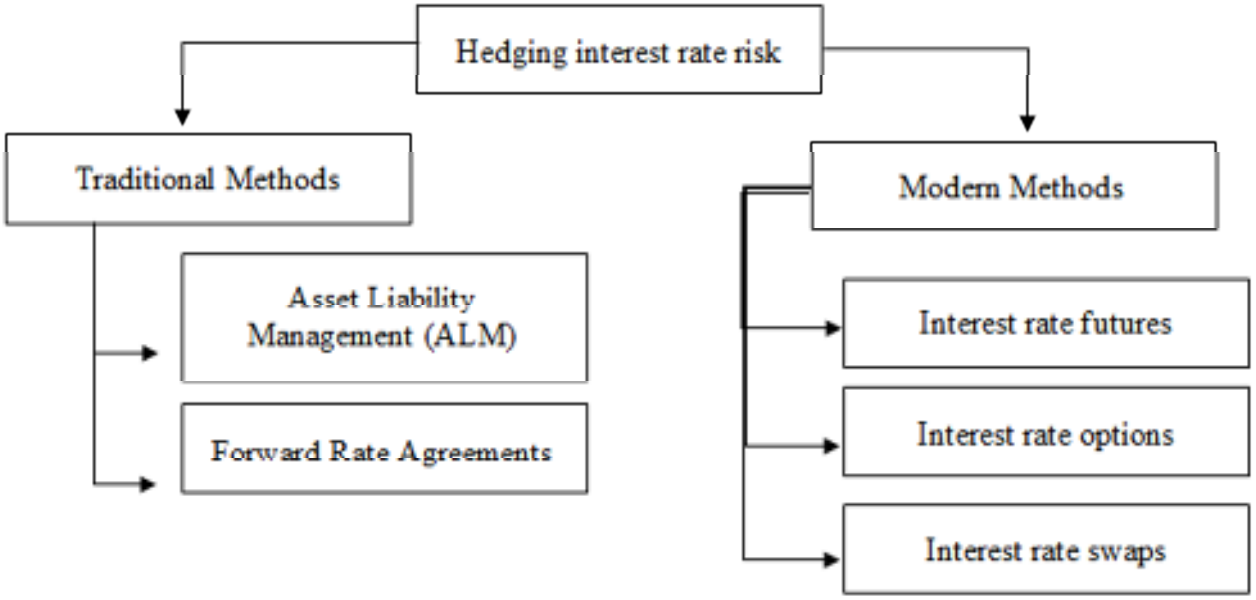
Similarly, banks who borrow money and lend it are affected in a different way. Banks would also be affected by interest rate movements to the extent such movements affect the valuation of bonds since banks hold a large portion of their funds in such bonds.

What are the different types of Interest rate risk

Gap Exposure (typically more important for Banks)	A gap or mismatch risk arises from holding assets and liabilities (and off balance sheet items) with differing principal amounts or maturity dates thereby creating exposure due to sudden and unexpected changes in the interest rates	Where the bank holds more Rate sensitive Assets (RSA) than Rate sensitive Liabilities (RSL) there would be a positive Gap (meaning increase in interest rates could result in Net Interest Income going up) and vice versa.
Basis risk	Market interest rates of various instrument seldom change by the same degree. The risk of different assets and liabilities may change in different magnitude is referred to as basis risk	For example: Assets may be linked to Fixed Interest rates while liabilities may be linked to floating rates.
Embedded option risk	There may be assets / liabilities which have an embedded option and any change in interest rates may trigger such embedded option resulting in losses	For example: A put table loan (i.e. a loan which can be repaid by the borrower at any time) will be triggered if the interest rates go down i.e. the borrower may decide to repay the high interest cost loan
Yield Curve risk	In a floating rate scenario banks may price their assets and liabilities on different benchmarks like TBill yield, fixed deposit rates, call money rates etc. In such a case any non-parallel move in the yield curve i.e. one benchmark moves but the other does not may expose the entity to interest rate risk	These are more likely to happen when the economy is moving through business cycles

Price risk	We know that yield and price of bonds are inversely related. Hence any movement in the interest rates results in an opposite movement in the price of the bonds	Banks hold a significant part of their funds in bonds and that too in the held for trading category. Any interest rate movement will affect the value of such bond portfolio
Reinvestment risk	Reinvestment risk is the risk of interest rate movements at the time of reinvestment of cash flows	Any mismatch in cash flows could affect the returns of the bank if interest rates have moved in the interim period.

Hedging interest rate risk - Two broad methods



TRADITIONAL METHODS	
Asset Liability Management (ALM)	Asset Liability Management (ALM) can be defined as a mechanism to address the risk faced by a bank due to a mismatch between assets and liabilities either due to liquidity or changes in interest rates. Liquidity is an institution's ability to meet its liabilities either by borrowing or converting assets.
Forward Rate Agreements (FRAs) (Discussed in detail later in the chapter)	FRAs are Over the Counter (OTC) products and are not traded on the exchange. A FRA is an agreement between two parties through which a borrower / lender protects itself from unfavorable changes in interest rates

MODERN METHODS	
(Detailed discussion given later in this chapter)	
Interest rate futures	An interest rate future is a futures contract with an underlying instrument that pays interest. The interest rate future allows the buyer and seller to lock in the price of interest bearing asset for a future date (and thereby lock in the yield or interest rates)
Interest rate options	Cap option. Cap option is usually purchased by a borrower whereby he gets reimbursed for any interest rise above the cap level. The buyer of the cap pays a premium to the seller of the cap. Refer Example 1 below
	Floor option: Floor option is usually purchased by a lender whereby he gets reimbursed for any interest fall below the floor level. The buyer of the floor pays a premium to the seller of the floor. Refer Example 2 below
Interest rate collars	It is a combination of a floor and a cap. The buyer of the cap (pays the premium) and simultaneously sells a floor (and receives a premium). Creation of a collar has the effect of reducing the premium outflow and creating a band within which the interest rate will move for the creator of the collar) Refer Example 3 below
Interest rate swaps	In an interest rate swap, the parties to the agreement, termed the swap counter-parties, agree to exchange payments indexed to two different interest rates. Total payments are determined by the specified notional principal amount of the swap, which is never actually exchanged.
Swaptions	An interest rate swaption is simply an option on an interest rate swap. It gives the holder the right but not the obligation to enter into an interest rate swap at a specific date in the future, at a particular fixed rate and for a specified term.

Example 1: CAP OPTION

Let's say Mr X is a borrower who has borrowed money at LIBOR + 1%. Currently the LIBOR is at 4%, thereby making the current borrowing cost of Mr X 5%. Let's presume that Mr X buys a Cap at LIBOR of 6%. If LIBOR goes above 6% say to 7% then Mr X will pay the lenders of money 8% (because he has borrowed at LIBOR + 1%) but on the other hand he will receive 1% from the seller of the cap the difference between LIBOR (7%) and the Cap rate (6%) thereby making his cost of borrowing 7+1-1 = 7%. If the LIBOR went to 10% (say) Mr X will pay the lenders of money L+1 i.e. 11% but on the other hand he will receive the difference between LIBOR(10%) and cap rate (6%) i.e. 4%. Hence his net borrowing cost will be again 7% i.e. 10+1-4 = 7%. If on the other hand LIBOR went down to say 2% he will pay the lenders of money 2+1 =3% and will not exercise the cap (since the LIBOR has not crossed the cap level of 6%) making his cost of borrowing 4%

Conclusion: Caps have the effect of freezing the upward movement of interest cost (in this case - 7%) while it allows the buyer of the cap option to take advantage of downward moves.

Example 2: FlOOR OPTION

Example: Let's say Mr X is a lender who has lent money at LIBOR + 1%. Currently the LIBOR is at 7%, thereby making the current interest earning of Mr X 8%. Lets presume that Mr X buys a floor at LIBOR of 4%. If LIBOR goes below 4% say to 3% then Mr X will receive 4% from the borrower(because he has lent at LIBOR + 1%) but on the other hand he will receive 1% from the seller of the floor (the difference between LIBOR (3%) and the Floor rate (4%) thereby making his net interest income 3+1+1 = 5%. If the LIBOR went to 1 % (say) Mr X will receive from the borrower L+1 i.e. 2% but on the other hand he will receive the difference between LIBOR(1%) and floor rate (4%) i.e. 3%. Hence his net interest income will be again 5% i.e. 1+1+3% = 5%. If on the other hand LIBOR went up to say 10% he will receive from borrowers 10+1 =11% and will not exercise the floor (since the LIBOR has not crossed the floor level of 4%) making his net interest income 11%

Conclusion: Floors have the effect of freezing the downward movement of interest earnings (in this case - 5%) while it allows the buyer of the floor option to take advantage of upward moves.

Example 3: INTEREST RATE COLLARS

Let us presume that Mr X has borrowed money at L+2%. Currently Libor is at 5%. Mr X decides to buy a cap of Libor at 7% and simultaneously sell a floor at Libor of 3%. Let us analyse what will be his net borrowing cost under different scenarios of Libor:

If Libor =	Pay to Lenders (L+2%)	Receive on the Cap option purchased @ 7%	Pay on the floor option sold @ 3%	Net borrowing cost
1%	3%	Nil	2%	5%
2%	4%	Nil	1%	5%
3%	5%	Nil	Nil	5%
4%	6%	Nil	Nil	6%
5%	7%	Nil	Nil	7%
6%	8%	Nil	Nil	8%
7%	9%	Nil	Nil	9%
8%	10%	1%	Nil	9%
9%	11%	2%	Nil	9%
10%	12%	3%	Nil	9%

Hence we see from the above that by creating a floor Mr X has capped his lower level of interest rate at 5% (ie his cost of borrowings will never go below 5%) and has also capped the higher level of interest @ 9% (ie his cost of borrowings will never go beyond 5%)

Swaptions

An interest rate swaption is simply an option on an interest rate swap. It gives the holder the right but not the obligation to enter into an interest rate swap at a specific date in the future, at a particular fixed rate and for a specified term.

There are two types of Swaption contracts:

a. Fixed rate payer swaption gives the owner of the swaption the right but not the obligation to enter into a swap where they pay the fixed leg and receive the floating leg.
b. Fixed rate receive swaption gives the owner of the swaption the right but not the obligation to enter into a sway in which they will receive the fixed leg and pay the floating leg.

Uses of swaption:

a. Swaption can be used by traders (to speculate) as well as by corporates (to hedge).
b. Swaptions are useful to borrowers to lock into a particular rate in case of adverse interest rate movements. (They would pay fixed and receive floating)
c. Swaptions are useful to investors / lenders to participate in upward interest rate movements (they would pay floating and receive fixed).
d. Swaptions can be useful for corporates tendering for contracts and who want to eliminate the effect of adverse interest rate movements beyond a certain point.
e. Swaptions also provide protection on callable / puttable bond issues

Forward rate Agreements

A Forward Rate Agreement (FRA) is an agreement between two parties through which a borrower/ lender protects itself from the unfavourable changes to the interest rate. Unlike futures FRAs are not traded on an exchange thus are called OTC product.

Main features of Forward rate agreements

a. Normally it is used by banks to fix interest costs on anticipated future deposits or interest revenues on variable-rate loans indexed to LIBOR.
b. It is an off Balance Sheet instrument.
c. It does not involve any transfer of principal. The principal amount of the agreement is termed "notional" because, while it determines the amount of the payment, actual exchange of the principal never takes place.
d. It is settled at maturity in cash representing the profit or loss. A bank that sells an FRA agrees to pay the buyer the increased interest cost on some "notional" principal amount if some specified maturity of LIBOR is above a stipulated "forward rate" on the contract maturity or settlement date. Conversely, the buyer agrees to pay the seller any decrease in interest cost if market interest rates fall below the forward rate.

Interest rate futures:

An interest rate future is a futures contract with an underlying instrument that pays interest. The interest rate future allows the buyer and seller to lock in the price of interest bearing asset for a future date (and thereby lock in the yield or interest rates).

Futures use the inverse relationship between interest rates and bond prices to hedge against interest rate movements.

A borrower will enter into a sell futures today. Then if the interest rates rise in the future, the value of future will fall (as it is linked to the underlying asset, bond prices) and hence a profit can be made when closing out the futures (i.e. buying the futures).

PROBLEMS

Question 1:

In November 2012 a company's corporate treasurer realises that in mid-December he will need to borrow $1 million for 3 months. He is concerned that interest rates might rise in the intervening period. The following data is available in November:

- November spot $ interest rate 10%
- December 3 month Euro Dollar futures 11%
- The contract size for Euro dollar futures is $1 million.

Required:

Show how the treasurer might hedge his position using a futures market operation.

Assume the funding requirement is on the last day of December futures trading. Illustrate your answer with reference to the following December spot rates:

9%
11%
13%

Question 2:

In UK, X Ltd has realised from its cash budget that it is likely to have a surplus of £ 100 lacs arising in 2 months' time (May) for a period of 3 months. It is concerned that interest rates in the next 2 months may fall and wishes to hedge this risk using future contracts.

June 3 months sterling interest rate futures contracts are available with a contract size of £ 5 lacs. They are currently priced at £ 96.00. Interest rate currently stands at 4%.

Explain how X Ltd can hedge its interest rate exposure using futures contracts if in 2 months' time the market interest rate has fallen to 3% and the futures price has moved to £ 97.00

Question 3:

The monthly cash budget of HYK Communication plc shows that the company is likely to need £ 18 million in two months' time for a period of four months. Financial markets have recently been volatile and finance director fears that the short-term interest rates could rise by as much as 150 tics that is 1.5%. Libor is currently at 6.5% and HYK plc can borrow at Libor + 0.75%.

LIFFE £ 5,00,000 3 month future prices are as follows:

December	93.40
March	93.10
June	92.75

Assume that it is now 1st December and that exchange traded future contracts expire at the end of the month. You are required to estimate the result of undertaking an interest rate futures on the London International financial futures exchange if LIBOR increases by 150 tics that is 1.5% and March future increases by 130 tics that is 1.3%

Question 4

X Ltd would require Rs.500 crores after six month and is worried that it's cost of capital at that time might go up beyond 11% .Hence it decides to buy a Cap at 11% on 500 crores for five years interest to be paid at quarterly interval. It pays a premium of Rs.5 crores to Z limited. Y Ltd is expecting surplus of ₹ 100 crores after six months for three years and it is worried that interest rates may fall below 7%. Hence it buys a floor floor at 7% on ₹ 100 crores for three years on quarterly compounding basis and pays the premium of Rs.2 crores to X Ltd. You are required to bring out the cash flow implications for X Ltd and Y Limited if the interest rates after six months are as below:

a. 6.5% -10.45%
b. 7.5% -11.45%
c. 06% - 10.5%
d. 7.4% - 14%
e. 5% -13%

Question 5.

A Plc wishes to raise fixed interest debt capital. Because of its current poor credit rating it considers a debenture issue to be out of the question and the best fixed interest rate loan it can obtain is at 12.5% p.a. A Plc can however borrow at a variable rate of LIBOR + 0.5. B Plc can issue fixed rate debentures at 11% or alternatively borrow at a variable rate equivalent to LIBOR. B plc wants a floating rate loan.

A and B arrange to swap with the following conditions (assume each firm requires £ 1 million of funds.

i. A borrows £ 1 million at a variable rate of LIBOR + 0.5%
ii. B borrows £ 1 million at the fixed rate of 11%
iii. In the swap arrangement A agrees to pay B interest of 11.5% (fixed) on the £ 1 million while B agrees to pay A an interest rate of LIBOR (variable) on the same sum.

Required:

a. Calculate the net cost of financing A & B
b. Evaluate the effect on A and B of a LIBOR of (a) 8% (b) 17%
c. Draft the scheme of swap if the bank arranging the swap, A Plc, B Plc are to share the net gain in the ratio of 3:3:4

Question 6:

Derivative Bank entered into a plain vanilla swap through an OIS (overnight Index Swap) on a principal of ₹ 10 crores and agreed to receive MIBOR overnight floating rate for a fixed payment on the principal. The swap was entered into on Monday 2nd August, 2010 and was to commence on 3rd August 2010 and run for a period of 7 days.

Respective MIBOR rates for Tuesday to Monday were:
7.75%, 8.15%, 8.12%, 7.95%, 7.98%, 8.15%
If Derivative Bank received ₹ 317 net on settlement, calculate Fixed rate and interest under both legs.

Note:

a. Sunday is a holiday
b. Work in rounded rupees and avoid decimal working

Question 7:

You are given the following interest rates by a bank:

Period	Rates
3 months	6% - 6.4%
6 months	8% - 10.2%

Another bank has quoted 3/6 FRA as 6% - 7.2%

Required

A. Calculate 3/6 FRA in respect of deposits
B. Verify whether there is any arbitrage opportunity if the client can borrow ₹ 1,00,000 now.
C. Also, if yes, describe the actions to be taken by the arbitrager to avail arbitrage opportunity.

Question 8:

Consider the following data for Government Securities:

Face value	Interest rate (%)	Maturity (Years)	Current Price (₹)
1,00,000	0	1	91,000
1,00,000	10.5	2	99,000
1,00,000	11.00	3	99,500
1,00,000	11.50	4	99,900

Calculate the forward interest rates

Question 9:

Electra space is a consumer electronics wholesaler. The business of the firm is highly seasonal in nature. In 6 months of a year the firm has a huge cash deposit and especially near Christmas time and other 6 months the firm faces a cash crunch leading to borrowing of money to cover up its exposure for running the business.

It is expected that the firm shall borrow a sum of Euro 50 million for the entire period of slack season in about 3 months' time.

A Bank has given the following quotations:

Spot 5.50% - 5.75%
3 x 6 FRA 5.59% - 5.82%
3 x 9 FRA 5.64% - 5.94%

3 months Euro 50000 futures contract maturing in 3 months' time is quoted at 94.15 (5.85%)

You are required to determine:

(a) How a FRA shall be useful if the actual interest rate after 3 months turnout to be
(i) 4.5% (ii) 6.5%

(b) How 3 month futures contract shall be useful for company if the interest rate turns out as mentioned in (a) above

Question 10

Suppose a life insurance company issued $ 100 million of 5 year guaranteed investment contracts that commit it can pay a fixed rate of 9% semiannually. Suppose the company is able to invest $ 100 million is a 5 year semiannual floating rate instrument yielding 6 month LIBOR + 1%

a. Describe the interest exposure by the insurance company. At what point would the company not be able to earn enough on the floating rate instrument to pay for its fixed obligations?

b. Suppose there is available in the market a 5 year floating interest rate swap with a notional amount $ 100 million with the following terms that i) receive fixed 8.5% every 6 months and ii) pay 6 month LIBOR, then how can the insurance company use this swap to hedge its interest rate exposure

Question 11

The following details are related to the borrowing requirements of two companies ABC Ltd and DEF Ltd :

Company	Requirement	Fixed rate offered	Floating rate offered
ABC Ltd	Fixed rupee rate	4.5%	PLR + 2%
DEF Ltd	Floating rupee rate	5%	PLR + 3%

Both companies are in need of ₹ 2,50,00,000 for a period of 5 years . The interest rates on the floating rate loans are reset annually. The current PLR for various period maturities are as follows :

Maturity (Years)	PLR (%)
1	2.75%
2	3%
3	3.20%
4	3.30%
5	3.375%

DEF Ltd has bought an interest rate cap at 5.625% at an upfront premium of 0.25% per annum.

a. You are required to exhibit how these two companies can reduce their borrowing cost by adopting swap assuming that gains resulting from swap shall be shared equally among them.

b. Further calculate cost of funding to these two companies assuming that expectation theory holds good for 4 years.