BANK3011 NOTES

Contents

Topic 1: Introduction and Overview

Risk in Finance:

- Uncertainty in the future
- Two major aspects in investment decisions – risk and return
- Risk management process:
    - Identifying, measuring and managing financial risks
    - Quantify the risk (the financial consequences of these risks for the banks)
    - Management of these risks

The Role of Banks in the Financial System

- Very important role – intermediate the flow of funds (in particular, the investment and borrowing activities in the economy)
- In performing this role, banks are <u>exposed to various types of risk</u>
    - Need to manage these risks:
        - If banks fail to manage these risks – they are not only at risk of failing but the financial system is at risk of collapse
        - E.g. 2008 GFC – resulted in the virtual collapse of the global financial system
- **Financial Markets and Economy:**
    - Funds flow from the lenders to the borrowers, and in between them are intermediaries such as banks, mutual funds, hedge funds and pension funds
    - Funds flow from households to these financial institutions, which may be borrowed by firms or the government
    - FIs deliver funds from one side of the economy to the other side:
    - **Financial Intermediaries:**
        - Provide **brokerage services** (or investment banking) – when a service provider matches between the buyer and the seller or lender and borrower
        - Provide **asset transformation** – e.g. lending (deposits are transformed into some different types of investment that are handed over to borrowers)
        - Need for intermediaries = transaction costs
            - As a lender - transaction costs due to searching costs to find a borrower, agency costs or information cost, monitoring costs (ensuring borrower repays on time)
            - Agency Costs:
                - Adverse selection – need to thoroughly review borrower's credit history to reduce risk of default
                - Monitoring – Ensure borrower meeting criteria of repayments requested in loan contract
            - Banks are providing these monitoring and screening costs for the lenders (less costly for lenders)
            - If transaction cost is high in lending → cost of borrowing will be high
        - Intermediaries enable for liquidity – maintain good liquidity in the financial market
    - **FI's & the flow of savings and investments (ex government)**
        - <u>Households:</u>

- o Financial Institutions (FI's) accept funds from households with surplus funds even though there may not be an immediate demand for those funds
- o FI's make commitments to lend funds to corporations often in anticipation of receiving funds in the future
- o Resultant timing mismatches = banks are exposed to <u>liquidity risk</u>, which are managed through the liquidity management process

2. **Maturity Intermediation**
   - o = Short-term maturity of liabilities and long-term maturity assets → causes interest rate risk (changes in interest rate affects interest bearing securities differently based on maturities – asymmetric changes between MV of liabilities and assets)
   - o Maturity costs of deposits accepted by banks are typically short term (e.g. < 2 years)
   - o However, the maturity of the loans made by a bank are often considerably longer
   - o In the absence of banks – borrower would either have to borrow for a shorter term or find an entity willing to invest for the length of loan sough; depositors would have to commit their funds for a longer length of time than wanted
     - ▪ Maturity of deposit account = 0 (accessible at any time, like cash)
     - ▪ Average maturity of a loan = 4-5 years
   - o Resultant Maturity Mismatches = <u>create interest rate risk</u>, managed through market risk management processes
     - ▪ Interest Rate Risk = due to time value of money, affects values of any type of financial assets in the market → systematic risl
     - ▪ May cause an asymmetry on assets and liabilities side which may jeopardise bank's financial performance

3. **Risk reduction via diversification (credit allocation)**
   - o FI's when accepting deposits and other similar funds do so in their own name
   - o Use these funds to lend/invest with corporations – by investing or lending to a broad range of counterparties or customers, they enhance the creditworthiness of their portfolios (through diversification)
   - o Consistent with modern portfolio theory – which holds that a portfolio of diversified instruments will reduce aggregate portfolio risk
   - o Creditworthiness of the bank is a function of the creditworthiness of its investments and hence the bank's overall creditworthiness is improved
   - o Lending/Investment activities create <u>credit risk</u> (risk of default/ not meeting payment schedule)– these risks are now able to be actively managed

4. **Reducing transformation costs, including contracting and information processing (information costs)**
   - o Involves reducing the costs of contracting and the costs of information processing/monitoring
     - ▪ Agency costs – moral hazard problem vs adverse selection problem
       - • ***Need to know agency problem – what moral hazard is and what adverse selection is, and need to be able to apply to different scenarios → also need to be able to tell between whom and whom***
     - ▪ Information and monitoring – it is costly for individual savers to collect information and monitor these managers
       - • <u>Bondholders vs Bank holders</u>: banks are better at monitoring; more incentive (the shares of the bonds are more segregated

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- o <u>Main Issue with this Problem:</u> knowing that they have a safeguard may incentivise banks to take on more risk

Investment Banking

- Investment banks to a large extent operate in markets to facilitate financial intermediation
- <u>Three Types of Market:</u>
  - o **Primary Markets** – the origination, underwriting and placement of securities
    - Applies to both debt and equity issues
    - Via public issues or private placement – the choice will be impacted by the size of issue, costs of issue and breadth of distribution sought
    - Equity IPO's, seasoned issues
    - Issues can be underwritten (firm or best efforts) or non-underwritten
    - Related advisory services including Mergers and Aquisitions
  - o **Secondary Markets** – trading, broking and market making in the above securities as they are exchanged
    - Broking
      - Discount Brokers – usually offer services electronically, dominated by Comsec in Australia, also Etrade
      - Full service brokers – provide advisory services, e.g. Goldman Sachs / J B Were
  - o **Tertiary Markets** – the facilitation of risk management activities for the issuers and holders of securities (derivative and futures markets)
    - Market Making (Secondary and Tertiary Markets)
      - The process of providing (usually firm) prices to buy and sell securities
      - In US there are specialist market makers who operate as agents for investors
      - Market makers can also act as principals – e.g. most block trades in Australia

TUTORIAL 1 SUMMARY:

Timing & Rumeraction - mismatches in the timing of demand & supply, differences in timing preferences between lender and borrower
- This poses a **liquidity risk** to banks - how easy it is for you to convert a financial asset into cash / meet certain cash needs
- Fire sell illiquid assets - sell at a very big discount

Maturity & Rumination
- Maturity of deposits = 0
- Typically with loans the maturity is 4-5 years
- Deposit they take is very short term, whereas their asset is very long term
  - o Imbalance between asset sign of balance sheet and deposit side
  - o Causes interest rate risk - affects the discount rate in calculating NPV (**inverse impact** between interest rate and the price of a security)
  - o Fluctuations in interest rate → Systematic effect on the economy

Lower the Transaction Cost / The Agency Cost
- **What is the Agency Problem:** arises when there is a conflict of interest between a principal (someone who delegates authority) and an agent (someone who acts on behalf of the principal)

Topic 2: Interest Rate Risk Part 1

Introduction:

- Timing Intermediatory – differences in timing preferences between borrowers and lenders
  - Commercial banks are exposed to <u>liquidity risks</u> (how easy it is to meet cash needs in short period of time)
- Maturity Intermediatory – differences between the maturity preferences of borrowers (typically 4-5 year loans) and lenders (maturity of 0)
  - Exposes commercial banks to <u>interest rate risks</u>
- Systematic vs Unsystematic Risk:
  - Systematic: impacts entire market
    - Cannot manage through diversification
  - Unsystematic: affects a specific borrower, lender or a specific industry
- Interest rate risk – affects all financial assets in the market
  - Even those who do not have repayment based on interest rate
  - This is due to calculation of present value of assets – impacted by the interest rate (discount rate)
- **Two Impacts of interest rate changes for commercial banks:**
  1. Impact on the net interest earnings (represented through **repricing model**)
  2. Market value of overall portfolio of commercial banks (represented through **maturity model**)
- Both repricing and maturity models aim to measure the potential quantum of loss arising from changes in interest rate markets

Market Risk

- Market risk = risk incurred in the trading or from holding assets and liabilities in a portfolio due to changes in the underlying market for those instruments
- The risk has become more significant due to the increase in the level of bank trading activities
- More of the assets and liabilities in the banks' portfolios are exposed to market variation, due to the increasing levels of disintermediation
  - Disintermediation = the process by which access to capital markets is directed through the issuance of securities rather than obtaining finance from an FI → results in more assets (and liabilities) of banks effectively being exposed to market forces
- More disintermediation → investors are directly investing into the financial market more → investment banking is becoming more important → banks exposed to various risks from various types of markets
- <u>When do market risks arise?</u>
  - Whenever an FI takes an open, unhedged or imperfectly hedged position in a traded market or holds a portfolio of instruments whose values are affected by traded markets:
    - Bonds or debt markets
    - Equities
    - Foreign exchange
    - Derivatives
    - Commodities

- Two identical securities with the only difference being the maturity → interest rate fluctuations will more heavily affect the security with a longer maturity
  - Base idea of the Maturity model
- **Maturity Model: The Three Principles (Plus One) of Interest Rate Price Relationships:**
  - A rise in interest rates:
    1. Leads to a fall in the market value of an asset
    2. The longer the maturity of an asset the larger the fall in its market value
    3. The rate of fall in market value of an asset diminishes the longer the maturity of the asset (convexity)
       → relationship between the interest rate and market value is non-linear, change in the impact diminishes (convex)
  - The rise in interest rates will have the opposite affect in market value for liabilities
    - The absolute value will fall if interest rates increase, but since liabilities are an obligation (i.e. they have a 'negative' value) → this will result in a lower obligation or a smaller negative value (which is a gain)
- **The Maturity Model calculates the structure of the portfolio as:**
  - The weighted average maturity of assets or liabilities in the portfolio, where the weighted value is calculated on the basis of market values → relevant for determining impact on shareholder's equity value
  - Interested in the impact on shareholder's equity value
    - Maturity mismatches create an asymmetric impact – need to make sure that this does not have a negative impact on shareholder's equity value
    - I.e. need to be concerned with either interest rate decrease or interest rate increase depending on whether assets exceeds liabilities or visa versa (longer maturity for assets or liabilities)
- **Maturity Model:**
  - Calculating the maturity gap:

    $$M_{GAP} = M_A - M_L$$

    Where

    - M_A = Weighting of each Asset in the portfolio x Maturity of each asset
    - M_L = Weighting of each liability in the portfolio x Maturity of each liability

    - If ==gap is positive== = need to **worry about ==interest rate increase==**
    - If ==gap is negative== = need to **worry about ==interest rate decrease==**
  - Model suggests that matching M_A and M_L will "immunise" the risk
    - If gap = 0 → both sides equally sensitive to market rate risk
    - However, differences in timing in cash flows between assets and liabilities means that even if maturity gap is zero, company may still be exposed to interest rate risk (covered in next topic)
- Weaknesses of Maturity Model:
  - Does not account for the degree of leverage
  - Does not account for the timing of cashflows (even if maturity is the same, if CFs are different might respond to interest rate changes differently)
  - Assumes symmetric changes in interest rates across different maturities

	Positive Maturity Gap (weighted average maturity of assets > weighted average maturity of liabilities)	Negative Maturity Gap (weighted average maturity of assets < weighted average maturity of liabilities)
Interest Rate Increase	More drop in asset values and liability values less impacted → Shareholders equity value will be **negatively affected**	Less drop in asset values and liability values more impacted → Shareholders equity value will be **positively affected**
Interest Rate Decrease	More increase in asset values and liability values less impacted → Shareholders equity value will be **positively affected**	Less increase in asset values and liability values more impacted → Shareholders equity value will be **negatively affected**

- ***You have to know when there is a repricing gap or a maturity gap → when you forsee some negative interest rate shock, need to set out strategies to reduce the repricing and maturity gap***
    - ***How to minimise the repricing gap and the maturity gap***
    - ***Set out the ways to reduce the gap***

Topic 3: Interest Rate Risk Part 2

Review:

- **Interest Rate Risk** = unexpected change in interest rate
  - All financial securities traded in the market are affected → affects market values of all securities traded in the market
  - Perspective of commercial banks: exposed to interest rate risks due to maturity mismatches on assets and liabilities side
    - Asymmetry in maturity structures between assets and liabilities affects net interest income
    - Quantifying these consequences on net interest income:
      1. **Repricing Model:**
         - Two Assumptions: refinancing and reinvesting the asset and liability securities over and over again (so balance sheet stays the same); able to do so at book value
         - Measures only changes in earnings (net interest income)
         - Calculate repricing gap – tells you the dollar difference in sensitive assets and liabilities
           - Positive repricing gap – worry about interest rate decrease
           - Negative repricing gap – worry about interest rate increase
         - Major Weakness: does not account for market value impact
      2. **Maturity Model:**
         - Main Idea: market price of the longer term security is more volatile to interest rate shock
           - Positive Gap – worry about interest rate increase
           - Negative Gap (liabilities have longer maturity on average): worry about interest rate decrease (because this will negatively affect shareholders equity)
         - Try to mitigate interest rate risk by balancing maturity on both sides of balance sheet
           - However – still cannot be confident that perfectly immune to interest rate shock
           - Does not consider the timing of cash flows

Duration Model

Duration

- Quantifies the price sensitivity of an asset with relation to interest rate shock
- Duration Model is more accurate in calculating the MV impact compared to the Maturity Model
- **Duration**: the PV weighted average term of a security
  - Rather than being the product of PV of assets and liabilities and their maturity (as in the Maturity Model) – it incorporates the value and timing of all the cashflows that exist within them

$$D_p = \Sigma(MV_i \times D_i) / \sum MV_i$$

✓ Where:
  D_p = Duration of the portfolio
  MV_i = Market Value of the ith security
  D_i = Duration of the ith security

- o NOTE: Approach similar to Maturity Model – except rather than calculating weighted average of the maturity we calculate weighted average duration
- Managing Interest Rate Risk for FI:
  - o Calculate changes in the market values of assets and liabilities based on durations

$$\Delta A = \left[-D_A \times A \times \frac{\Delta R_A}{(1+R_A)} \right] \qquad \Delta L = \left[-D_L \times L \times \frac{\Delta R_L}{(1+R_L)} \right]$$

  - ▪ A = aggregate value of assets; L = aggregate value of liabilities
  - o Changes in equity values (recall we need to quantify the impact on shareholders equity value):

$$\Delta E = \left[-D_A \times A \times \frac{\Delta R_A}{(1+R_A)} \right] - \left[-D_L \times L \times \frac{\Delta R_L}{(1+R_L)} \right]$$

  - o Assuming that R_A and R_L are equal (i.e. same level of interest and expected shock to interest rates across assets and liabilities), the equation can be further simplified:

$$\Delta E = -\left(D_A - D_L k\right) \times A \times \frac{\Delta R}{(1+R)}$$

Where k = L / A (a FI's leverage measured in market values)

  - ▪ Important: all variables are in market values (<u>not</u> book values)
  - ▪ Determinants of interest rate risk exposure:

    ΔE = –(adjusted duration gap) × FI size × interest rate shock

  - ▪ Generally, the objective of risk management is to minimise the effect of interest rate changes on shareholder value: $\Delta E = 0$
    1. Specifically, managers can play around with leverage (k) or lengthen / shorten liability duration to make $-D(D_A - D_L k) = 0$

TUTORIAL 3 SUMMARY

- Changes in interest rate → systematic risk
- **Maturity Model:**
  - o Longer maturity = more sensitive to interest rate changes
  - o Shareholder's equity value is what matters
  - o Fluctuation in interest rates → Both asset values and debt values move in the same direction with same intensity
  - o But if difference in maturity structure between debt and equity values - possible to produce negative results for equity holders
  - o Match maturity structures of debt and equity - zero maturity gap:
    - ▪ Does not correlate to no interest rate risk - timing differences

- The possibility that when interest rates occur, securities may move in a non-correlated way
- **Duration Model:**
  - Duration - a measure of price sensitivity of a security with respect to interest rate shock
  - Duration Measure: Weighted average duration structure of assets and liabilities, with leverage adjustment → calculate the impact on shareholder equity value
- **Features of Duration**
  - If 0 interest / single cash flow (coupon bond?): Duration = maturity
  - Longer maturity in identical securities → higher duration
  - Smaller yield → higher duration (impact of interest rate shock would be less)
  - High coupons → Smaller duration (rely less on later cash flows)
    - *How much cash flows do you receive in the later period?*
- **If you have zero duration gap, are you perfectly immune to interest rate risk?**
  - Duration model is a linear approximation of price changes – however the price and yields are convexly related
  - Therefore duration model (which we learnt in class) has some estimation error – as it does not consider the convexity

	Maturity Model	**Duration Model**
Focus	Time until the bond's maturity	Sensitivity of bond price to interest rate changes
Risk Measure	Interest rate risk estimated based on **time to maturity**	Interest rate risk measured by **duration (weighted average time)**
Assumption	Longer maturity = higher interest rate risk	Accounts for **timing and size of all cash flows**
Accuracy	Crude estimate – ignores coupon payments	More precise – incorporates present value of all cash flows