THEORY OF FINANCIAL INSTITUTIONS II: BASIC BANKING MANAGEMENT

Semester 2/2017

EE431

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READINGS

Mishkin Chapter 9

Kent Matthew and John Thompson,

- Chapter 7: Bank behaviors
- Chapter 12: Risk management

AGENDA

- What does a commercial bank do: balance sheet analysis.

- Goals of commercial banks, how do they operate and manage their business?

WHAT DOES A COMMERCIAL DO?

- Like many other financial intermediaries, commercial banks operate the business by
  - Raise funds in the market (liability)
  - Generate return from portfolio investment (Asset)

- The activities can be best summarized by *bank's balance sheet*.

BASIC BANKING ACTIVITIES: THE BANK BALANCE SHEET

Assets	Liabilities
- Reserves - Cash items in process of collection - Tradable Securities - **Credit Loans** - Other assets	- **Checkable deposits** - **Non-transaction deposits** - Borrowings Bank capital

TABLE 1 BALANCE SHEET OF ALL COMMERCIAL BANKS (ITEMS AS A PERCENTAGE OF THE TOTAL, JUNE 2014)

TABLE 1 Balance Sheet of All Commercial Banks (items as a percentage of the total, June 2014)

Assets (Uses of Funds)*		Liabilities (Sources of Funds)	
Reserves and cash items	19%	Checkable deposits	11%
Securities		Nontransaction deposits	
U.S. government and agency	13	Small-denomination time deposits (<$100,000) + savings deposits	47
State and local government and other securities	6	Large-denomination time deposits	11
Loans		Borrowings	20
Commercial and industrial	12	Bank capital	11
Real estate	25		
Consumer	8		
Interbank	1		
Other	7		
Other assets (for example, physical capital)	9		
Total	100	Total	100

*In order of decreasing liquidity.

Source: http://www.federalreserve.gov/releases/h8/current/.

BALANCE SHEET OF ALL COMMERCIAL BANKS IN THAILAND (ITEMS AS A PERCENTAGE OF THE TOTAL, FEB 2018)

Items	Assets			Items	Liability	
1	Currency and Deposits	4.62		7	Deposits	71.91
2	Securities Other Than Shares	15.03		8	Securities Other Than Shares Incl. in BM	3.23
3	Loans	74.29		9	Borrowing	8.60
4	Other Accounts Receivable	3.09				
5	Nonfinancial Assets	2.98				
6	Total Assets	100.00		10	Other Accounts Payable	7.96
				11	Shares and Other Equity	12.67
				12	Total Liabilities	100.00

Sources: BOT / exclude foreign bank, foreign branch

WHAT DOES A COMMERCIAL DO?

- Principle: Bank operates by managing *asset and liability*.
- Difficulty: Banks face various kind of risks in the investment.
  - Risks appear both on the liability side and asset side.
  - Principle of financial investment revisited: risk and return!
- Maximizing value of Bank (long-term profit maximized.)
  - Enhancing financial return: Risk management
  - Ensuring long-term financial strength: Capital management

TYPES OF COMMON RISK EXPOSURE

Liquidity risk

Market risk (interest rate)

Credit risk

LIQUIDITY RISK

- Banks typically raise fund in the deposit market, but invest in credit loan.
- Banks operate under a mismatch liquidity environment.
  - Credit loan is long-term illiquid
  - Deposit is highly liquid.
- Banks are subjected to liquidity risk!
- How does a commercial bank manage the liquidity risk?

MANAGING LIQUIDITY RISK: HOLDING RESERVE

- To insure against the possibility of deposit outflow, bank may choose to hold x% of its deposit as reserve.
  - The traditional way in which banks protect against the liquidity risk by voluntarily holding reserve is known as the fractional reserve banking system.

- Since the establishment of the central bank, part of the x% is also compulsory by the regulation, i.e. reserve requirement ratio.

MANAGING LIQUIDITY RISK: HOLDING RESERVE

- So, two underlying motives for bank's reserve
  (i) Required reserve: regulatory constraint.
  (ii) Used to protect against the withdrawal or deposit outflow.

- What are the possible choices of banks' liquidity management to fulfil both tasks?

MANAGING LIQUIDITY RISK: HOLDING EXCESS RESERVE

Excess reserves:

Before

Assets		Liabilities	
Reserves	$20M	Deposits	$100M
Loans	$80M	Bank Capital	$10M
Securities	$10M		

After $10M deposit outflow

Assets		Liabilities	
Reserves	$10M	Deposits	$90M
Loans	$80M	Bank Capital	$10M
Securities	$10M		

- Suppose a bank's required reserves are 10%.
- If a bank has ample excess reserves, a deposit outflow does not necessitate changes in other parts of its balance sheet.

MANAGING LIQUIDITY RISK: TRADABLE SECURITIES

- Holding excess reserve ratio is costly; reserve account earns banks a return lower than the market rate.

- Bank tends to use other more active options instead.

- Bank holds some liquid assets in terms of tradable securities, e.g. treasury bills and government bond.

Asset	Liability
Credit loan **- highly illiquid** **- Difficult to resell**	**Deposit** **- highly liquid** **- Outflow can occur anytime.**
Reserve - Required - Excess	
Marketable security - Short-term Bonds - Long-term Bond	

MANAGING LIQUIDITY RISK: TRADABLE SECURITIES

Securities (outright) sale:

Before			
Assets		**Liabilities**	
Reserves	$10M	Deposits	$100M
Loans	$90M	Bank Capital	$10M
Securities	$10M		

After $10M withdrawal			
Assets		**Liabilities**	
Reserves	$9M	Deposits	$90M
Loans	$90M	Bank Capital	$10M
Securities	**$1M**		

- Cost: (i) brokerage and other transaction costs.
  (ii) Depressed price → holding short-term then.

MANAGING LIQUIDITY RISK: INTERBANK BORROWING

- Some banks may be running surplus in their reserve, and would seek to loan the money.

- Bank may choose to borrow from the so called "interbank borrowing market"

Asset	Liability
Credit loan **- highly illiquid** **- Difficult to resell**	**Deposit** **- highly liquid** **- Outflow can occur anytime.**
Reserve - Required - Excess	Interbank borrowing
Marketable security - Short-term Bonds - Long-term Bond	

MANAGING LIQUIDITY RISK: INTERBANK BORROWING

Borrowing:

Before			
Assets		**Liabilities**	
Reserves	$10M	Deposits	$100M
Loans	$90M	Bank Capital	$10M
Securities	$10M		

After $10M outflow			
Assets		**Liabilities**	
Reserves	$9M	Deposits	$90M
Loans	$90M	**Borrowing**	**$9M**
Securities	$10M	Bank Capital	$10M

- Typically called "interbank borrowing".
- Cost incurred is the interest rate paid on the borrowed funds
- **Unsecured borrowing!!**

MANAGING LIQUIDITY RISK: SECURITIES-BACKED BORROWING (REPO BORROWING)

- Banks with liquidity shortage can also secure liquidity from the REPO market.
- REPO market can be viewed as the credit market in which marketable securities are used as the collateral.
  - Operationally, the holder of marketable security may sell asset to a buyer, and agree to buy back within fixed term period. (1 day, 14 days, etc.)
  - Purchase price is lower than market value of the security. (Hair cut)
  - Repurchase price is the purchase price + interest rate (REPO rate)

MANAGING LIQUIDITY RISK: BORROW CENTRAL BANK FACILITY

- Commercial banks might secure findings and meet the liquidity shortage through the standard lending facility designed by the central bank.

  - Bilateral REPO market

  - Marginal lending facility (policy rate + 0.5%)

  - Discount rate

Asset	Liability
Credit loan - **highly illiquid** - **Difficult to resell**	**Deposit** - **highly liquid** - **Outflow can occur anytime.**
Reserve - Required - Excess	Interbank borrowing REPO borrowing
Marketable security - Short-term Bonds - Long-term Bond	Central bank borrowing - Lending facility - Discount rate

MANAGING LIQUIDITY RISK: BORROW CENTRAL BANK FACILITY

Central bank:

Before			
Assets		**Liabilities**	
Reserves	$10M	Deposits	$100M
Loans	$90M	Bank Capital	$10M
Securities	$10M		

After $10M + Borrowing			
Assets		**Liabilities**	
Reserves	$9M	Deposits	$90M
Loans	$90M	**Borrow from Central bank**	**$9M**
Securities	$10M	Bank Capital	$10M

- Borrowing from the central bank also incurs interest payments based on the discount rate or market rate + fees (penalty)
- Reputational cost! → poor liquidity management plus bad signal to bank's quality as well.

MANAGING LIQUIDITY RISK: LOAN SELL

Reduce loans:

Assets		**Liabilities**	
Reserves	$9M	Deposits	$90M
Loans	**$81M**	Bank Capital	$10M
Securities	$10M		

- Reduction of loans is the most costly way of acquiring reserves.
- Calling in (ask for repayment) loans antagonizes customers.
- Other banks may only agree to purchase loans at a substantial discount.

RESERVE REQUIREMENT IN PRACTICE

- A bit complicate than standard textbook.
- Regulator often periodically examines the status of bank's reserve requirement with lagged (maintenance) period.
- The level of reserve required under the examination window will be calculated from the level of deposit outstanding during the previous lagged maintenance period. (normally two week before)
- The BOT has adopted the so called "*two-week* lagged maintenance period" (begin Wednesday and ends the second following Thursday), and allowed commercial bank to meet the reserve requirement on its *average basis*.

TYPES OF COMMON RISK EXPOSURE

Liquidity risk

Interest rate risk

Credit risk

INTEREST RATE RISK: MOTIVATION

- Banks raise funds in terms of deposit, and make the profit from grating loan.
  - Deposit rate/loan rate can be considered as "price" of banks' output.
- Change in market interest rate could affect the deposit rate and loan rate, and hence affect the ability that a commercial bank can earn its profit.
- As the financial position of a commercial bank could be varied with market interest rate, the commercial bank faces with interest rate risk exposure.

INTEREST-RATE RISK: MEASURING THE EXPOSURE

First National Bank

Assets		Liabilities	
Rate-sensitive assets	$20 million	Rate-sensitive liabilities	$50 million
Variable-rate and short-term loans		Variable-rate CDs	
Short-term securities		Money market deposit accounts	
Fixed-rate assets	$80 million	Fixed-rate liabilities	$50 million
Reserves		Checkable deposits	
Long-term loans		Savings deposits	
Long-term securities		Long-term CDs	
		Equity capital	

INTEREST-RATE RISK: MEASURING THE EXPOSURE USING GAP ANALYSIS

Basic GAP analysis:

$$\Delta\, profit = \Delta i * GAP$$

GAP = (rate sensitive assets - rate sensitive liabilities)

If a bank has more rate-sensitive liabilities than assets (GAP < 0), a rise in interest rates will reduce bank profits and a decline in interest rates will raise bank profits.

GAP ANALYSIS: PROBLEMS

- GAP analysis relies on a crude assumption; assuming that one percent change in market interest produces an even impact to both borrowing and deposit rate.
- The shortcoming is fixed by using a generalized GAP analysis.
  - Grouping the rate-sensitive asset/liability by maturity structure.
  - Full-blown simulation.

WHAT HAPPEN IF LOAN INTEREST INCREASES BY 1% AND BORROWING RATE INCREASE BY 0.5%?

Assets		Liabilities and Equities	
Fixed Rate Asset	**350**	**Fixed rate libilities**	**230**
reserves, long-term security, fixed rate loans, government bonds		checkable deposits long-term CDs	
Variable Rate Assets	**130**	**Variable Rate Liabilities**	**230**
S-T securities, variable rate loans		S-T CDS, saving deposits	
		Net Worth	.....
Total Asset	**480**	**Total Liabilities**	.....

GAP ANALYSIS: PROBLEMS

10 years

Assets		Liabilities and Equities	
Fixed Rate Asset	**350**	**Fixed rate libilities**	**230**
reserves, long-term security, fixed rate loans, government bonds		checkable deposits long-term CDs	
Variable Rate Assets	**130**	**Variable Rate Liabilities**	**230**
S-T securities, variable rate loans		S-T CDS, saving deposits	
		Net Worth	.....
Total Asset	**480**	**Total Liabilities**	.....

5 years

- GAP ignores all fixed rate asset/liability. (what if not held to maturity)
- Face value fixed, but market value of fixed rate might change.
- Different *compositions* on maturity of long-term asset/liability might matter for profit/loss of banks.

INTEREST RATE RISK: DURATION

- Change in interest rate affects market value of asset and liability as a whole.
- This needs comprehensive measurement using market-valued approach.
- Use the weighted average duration of a financial institution's assets and of its liabilities to see *how net worth responds to a change in interest rates.*

INTEREST RATE RISK: DURATION

Measuring sensitivity of bank's balance sheet position with respect to market interest rate:

$$\frac{\%\Delta NW}{\Delta i} = ??$$

$$NW = Asset - Liability$$

INTEREST RATE RISK: DURATION

$$\frac{\%\frac{\Delta Asset}{Asset}}{\Delta i} = -MOD_A \quad \text{and} \quad \frac{\%\frac{\Delta Liability}{liability}}{\Delta i} = -MODD_L$$

$$\frac{\%\frac{\Delta NW}{NW}}{\Delta i} = -MOD_A * \frac{Asset}{NW} + MOD_L * \frac{liability}{NW}$$

INTEREST RATE RISK: DURATION

$$\frac{\Delta NW}{\Delta i} = \frac{\Delta Asset}{\Delta i} - \frac{\Delta Liability}{\Delta i}$$

$$\frac{\frac{\Delta NW}{NW}}{\Delta i} = \frac{\frac{\Delta Asset}{NW}}{\Delta i} - \frac{\frac{\Delta Liability}{NW}}{\Delta i}$$

$$\frac{\frac{\Delta NW}{NW}}{\Delta i} = \frac{\frac{\Delta Asset}{Asset}}{\Delta i}\frac{Asset}{NW} - \frac{\frac{\Delta Liability}{Liability}}{\Delta i}\frac{Liability}{NW} = -MOD^A * \frac{Asset}{NW} + MOD^L * \frac{liability}{NW}$$

INTEREST RATE RISK: DURATION

$$Asset = \sum_{j=1}^{N} Asset_j$$

$$\frac{\frac{\Delta Asset}{Asset}}{\Delta i} = \sum_{j=1}^{N} \frac{\frac{\Delta Asset_j}{Asset_j}}{\Delta i} * \frac{Asset_j}{Asset}$$

$$\boldsymbol{MOD^A = \sum_{j=1}^{N} MOD_j^A * \frac{Asset_j}{Asset} = weighted - average\ asset\ Duration}$$

INTEREST RATE RISK: DURATION

$$Liability = \sum_{k=1}^{M} Liability_k$$

$$\frac{\frac{\Delta Liability}{Liability}}{\Delta i} = \sum_{k=1}^{M} \frac{\frac{\Delta Liability_k}{liability_k}}{\Delta i} * \frac{Liability_k}{Libaility}$$

$$\boldsymbol{MOD^L = \sum_{k=1}^{M} MOD_k^L \frac{Liability_k}{Libaility} = weighted - average\ liability\ duration}$$

INTEREST RATE RISK: DURATION

Assets		Liabilities and Equities	
long term assets	480	short-term liablities	460

- Suppose that modified duration of bank assets = 3 years, modified duration of liabilities = 2 years. The interest rate is expected to fall by 5%.

INTEREST RATE RISK: DURATION

Initial NW = _____

From the formula, we know that:

$$\frac{\%\frac{\Delta NW}{NW}}{\Delta i} = -MOD_A * \frac{Asset}{NW} + MOD_L * \frac{liability}{NW}$$

So, $\frac{\%\frac{\Delta NW}{NW}}{\Delta i}$ = _____

MANAGING THE INTEREST RATE RISK

Having known that banks face with interest rate risk, what then can a bank do?

What do we need to do so that interest rate risk is minimized.

MANAGING THE INTEREST RATE RISK

- Setting GAP = 0
- Balance duration/leverage
  - Practically, balancing maturity structure of asset and liability.
  - Attempt to make them stay close together, on average

In finance, this is called **immunization**.

MANAGING THE INTEREST RATE RISK

Using financial derivative (SWAP)

Bank A

Asset	Liability
Long-term instrument (fixed rate)	Short-term instrument (variable-rate)

Bank B

Asset	Liability
Short-term instrument (variable rate)	Long-term instrument (fixed rate)

MANAGING THE INTEREST RATE RISK

Using financial derivative (SWAP)

Bank A

Asset	Liability
Long-term instrument (fixed rate)	Short-term instrument (variable-rate)

Bank B

Asset	Liability
Short-term instrument (variable rate)	Long-term instrument (fixed rate)

- Bank A gets hurt if market rate increases.
- BUT bank B gets hurt if market rate decreases.
- Different risk exposure to different kind of an adjustment in market rate.

MANAGING THE INTEREST RATE RISK

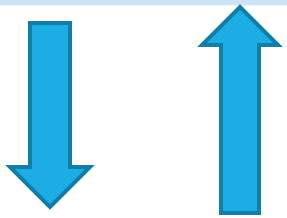
Perfect neutralization if both banks could simply swap the balance sheet.

Bank A

Asset	Liability
Long-term instrument (fixed rate)	Short-term instrument (variable-rate)

Practically, not possible

Bank B



Asset	Liability
Short-term instrument (variable rate)	Long-term instrument (fixed rate)

MANAGING THE INTEREST RATE RISK

Off-balance sheet

Paying fixed rate to B

Bank A

Notional amount

Bank B

Paying variable rate to A

On-balance sheet

Bank A

Asset	Liability
Long-term instrument (fixed rate)	Short-term instrument (variable-rate)

Bank B

Asset	Liability
Short-term instrument (variable rate)	Long-term instrument (fixed rate)

TYPES OF COMMON RISK EXPOSURE

Liquidity risk

Market risk (interest rate)

Credit risk

CREDIT RISK

- Interest payment on credit loan is the largest source of bank's income/revenue/return.
- Payment on credit loan is subjected to default.
  - Default loss suffers bank's balance sheet.
  - Reducing bank's net-worth → solvency issue.
- While enhancing return on credit loan, banks need to concern about the possibility of default too.

CREDIT RISK MANAGEMENT 1

Screening *and* Monitoring → common activity to cope with moral hazard and adverse selection

- Intrinsic default (Adverse selection): Screening and Specialization in lending.
- Strategic default; incentive-based default (Moral hazard): Monitoring and enforcement of restrictive covenants.

CREDIT RISK MANAGEMENT 2

Develop Long-term relationship with borrower and Loan-Commitment

- Asymmetric information leads to screening and monitoring cost.
- One way to reduce the cost is to incentivize borrowers with loan-commitment contract.

CREDIT RISK MANAGEMENT 3

Diversifications

- The same principle in basic portfolio investment applies to credit loan management.
- Different industries/borrowers might have different characteristics.
- Not to concentrate on granting loan to a single client or a single line of credit business.

Loan syndicate

CREDIT RISK MANAGEMENT 4

Require collateral → solving moral hazard and adverse selection

- Reduce the chance of getting bad borrowers into the portfolio at the first place.
  - High risk borrowers don't usually want to use their own collateral in the borrowing.
- Worst comes to worst, loss can be mitigated by having collateral put upfront.

CREDIT RISK MANAGEMENT 5

Credit rationing

- Choose to limit quantity of loan granted, rather than using interest rate as tool for allocation.
- Loan is limitedly **rationed** among borrowers, i.e. maximum loan value granted.

- Under asymmetric information, rationing in quantity of credit might be an optimal bank strategy, and hence representing an equilibrium feature in the credit market.
- Bank won't grant loan further even borrowers are willing to pay-off higher rate. Why?

CREDIT RISK MANAGEMENT 6

Use financial derivative

- E.g. Credit Default Swap
- Seller of the CDS promises to pay the buyer of CDS (bank) for a compensation of loss given the default.
- Seller charge buyers with an insurance premium as the incentive to accept the risk.

CAPITAL ADEQUACY MANAGEMENT

- Other than the risk-return management, bank needs to concern about long-term financial strength, i.e. insolvency issue.

- Bank capital helps prevent bank failure.

  - The amount of capital affects return for the owners (equity holders) of the bank.

  - Banks face with a trade-off between returns and solvency!

CAPITAL ADEQUACY MANAGEMENT

How Bank Capital Helps Prevent Bank Failure:

High Capital Bank

Assets		Liabilities	
Reserves	$10 million	Deposits	$90 million
Loans	$90 million	Bank capital	$10 million

Low Capital Bank

Assets		Liabilities	
Reserves	$10 million	Deposits	$96 million
Loans	$90 million	Bank capital	$ 4 million

High Capital Bank

Assets		Liabilities	
Reserves	$10 million	Deposits	$90 million
Loans	$85 million	Bank capital	$ 5 million

Low Capital Bank

Assets		Liabilities	
Reserves	$10 million	Deposits	$96 million
Loans	$85 million	Bank capital	−$ 1 million

CAPITAL ADEQUACY MANAGEMENT

How the Amount of **Bank Capital Affects Returns** to Equity Holders:

Return on Assets: net profit after taxes per dollar of assets

$$\text{ROA} = \frac{\text{net profit after taxes}}{\text{assets}}$$

Return on Equity: net profit after taxes per dollar of equity capital

$$\text{ROE} = \frac{\text{net profit after taxes}}{\text{equity capital}}$$

Relationship between ROA and ROE is expressed by the

Equity Multiplier: the amount of assets per dollar of equity capital

$$\text{EM} = \frac{\text{Assets}}{\text{Equity Capital}}$$

$$\frac{\text{net profit after taxes}}{\text{equity capital}} = \frac{\text{net profit after taxes}}{\text{assets}} \times \frac{\text{assets}}{\text{equity capital}}$$

$$\text{ROE} = \text{ROA} \times \text{EM}$$

CAPITAL ADEQUACY MANAGEMENT

- Trade-off between *safety and returns* to equity holders:
  - Benefits the owners of a bank by making their investment safe.
  - Costly to owners of a bank because the higher the bank capital, the lower the return on equity
  - Choice depends on the state of the economy and levels of confidence.