equaliFi ACADEMY

CTM

CERTIFICATE IN INTEGRATED TREASURY MANAGEMENT

Session 10-Treasury Risk Management

WHAT IS RISK?

- Risk is the potential that a chosen action or activity (including the choice of inaction) will lead to a loss (an undesirable outcome)
- Damodaran says, risk includes not only "downside risk" but also "upside risk" (returns that exceed expectations)

CORPORATE RISKS

- **Business Risks-**
  - Sales
  - Marketing
  - Manufacturing
  - Competition
  - Reputation
- **Market Risks**
  - Foreign Exchange
  - Interest Rates
  - Commodity
  - Equity
  - Inflation

Liquidity Risks

- Funding Risks
- Long Term v/s Short Term
- Capital

Credit Risks

- Commercial
- Counterparty
- Settlement

Operational Risks

- Systems
- Controls
- Regulatory
- Frauds
- Weather
- Natural disasters

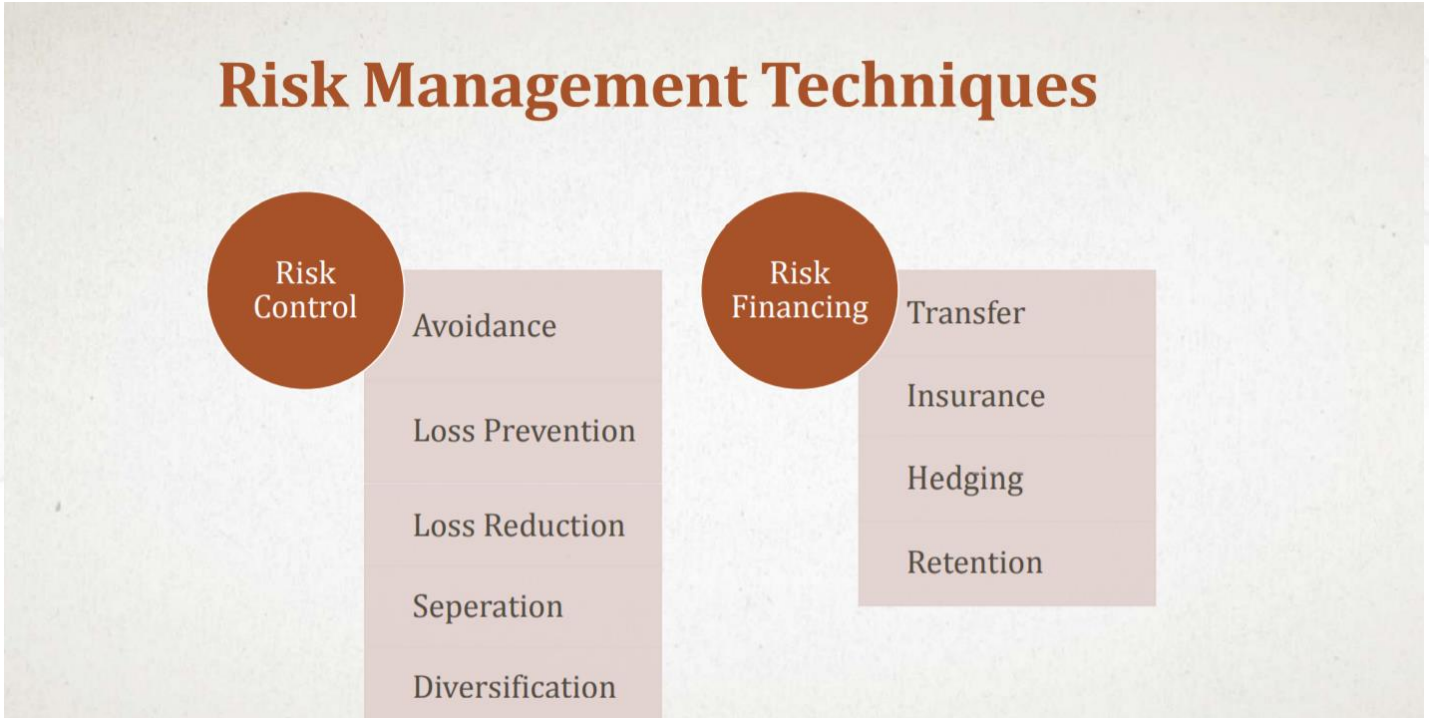
Risk Management

Definition

It is the identification, assessment, and prioritization of risk followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities.

How To Manage Risk?

Risk Management Techniques



HEDGING

Hedging is the act of reducing your risk of losing money in the future.

BENEFITS OF HEDGING

- Hedging as a strategic resource
- Capital raising capability
- Lowering distress costs
- Lowering tax liabilities
- Hedging as a tool for corporate governance

HEDGING STRATEGIES/ INSTRUMENTS

- Forwards
- Futures
- Options
- Swaps

INTEREST RATES AND INTEREST RATE FUTURES

Risk-free Rate

Risk-free Rates – LIBOR and Treasury Rate

Treasury Rate:

- Treasury Rates are the rates at which the government issues securities (for a short-term), in its own currency. Also known as T-rates.
- Ex. 91-day 8.5% T-bill issued by Reserve Bank of India.
- These are risk-free rates, as there is no default risk faced by the investor in government securities.

LIBOR (London Interbank Offered Rate):

- LIBOR is the rate at which large international banks issue securities to fund their activities. Hence, there is some default risk prevalent with LIBOR, although limited.
- Derivative Traders consider LIBOR as a reference risk-free rate for valuation, as they consider **LIBOR to be their Opportunity Cost Capital**.
- Treasury Rates are considered to be too low to be called risk-free.

Repo Rate

Repo Rate

- Repo Rate is the implied rate of the Repurchase Agreement ("Repo Agreement").

- In a Repurchase Agreement, one party agrees to sell an asset or security to a buyer, with a promise to "Repurchase" the asset or security at a future date, at a specified higher purchase price.
- The difference between the purchase price and the selling price is the implied interest rate for the transaction, which is known as the "Repo Rate".

Ex. Mr. P sells 500,000 USD to Mr. Q at Rs. 65/USD, with a promise to repurchase 500,000 USD at Rs. 66/USD after one month.

- In this case, the difference of Rs.1/USD or 1.5% per month (18% pa) is Repo Rate.

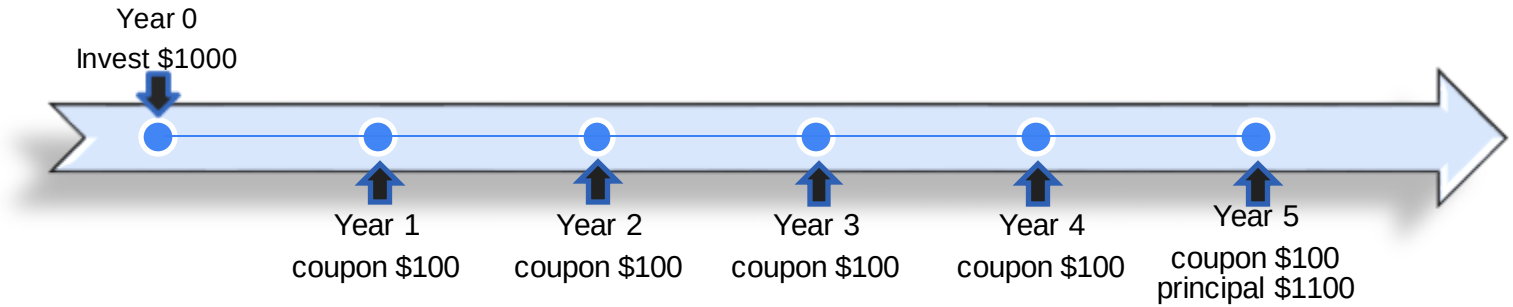
- Most common forms of Repo is the Overnight Repo (Overnight Repurchase Agreement). Long-term Repo is known as a Term Repo.
- Repo Rates have a certain amount of Default Risk involved.

Discount Rate

Market Discount Rate

- Valuation of securities (Equity, bond, derivatives, etc.) includes time value of money concept.
- Fixed income security i.e. a bond can be valued by totalling the present values of all of the bond's pre-defined cash flows i.e. interest & principal.
- Cash flow structure of a plain vanilla fixed coupon bond includes series of periodic fixed interest payments and ultimate principal repayment at maturity.
- Market discount rate is used to calculate the present value for valuation which is the return required by investors according to the risk level of investment.
- Market discount rate is a.k.a. the required yield or the required rate of return.

Cash flow for a plain vanilla Fixed coupon bond



Discount Rate

Calculation of Bond's Price given a Market Discount Rate

- E.g. a newly issued 5-year, $1,000 par value, 8% coupon, annual paying bond
- The coupon payments will be $80 at the end of each year
- the $1,000 par value is paid at the end of year 5 along with the last coupon of $80
- If the market discount rate is 10%, all the bond's cash flows discounted at 10%:

$$\frac{\$80}{(1.10)^1} + \frac{\$80}{(1.10)^2} + \frac{\$80}{(1.10)^3} + \frac{\$80}{(1.10)^4} + \frac{\$1080}{(1.10)^5} = \$924.2$$

- If the market discount rate is 6%, all the bond's cash flows discounted at 6%:

$$\frac{\$80}{(1.06)^1} + \frac{\$80}{(1.06)^2} + \frac{\$80}{(1.06)^3} + \frac{\$80}{(1.06)^4} + \frac{\$1080}{(1.06)^5} = \$1,084.2$$

- If the market discount rate is 8%, all the bond's cash flows discounted at 8%:

$$\frac{\$80}{(1.08)^1} + \frac{\$80}{(1.08)^2} + \frac{\$80}{(1.08)^3} + \frac{\$80}{(1.08)^4} + \frac{\$1080}{(1.08)^5} = \$1,000.0$$

Discount Rate

Bonds Valued at Discount, Premium and At Par			
Bond Valuation	**At discount**	**At premium**	**At par**
Face Value	$ 1,000	$ 1,000	$ 1,000
Annual Coupon Rate	8.0%	8.0%	8.0%
Market Discount Rate	10.0%	6.0%	8.0%
Years to Maturity	5.0	5.0	5.0
Payment Frequency	1	1	1
Present value	$924.2	$1,084.2	$1,000.0

- If bond yield increases, the present value of a bond's payments and its market value decreases.
- If bond yield decreases, the present value of a bond's payments and its market value increases.
- If bond yield remains same as coupon rate, the present value of a bond's payments and its market value remains same as par value.

Discount Rate

Calculating a bond's price with different periodicity given a market discount rate

- Coupon frequency a.k.a. periodicity of a bond – Interest can be paid annually, six-monthly, quarterly or monthly.
- Most European bonds make **annual payments** whereas Asian and North American bonds make **semi-annual payments.**
- Ex: A newly issued 3-year, $1000 par value, 8% coupon, semi-annual paying bond
  - The coupon payments will be $40 at the end of each period ($40=8%/2*$1000)
  - The coupon will be paid twice a year hence total 6 semi-annual payment periods
  - The $1,000 par value is paid at the end of year 3 (on 6th period) along with the last coupon of $40
  - If the annual market discount rate is 10% i.e. 5% for each semi-annual payment period, the present value of bond's all the cash flows:

$$\frac{\$40}{(1.05)^1} + \frac{\$40}{(1.05)^2} + \frac{\$40}{(1.05)^3} + \frac{\$40}{(1.05)^4} + \frac{\$40}{(1.05)^5} + \frac{\$1040}{(1.05)^6} = \$949.2$$

Discount Rate

Calculating a price for a zero coupon bond given a market discount rate

- The **price of a zero-coupon bond** is simply the present value of the maturity payment.
- The zero-coupon bond will always trade below par value (at discount) as long as the required yield is greater than zero
- E.g. a newly issued 5-year, $1,000 par value, Zero coupon bond with a required return rate of 10%
  - The coupon payments will be $0 as Zero coupon bond doesn't pay periodic interest
  - The $1,000 par value is paid at the end of year 5 (on 5th annual period)
  - If the market discount rate is 10% for each annual payment period, the present value of bond's all the cash flows:

$$\frac{\$1000}{(1.10)^5} = \$620.9$$

Discount Rate

•Bond's price = Total PV of future CFs

Bond's price = Total PV of future CFs

$$\bullet\ PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \dots\dots + \frac{PMT+FV}{(1+r)^N}$$

- PV = Bond's current price = Total PV of future CFs
- PMT = the coupon payment per period = Coupon rate * FV / m
- N = number of periods till maturity = number of years * m
- Periodicity (m) = Coupon payment frequency
- r = the market discount rate per period
- FV = the par value or the future value paid at the maturity

Spot Rate

Using Spot Rate to Value a Bond

- Spot Rates – A series of market discount rates can be used to calculate the present value of each corresponding cash flow.

- These spot rates used to value a bond are Yield To Maturity (YTMs) on zero coupon bonds, which matures on the same date as the payment dates of bond's each cash flow.

- $PV = \frac{PMT}{(1+Z_1)^1} + \frac{PMT}{(1+Z_2)^2} + \dots\dots + \frac{PMT+FV}{(1+Z_N)^N}$

  - Z_1 = spot rate or zero coupon yield or zero rate for period 1
  - Z_2 = spot rate or zero coupon yield or zero rate for period 2
  - Z_N = spot rate or zero coupon yield or zero rate for period N

Spot Rate

Using Spot Rate to Value a Bond

- E.g. value same 5-year, $1,000 par value, 8% coupon, annual paying bond
  - Spot rates available are: 1 Year 8.12% (Z_1), 2 Years 8.3% (Z_2), 3 years 8.7% (Z_3), 4 years 9.0% (Z_4) and 5 years 10.3% (Z_5)
  - Using the spot rates, the price =
  - $$\frac{\$80}{(1.0812)^1} + \frac{\$80}{(1.083)^2} + \frac{\$80}{(1.087)^3} + \frac{\$80}{(1.09)^4} + \frac{\$1080}{(1.103)^5} = \$924.2$$
- Bond's price calculated by using spot rates is referred to as 'no-arbitrage value'
- If current price differ from the 'no-arbitrage value', an arbitrage opportunity exists

Forward Rate

Using Forward Rate to Value a Bond

- Forward Rates can be described as the Market's Current Estimate of future spot rates.
- A Forward Rate can be interpreted as an incremental (marginal) return for extending the term-to-maturity for an additional time period.
- The Implied Forward Rate is the break-even reinvestment rate as it links the return on a short-term zero-coupon bond to the return on a longer-term zero-coupon bond.
- It is the Rate at which the Reinvestment is made for a particular time (Lending or Borrowing), a certain period of time from now.

Interpretation of Forward Rates:

1y1y: Forward Rate for a 1 year loan to be made, one year from now.

2y1y: Forward Rate for a 1 year loan to be made, two years from now.

3y2y: Forward Rate for a 2 year loan to be made, three years from now.

Forward Rate

Using Forward Rate to Value a Bond

- Formula to calculate Bond Value using Spot Rates (YTMs on Zero Coupon Bonds):

$$PV = \frac{PMT}{(1+Z_1)^1} + \frac{PMT}{(1+Z_2)^2} + \ldots\ldots + \frac{PMT+FV}{(1+Z_N)^N}$$

To calculate a bond value using Forward Rate, replace:

- $(1+Z_2)^2$ with $(1+ Z_1) * (1 + 1y1y)$
- $(1+Z_3)^3$ with $(1+ Z_1) * (1 + 1y1y) * (1 + 2y1y)$ and so on…

Forward Rate

Using Forward Rate to Value a Bond

Eg: If the Spot Rate (Z_1) is 3%, the "1y1y" implied forward yield is 4% and the "2y1y" implied forward yield is 5%. Calculate the value of a 3-year annual-pay bond with a 7% coupon and a par value of $1000.

Answer:

"1y1y" means implied one year forward rate for lending one year in future.

"2y1y" means implied one year forward rate for lending two years in future.

7% annual coupon payment on par value of $1000 = $70

$$PV = \frac{PMT}{(1+Z_1)} + \frac{PMT}{(1+Z_1)(1+1y1y)} + \frac{PMT+FV}{(1+Z_1)(1+1y1y)(1+2y1y)}$$

$$PV = \frac{70}{(1.03)} + \frac{70}{(1.03)(1.04)} + \frac{1070}{(1.03)(1.04)(1.05)}$$

Hence Bond Value = $ 1084.62

Interest Rate Futures

What are Interest Rate Futures?

An Interest Rate Futures Contract:

"An agreement to buy or sell a debt instrument at a specified future date at a price that is fixed today."

In interest rate futures, the trader has ability to take delivery of the underlying asset.

Exchange-traded Interest Rate Futures Contracts:

- 6-year, 10-year and 13-year Government Bonds
- 91-day Treasury Bills (T-bills)

Interest Rate Forwards are also similar to Interest Rate Futures, except that such contracts are not exchange-traded and not Standardized contracts.

Forward Rate Agreements (FRAs)

Forward Rate Agreements (FRAs)

- In an FRA, one party pays a fixed interest rate and receives a floating interest rate.
- The actual payments are based on a Notional Principal (Ex. $ 1million).
- The net difference in the interest payments is exchanged between the parties, at the pre-determined intervals. This difference is the net gain or loss to the parties to the contract.

Example: Mr. A enters into a 2-year-$1 million FRA with Mr. B. Mr. A will pay Mr. B fixed interest at 10% and Mr. B will pay Mr. A floating interest rate (T-bill rate + 2%). Interest payments are made yearly. Assume T-bill rate are: Year 1: 9% and Year 2: 7.5%. Calculate Net pay-off to Mr. A in Year1 and Year 2.

Year 1: [(9% + 2%) – 10%] * 1,000,000 = **$ 10,000**

Year 2: [(7.5% + 2%) – 10%] * 1,000,000 = **- $ 5,000**

Strategies to Hedge Interest Rate Risk

Short Hedge to Offset Cash Position

- Consider an Investor holding $10 million worth of 8% Government Bonds, with 10 years to maturity, as on April 01, 2016.

- In this case, the Investor faces the Risk that the "Price" of such Government Bonds will decrease over the next quarter, as a result of increase in Yield. (An increase in yield results in decrease in prices of the bond.). This can result in a Capital Loss for the Investor in the quarter ending June 30, 2016.

Hedge Position: Sell 100 8% Government Bonds Futures contracts (100 * 100,000)

On June 30, 2016:

- If Bond Yield increases, the value of the investment will decrease, resulting in a capital loss.
- However, this Capital Loss will be substituted by the gain in the Futures Contract, which will gain in value, on account of rise in yield and fall in value.

Strategies to Hedge Interest Rate Risk

Offsetting Balance Sheet Positions (Liability Side)

Ex: A Bank wants to borrow $ 100 million for 1 year, 3 months from now, by issuing Certificate of Deposits. The Bank is facing Interest Rate Risk.

Therefore, to lock-in present interest rates, the following transactions can be made by the Bank.

Date	Cash Market	Futures Market
April 01, 2016 (Today)	No Transaction. The CDs are to be issued three months later. CD Rate = 9%	Sell: 100, 91-day T-bill contracts of $1 million each (current settlement price = 92)
July 01, 2016	Issue CDs: $100 million at 10%: Additional Interest Cost = 1% i.e. 1% of $100 million = **$1,000,000**	Cover the Position: (Interest Rate Rises to 10%) **Profit on the Position** = $100,000,000*91/360*(0.10-0.08) **= $505,555**

Strategies to Hedge Interest Rate Risk

Hedging Strategies Using Forward Rate Agreements (FRAs)

- Ex: Consider an NBFC who lends money at its borrowers at a floating rate of interest. For example, LIBOR + 3%, T-bill rate + 2%, etc.
- Since interest rates are uncertain at the time of giving the loan, the NBFC is facing Interest Rate Risk, as the interest rate of the loan given is based on future uncertain events.
- In order to hedge the Interest Rate Risk, the NBFC can enter into an FRA to exchange the floating-interest payments on the loan for fixed interest rate payments.

Consider the loan amount is Rs. 1,00,00,000 for 5 years at 10% G-Sec Yield + 3% p.a., with half-yearly interest payments. The NBFC has entered into a FRA with a Bank for the same principal amount, in which it receives 11% p.a. fixed rate payments for 5 years. Calculate the Net benefit of hedging, If the G-Sec yield in Year 1 is: H1Y1 – 7.5% and H2Y1 – 7.75%

H1Y1 – NBFC's Pay-off = 1,00,00,000 * [11% - (7.5%+3%)]/2 = 0.25% of 1 crore = **Rs. 25000**

H2Y1 – NBFC's Pay-off = 1,00,00,000 * [11% - (7.75%+3%)]/2 = 0.125% of 1 crore = **Rs. 12500**

If FRA was not taken, then the NBFC would have got Rs. 37500 less interest in Year 1.

FOREIGN EXCHANGE MARKET

Calculating a Financial Institution's Overall Foreign Exchange Exposure

What is a Financial Institution?

A Financial Institution is an entity that deals in financial transactions such as:

- Investments
- Loans
- Deposits

Financial Institutions are composed of Organizations such as:

- Banks
- Non-banking Financial Companies
- Trust Companies
- Insurance Companies
- Investments Dealers and Brokers

Calculating a Financial Institution's Overall Foreign Exchange Exposure

Financial Institution's Overall Foreign Exchange Exposure

Activities of Institutions like Banks and Large NBFCs includes giving loans and accepting deposits in foreign currency and making investments in foreign currency.

As a result, the Institution's **aggregate position in one currency** (Total loans + Total Deposits) may be extremely large.

However, the **Institution's net position in one currency** (Difference between the Loans and Deposits in that currency) may be relatively small.

A Banks's Net Exposure in One Currency = Net Long (Positive) or Net Short (Negative) in that currency

Net Exposure (USD) = (USD Assets – USD Liabilities) + (USD Investments bought – USD Investments sold)

Net Exposure (USD) = Net USD Assets + Net USD Investments bought

Calculating a Financial Institution's Overall Foreign Exchange Exposure

Financial Institution's Overall Foreign Exchange Exposure - Example

Liabilities	USD	Assets	USD
8% Debentures	200m	Loans to US Company	100m
		Investments in Indian Company (in USD)	100m
Total	200m	Total	200m

Consider the above Balance Sheet of a US Bank, having its subsidiary in India. To calculate its Net Exposure for USD, we use the following formula:

Net Exposure (USD) = (USD Assets – USD Liabilities) + (USD Investments bought – USD Investments sold)

Net Exposure (USD) = (100m – 200m) + (100m – 0) = 0

Calculating a Financial Institution's Overall Foreign Exchange Exposure

Financial Institution's Overall Foreign Exchange Exposure

- Net Long in a Currency: Means a Positive Net Exposure to that currency.

Asset > Liabilities

(Risk of Foreign Currency Value falling against Domestic Currency)

- Net Short in a Currency: Means a Negative Net Exposure to that currency.

Asset < Liabilities

(Risk of Foreign Currency Value rises against Domestic Currency)

Example for Net Long in USD:

Liabilities	Amt	Assets	Amt
Equity (in INR – USD Equivalent – 100m)	100m	Loans to US Company (USD)	100m
8% Debentures (USD)	100m	Investments in Indian Company (USD)	100m
Total	200m	Total	200m

Calculating a Financial Institution's Overall Foreign Exchange Exposure

Financial Institution's Overall Foreign Exchange Exposure

- Net Long in a Currency: Means a Positive Net Exposure to that currency.

Asset > Liabilities

(Risk of Foreign Currency Value falling against Domestic Currency)

- Net Short in a Currency: Means a Negative Net Exposure to that currency.

Asset < Liabilities

(Risk of Foreign Currency Value rises against Domestic Currency)

Example for Net Long in USD:

Liabilities	Amt	Assets	Amt
Equity (in INR – USD Equivalent – 100m)	100m	Loans to US Company (USD)	100m
8% Debentures (USD)	100m	Investments in Indian Company (USD)	100m
Total	200m	Total	200m

Types of Foreign Exchange Trading Activities

Foreign Exchange Trading Activities

Offsetting Exposure in Foreign Currency for Hedging Purposes

- The Financial Institution can reduce foreign exchange risk exposure through hedging activities.

Speculating on Foreign Currency to Earn Profits, by Forecasting Future Foreign Exchange Movements

- Through Speculation, the Financial Institution takes open positions in the Currency Market. They represent the unhedged portion of trades.
- These are taken after forecasting future foreign currency movement.
- Profits are earned on the difference between the buy and sell prices or on movements in the bid-ask spreads over time.

Types of Foreign Exchange Trading Activities – Source of Profit and Loss

Foreign Exchange Trading Activities- Source of Profit and Loss - Due to Mismatched Foreign Assets and Liabilities Position

Liabilities	Amt	Assets	Amt
USD CoDs, 1-year Maturity, Yield – 6%	10m	US Loans, 1-year Maturity, Yield – 8%	5m
		Indian Loans (in INR – USD 5 million equivalent), 1-year Maturity, Yield – 14%	5m

Question: Although duration of assets and liabilities are matched, the currency exposure of the bank is mismatched. From the US Loans, the bank is getting a positive spread of 2% (8%-6%). However, to invest in India, the bank decides to invest half its portfolio and give loans yielding 14% in India, denominated in INR. What transactions must the Bank undertake to make INR-denominated loans. (assume no hedging). Current Spot Rate: USD/INR is Rs. 65/USD

Types of Foreign Exchange Trading Activities – Source of Profit and Loss

Mismatched Foreign Assets and Liabilities Position - Example

Step 1: Sell USD 5 million for INR in the spot market at initiation of the year.
Proceeds – 5,000,000 * 65 = Rs. 325,000,000

Step 2: Make a Loan in INR using proceeds of Rs. 325,000,000 for 1 year at 14%

Step 3: After Year 1, receive the principal + interest on loan (assuming no default)
Proceeds – 325,000,000 * 1.14 = Rs. 370,500,000

Step 4: After Year 1, repatriate these funds back to US. Sell Rs. 370,500,000 in spot market at the prevailing exchange rate (after one year). Assuming Spot Rate after 1 year is same at Rs. 65/USD, USD = 370,500,000/65 = USD 5,700,000

$$\text{Return} = \frac{\text{USD } 5{,}700{,}000 - \text{USD } 5{,}000{,}000}{\text{USD } 5{,}000{,}000} = 14\%$$ (same as Return on Loan)

Types of Foreign Exchange Trading Activities – Source of Profit and Loss

Mismatched Foreign Assets and Liabilities Position - Example

Weighted Average Return on Assets:
(0.50)(0.08) + (0.50)(0.14) = **11%**
This is more than the Cost of Capital (6%) by: (11% - 6%) = **5%**

Situation 1: If INR has depreciated in Value, relative to USD. Exchange Rate at end of Year 1 was Rs. 69/USD.
INR Loan Revenue (in USD) = 370,500,000/69 = USD 5,369,565.

$$\text{Return} = \frac{\text{USD } 5{,}369{,}565 - \text{USD } 5{,}000{,}000}{\text{USD } 5{,}000{,}000} = 7.39\% \quad \text{(lower than before)}$$

Weighted Average Return on Assets: (0.50)(0.08) + (0.50)(0.0739) = **7.70%**

Although the Weighted Average Return exceeds the Cost of Capital by 1.70%, it has decreased substantially by 3.30%.

Strategies to Hedge Against Foreign Exchange Exposure

Currency Futures and Forwards

Currency Futures and Forwards represent an Obligation to buy or sell a certain amount of a specified currency, some time in the future, at an exchange rate determined now.

Currency Futures differ from Currency forwards, as they are Standardized contracts traded on an exchange-platform with greater liquidity. Futures are Mark-to-Market.

Ex. 3-month INR/USD futures on the BSE.

Size – USD 10000.
Quotation – USD/INR
Delivery Month – January, April, June and September
Min. Price Movement (Tick Size) - $0.0001 i.e. $10
Settlement Date – Last Thursday of Delivery Month

Mr. A goes Long 3-month June INR/USD Futures, quoted at 6,60,000. He will have to buy 10000 USD in June, based on Futures Price of Rs. 66/USD on last Thursday of June.

Strategies to Hedge Against Foreign Exchange Exposure

Currency Options

Currency Options give the right, but not an obligation to buy or sell the specified amount of underlying asset (currency), at a predetermined price (exercise price).

Call Option: Right to buy a currency at a predetermined exchange rate, in future
Put Option: Right to sell a currency at a predetermined exchange rate, in future.
Ex: Call Option buyer
Mr. A buys a 3-month call option on INR/YEN, to purchase 1,000,000 Yen after 3 months, with Strike Price of 100Y/60INR. The option premium is INR 0.05/100YEN

After 3 months, if the rate changes to 100Y/59INR, the option will be out-of-the-money and Mr. A will not exercise the option. In Spot Market, Yen is cheaper.
However, if the rate changes to 100Y/62INR, the option will be in-the-money. Mr. A can purchase the 1 million Yen in exchange for Rs. 60/100 yen and sell the purchased yen at the rate of Rs. 62/100 yen. Total Profit = 1.95/100 yen = **Rs. 19500**

Strategies to Hedge Against Foreign Exchange Exposure

On-Balance-Sheet Hedging

Liabilities	Amt	Assets	Amt
USD CoDs, 1-year Maturity, Yield – 6%	5m	US Loans, 1-year Maturity, Yield – 8%	5m
INR CoDs (raised in INR), 1-year Maturity, Yield – 10%	5m	Indian Loans (in INR – USD 5 million equivalent), 1-year Maturity, Yield – 14%	5m

In the above example, the asset-liability maturity is matched. Current Spot Rate: USD/INR is Rs. 65/USD. From Domestic Loans and Assets, the bank is still earning a positive spread of 2% (8% - 6%). To invest in India, the bank decides to invest half its portfolio and give loans yielding 14% in India, denominated in INR. In order to fund its investment in India, it issues CoDs (of the same amount) in Indian Rupee. Calculate the effects of INR "Depreciating" relative to USD

Strategies to Hedge Against Foreign Exchange Exposure

On-Balance-Sheet Hedging

1. The Bank has borrowed USD 5 million in INR for one year, at interest rate of 10%.
At current spot rate, Loan Proceeds (in USD) = 5,000,000 * 65 = **Rs. 325,000,000**

2. At end of Year 1, the INR Loan is repaid with interest. (325,000,000 * 1.10)
= **Rs. 357,500,000**

3. **If INR has depreciated in Value, relative to USD. Exchange Rate at end of Year 1 was Rs. 69/USD**.
Repayment of INR Loan, in USD terms will be: Rs. 357,500,000/69 = USD 5,181,159

$$\text{Dollar Cost} = \frac{\text{USD } 5{,}181{,}159 - \text{USD } 5{,}000{,}000}{\text{USD } 5{,}000{,}000} = 3.62\%$$

Strategies to Hedge Against Foreign Exchange Exposure

On-Balance-Sheet Hedging

4. The Bank has lent USD 5 million in INR for one year, at interest rate of 14%.
At current spot rate, Amount Lent (in USD) = 5,000,000 * 65 = **Rs. 325,000,000**

5. At end of Year 1, the INR Loan is received with interest. (325,000,000 * 1.14)
= **Rs. 370,500,000**

6. **If INR has depreciated in Value, relative to USD. Exchange Rate at end of Year 1 was Rs. 69/USD**.
Repayment of INR Loan, in USD terms will be: Rs. 370,500,000/69 = USD 5,369,565

$$\text{Dollar Cost} = \frac{\text{USD } 5{,}369{,}565 - \text{USD } 5{,}000{,}000}{\text{USD } 5{,}000{,}000} = 7.39\%$$

Strategies to Hedge Against Foreign Exchange Exposure

On-Balance-Sheet Hedging

7. At end of Year 1:

Average Returns of Assets:

(0.5)(0.08) + (0.5)(0.0739) = 7.70%

Average Cost of Funds:

(0.5)(0.06) + (0.5)(0.0362) = 4.81%

Net Return = (7.70% - 4.81%) = 2.89%

Conclusion:
By directly matching foreign assets and liabilities, the financial institution can lock in a positive return, if exchange rates move in either direction over the investment period.

Strategies to Hedge Against Foreign Exchange Exposure

Off-Balance Sheet Hedging

In the above example, the Bank can earn a positive return, even without directly matching foreign assets and liabilities.

This can be achieved by hedging the Foreign Currency exposure through Currency Forwards/Futures contracts.

The position in the Currency Forwards/Futures Contract would appear as a Contingent Liability, in Notes to Balance Sheet.

Ex:

Liabilities	Amt	Assets	Amt
USD CoDs, 1-year Maturity, Yield – 6%	5m	US Loans, 1-year Maturity, Yield – 8%	5m
INR CoDs (raised in INR), 1-year Maturity, Yield – 10%	5m	Indian Loans (in INR – USD 5 million equivalent), 1-year Maturity, Yield – 14%	5m

Strategies to Hedge Against Foreign Exchange Exposure

Off-Balance Sheet Hedging

1. The Bank can sell USD 5 million, in exchange for INR, at the Current spot Exchange Rate of Rs. 65/USD. Proceeds = **Rs. 325,000,000**

2. On receiving INR, the Bank can lend Rs. 325,000,000 in the Indian Market at 14%.

3. The Bank SELLS the expected principal + interest proceeds on the INR Loan, for USD at today's Forward Rate (take Rs. 68/USD) for 1-year delivery.

Proceeds from the Forward contract buyer: (325,000,000 * 1.14)/68 = USD 5,448,529

4. After Year 1: Indian loan proceeds are received by bank: Rs. 370,500,000

5. The proceeds of Rs. 370,500,000 is exchanged for USD 5,448,529 from the Forward contract buyer.

Strategies to Hedge Against Foreign Exchange Exposure

Off-Balance Sheet Hedging

6. On account of the Forward Contract, the Bank has locked-in the guaranteed return of:

$$\text{Dollar Return} = \frac{\text{USD } 5{,}448{,}529 - \text{USD } 5{,}000{,}000}{\text{USD } 5{,}000{,}000} = 8.97\%$$

This return is after assuming no default on Indian Loan and Fulfilment of Obligation of the Forward Contract buyer.

Overall Returns on Assets Portfolio:

$(0.5)(0.08) + (0.5)(0.0897) = 8.49\%$

Therefore, regardless of the spot exchange rate fluctuations, the bank has locked-in a risk-free return of 2.49% (8.49% - 6.00%) over the cost of funds, over the year.

Interest-Rate Parity

Interest Rate Parity

In the above case, Bank was able to earn a Fixed Return because of the difference in interest rates in INR and USD. The Bank could earn the additional 6% spread by investing in India and hedging the currency exposure through Forward.

However this is not practical in currency and interest rate markets:

- The Bank will be inclined to give additional loans in INR, as the Yield on INR loan is high.
- This will result in Bank buying more INR in Spot Market, which will increase the Spot Exchange Rate.
- The Forward Spread will decrease, until no additional profits are earned on the hedged position.
- This will result into No-arbitrage exchange rate, at which hedging through Forwards will not yield any profits.

This is known as **Interest Rate Parity**

Interest-Rate Parity

Interest Rate Parity

Interest Rate Parity – The hedged return on the Foreign Investments (INR Loan) should be equal to Return on Domestic Investments.

Therefore, as per Interest Rate Parity, in a competitive market, a firm should not be able to make excessive profits from foreign investments.
(i.e. earning a higher interest rate, in domestic currency, by lending in foreign currency and locking in the forward rate of exchange).

IRP equation:

$$\text{Forward} = \text{Spot} \frac{(1 + r_{DC})}{(1 + r_{FC})}^{T}$$

Where:

Note: If this equality does not hold, Arbitrage exists

r_{DC} = domestic currency interest rate

r_{FC} = foreign currency interest rate

Interest-Rate Parity

Interest Rate Parity

When direct quotes are used in the Formula (DC/FC), the numerator in the right side of the equation is the domestic interest rate and the denominators in the formula is the foreign exchange rate.

Example: Suppose you can invest in USD at 5% or you can invest in Swiss Francs at 5.5%. You are staying in USA and the current spot rate is 1.60 USD/CHF. Calculate the 1-year forward rate expressed in USD/CHF.

$$\text{Forward} = \text{Spot} \left(\frac{1 + r_{DC}}{1 + r_{FC}}\right)^{T}$$

$$= 1.60 \left(\frac{1.05}{1.055}\right)^{1} = 1.5924 \text{ USD/CHF}$$

Hence, USD has appreciated relative to CHF. Fewer USD can be bought for 1 CHF.

Benefits of Diversification into Multi-currency positions

Diversification into Multi-currency Positions

- Large banks and Financial Institutions have asset-liability positions in multiple currencies at the same time.
- Currencies are not perfectly correlated with each other. Therefore, if a bank has a asset-liability portfolio which is diversified across different currencies will reduce the overall portfolio risk for the bank.
- Further, stock returns, domestic currencies and foreign currencies do not move perfectly. Therefore, any risk arising from the mismatching of on currency's position will be offset by potential gains from portfolio diversification.

Real Interest Rate v/s Nominal Interest Rate

Real Interest Rate v/s Nominal Interest Rate

- **Real Interest Rate** reflects the demand and supply for funds in a given currency.
- If there is a difference in Real Interest Rate in two currencies, Capital will flow to the Currency with "Higher" Real Rates.
- This results in appreciation of the currency, relative to other currencies, as the demand for other currencies is low.
- **Expected Inflation Rate**: It is the compensation required by investors to offset the expected erosion of real value of the currency, due to inflation.
- If there is a difference in Inflation Rate in two countries, residents of the country with higher inflation will demand more imported goods. Ex: If the prices of Goods in India are rising twice as fast as Goods prices in China, then Indian Citizens will demand more goods produced in China. As a result, the demand for INR will reduce and Indian currency will depreciate, related to Chinese Yuan.

Real Interest Rate v/s Nominal Interest Rate

Real Interest Rate v/s Nominal Interest Rate

- **Nominal Interest Rate (r)** is the compounded sum of real interest rate (real r) and the expected inflation rate E(i).

(1 + r) = (1 + real r)[1+E(i)] (This takes into account the compounding effect)

Thank You