FN211
Financial Institutions and Banking Management

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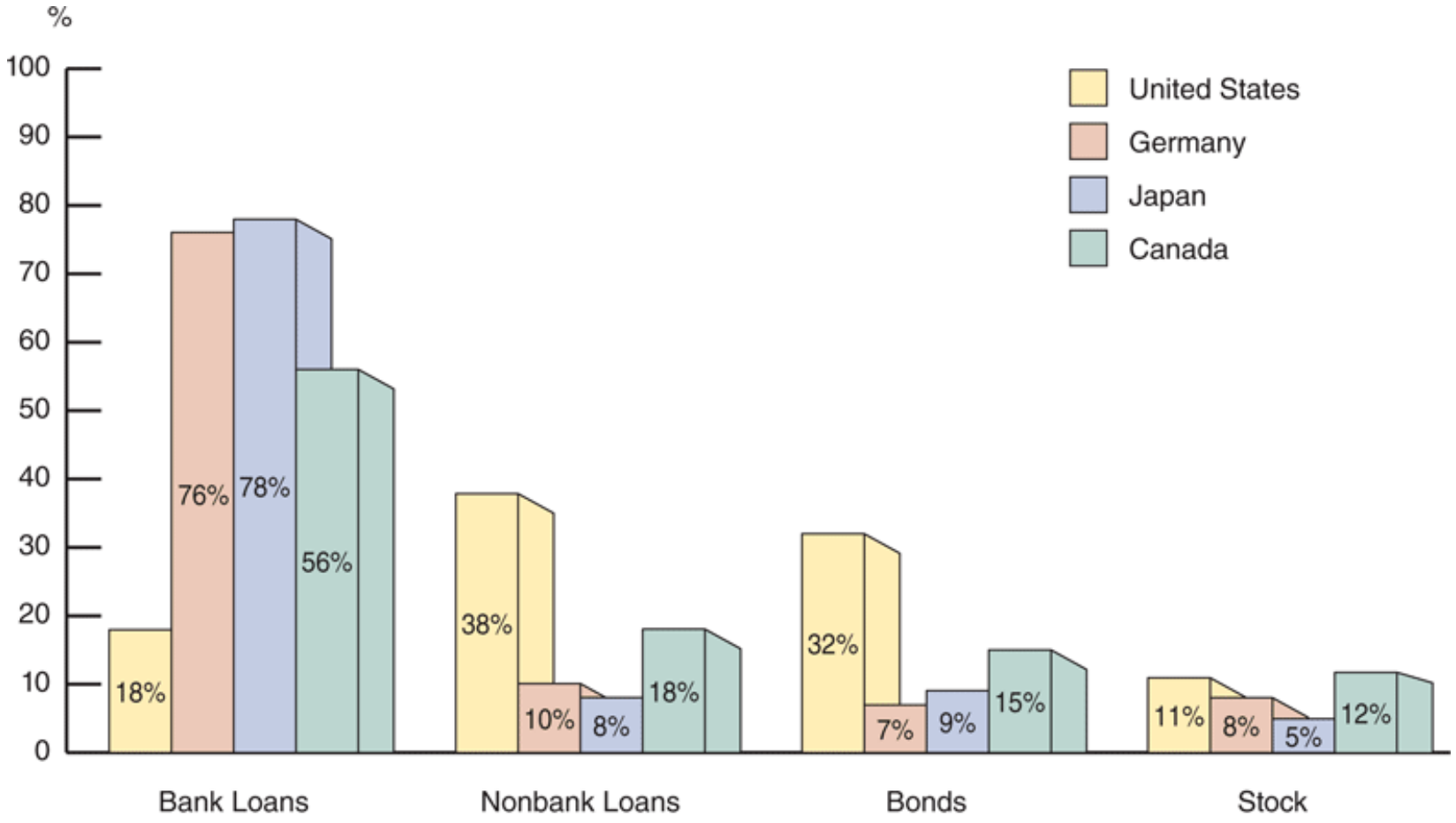
Sources of Foreign External Finance



Source: Andreas Hackethal and Reinhard H. Schmidt, "Financing Patterns: Measurement Concepts and Empirical Results," Johann Wolfgang Goethe-Universitat Working Paper No. 125, January 2004. The data are from 1970–2000 and are gross flows as percentages of the total, not including trade and other credit data, which are not available.

Source: Mishkin Figure 7.1

Transaction Costs

- Transactions costs influence financial structure
  - —E.g., a $5,000 investment only allows you to purchase 100 shares @ $50 / share (equity)
  - —No diversification
  - —Bonds even worse—most have a $1,000 size
- In sum, transactions costs can hinder flow of funds to people with productive investment opportunities

Transaction Costs

- Financial intermediaries make profits by reducing transactions costs
  1. Take advantage of economies of scale (e.g. mutual funds)
  2. Develop expertise to lower transactions costs and higher liquidity for investors

Asymmetric Information

- Asymmetric information can take on many forms, and is quite complicated. However, to begin to understand the implications of asymmetric information, we will focus on 2 specific forms:
  - Adverse selection
  - Moral hazard
- The analysis of how asymmetric information problems affect behavior is known as agency theory.

Asymmetric Information

- Adverse Selection
  1. Occurs when one party in a transaction has better information than the other party
  2. Before transaction occurs
  3. Potential borrowers most likely to produce adverse outcome are ones most likely to seek loan and be selected

Asymmetric Information

- Moral Hazard
  1. Occurs when one party has an incentive to behave differently once an agreement is made between parties
  2. After transaction occurs
  3. Hazard that borrower has incentives to engage in undesirable (immoral) activities making it more likely that won't pay loan back

The Lemons Problem

- Lemons Problem in Securities Markets
  - If we can't distinguish between good and bad securities → **pay average price**
  - Result: Good securities undervalued and firms won't issue them; bad securities overvalued so too many issued
  - Investors don't want to buy bad securities, so market don't function well
    - Explains why stocks not most important and why loans are more important
    - Less asymmetric info for well known firms, so smaller lemons problem

Tools to Help Solve Lemon Problems

1. Private Production and Sale of Information
    - But free-rider problem interferes with this solution

2. Government Regulation to Increase Information
    - Annual audits of public corporations
    - But firms have incentive to make themselves look good

Tools to Help Solve Lemon Problems

3. Financial Intermediation
    - Avoid free-rider problem by making private loans
    - Large firms are more likely to use direct instead of indirect financing through financial intermediaries

4. Collateral and Net Worth (Capital)

Moral Hazard Effects

- Moral Hazard in Equity Contracts: the Principal-Agent Problem
  1. Result of separation of ownership by stockholders (*principals*) from control by managers (*agents*)
  2. Managers act in own rather than stockholders' interest

Moral Hazard Effects

- Tools to Help Solve the Principal-Agent Problem from equity contracts
  1. Production of Information: Monitoring
  2. Government Regulation to Increase Information
  3. Financial Intermediation (e.g, venture capital)
  4. Debt Contracts

Moral Hazard Effects

- Tools to Help Solve Moral Hazard in debt Contracts
  1. Net Worth and Collateral
  2. Monitoring and Enforcement of Restrictive Covenants (ข้อตกลงร่วมกัน)
     - Discourage undesirable behavior
     - Encourage desirable behavior
     - Keep collateral valuable
     - Provide information
  3. Financial Intermediation—banks and other intermediaries have special advantages in monitoring

Asymmetric Information Problem	Tools to Solve It	Explains Fact Number
Adverse selection	Private production and sale of information	1, 2
	Government regulation to increase information	5
	Financial intermediation	3, 4, 6
	Collateral and net worth	7
Moral hazard in equity contracts (principal–agent problem)	Production of information: monitoring	1
	Government regulation to increase information	5
	Financial intermediation	3
	Debt contracts	1
Moral hazard in debt contracts	Collateral and net worth	6, 7
	Monitoring and enforcement of restrictive covenants	8
	Financial intermediation	3, 4

Note: List of facts:

1. Stocks are not the most important source of external financing.
2. Marketable securities are not the primary source of finance.
3. Indirect finance is more important than direct finance.
4. Banks are the most important source of external funds.
5. The financial system is heavily regulated.
6. Only large, well-established firms have access to securities markets.
7. Collateral is prevalent in debt contracts.
8. Debt contracts have numerous restrictive covenants.

Conflicts of Interest

- Conflicts of interest are a type of moral hazard that occurs when a person or institution has multiple interests, and serving one interest is detrimental to the other.
- 3 classic conflicts developed in financial institutions
  - U/W and research in IB business
  - Auditing and consulting in Accounting firms
  - Credit assessment and consulting in credit rating agencies

Remedies?

- Sarbanes-Oxley Act of 2002
  - Established an oversight board to supervise accounting firms
  - Increased the SEC's budget for supervisory activities
  - Limited consulting relationships between auditors and firms
  - Enhanced criminal charges for obstruction
  - Improved the quality of the financial statements and board → CEO and CFO have to certify financial statements

Remedies?

- Global Legal Settlement of 2002
  - Required IBs to sever links between research and underwriting
  - Spinning is explicitly banned
  - Imposed a $1.4 billion fine on accused investment banks
  - Added additional requirements to ensure independence and objectivity of research reports

Remedies – Will These Work?

- Criticism over the cost involved with these separations. In other words, financial institutions can no longer take advantage of the economies of scope gained from relationships.
- SOX effects to U.S. Capital Markets.
  - The cost of implementing SOX is not trivial. For companies with less than $100 million in sales, it's estimated to be around 1% of sales.
  - During the same period, European countries have made it easier for firms to go public.

The Bank Balance Sheet

- The B/S is a list of a bank's assets and liabilities
  - Total assets = total liabilities + capital

- A bank's B/S lists *sources* of bank funds (liabilities) and *uses* to which they are put (assets)
- Banks invest these liabilities (sources) into assets (uses) in order to create value for their capital providers

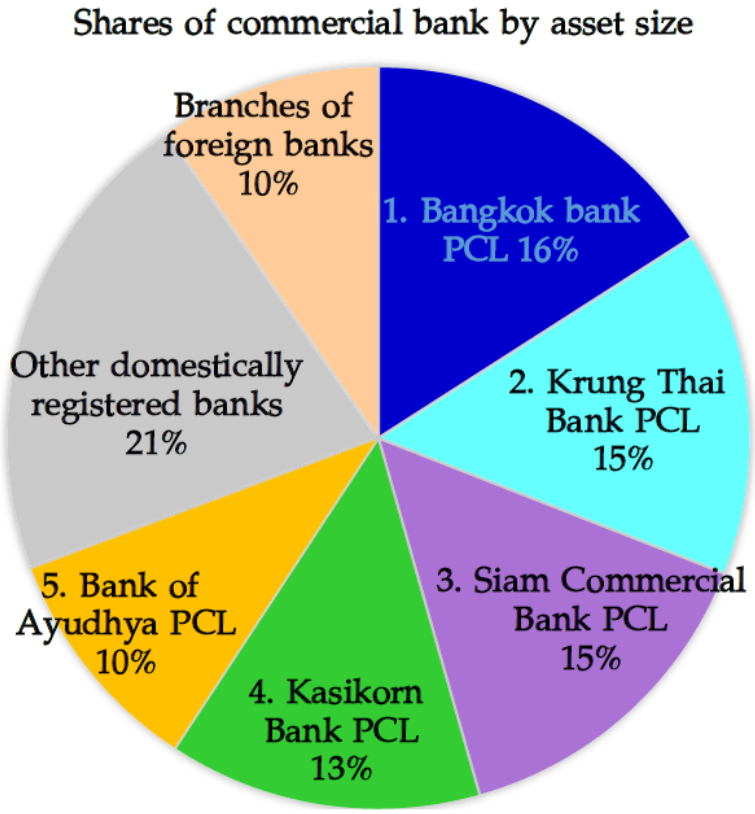
The Bank Balance Sheet

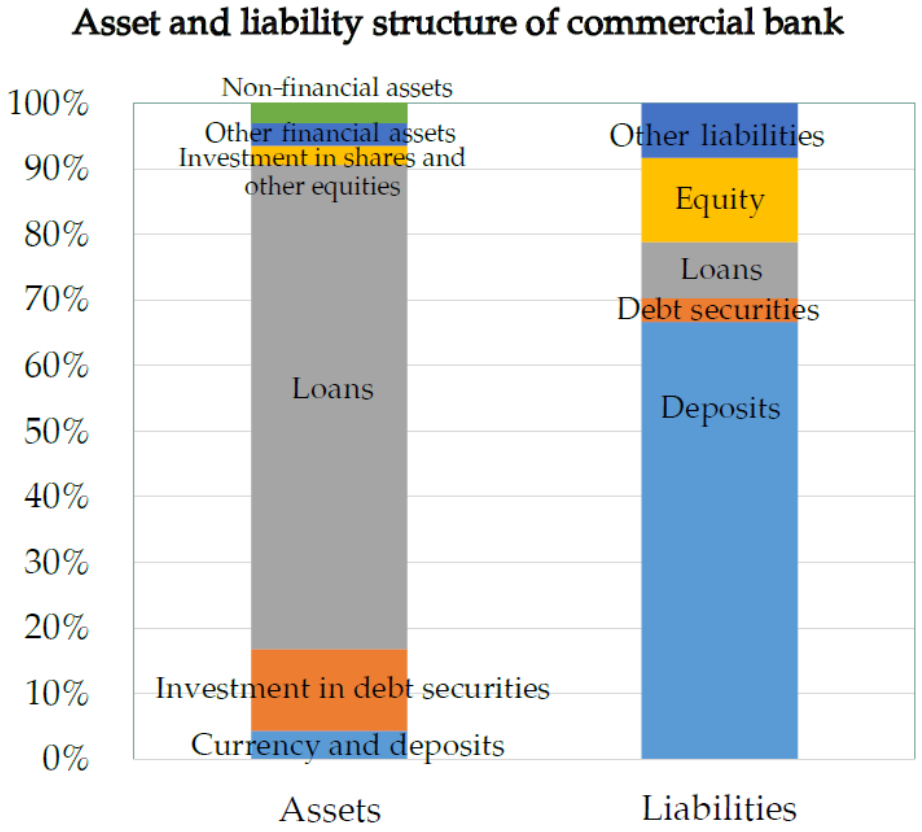
B/S of All Commercial Banks (items as a percentage of the total, 2013)

Assets		Liabilities	
Reserves and cash items	16	Checkable deposits	2
Securities		Nontransaction deposits	
U.S. government and agency	14		
State and local government and other securities	8	Small-denomination time deposits (<$100,000) + savings deposits	58
Loans		Large-denomination time deposits	11
Commercial and industrial	11		
Real estate	26	Other liabilities	6
Interbank	1		
Consumer	8	Borrowings	12
Other	7	Bank capital	11
Other assets (for example, physical capital)	9		
Total	100	Total	100

Source: Mishkin Table 17.1

The Bank B/S - Thailand





Source: Bank of Thailand – Financial Stability Report 2016

The Bank B/S - Liabilities

- **Checkable Deposits (**เงินรับฝากกระแสรายวัน**)**: accounts that allow the owner (depositor) to write checks to third parties
  - ― non-interest earning checking accounts
  - ― interest earning negotiable orders of withdrawal (NOW) accounts
  - ― money-market deposit accounts
- Lowest cost funds - safe and liquid, but offer low interest.

The Bank B/S - Liabilities

- **Nontransaction Deposits (**เงินรับฝากออมทรัพย์ ประจำ และเงินรับฝากอื่น**)**: primary source of bank liabilities (69%) and are accounts from which the depositor cannot write checks
  - savings accounts
  - time deposits (CDs or certificates of deposit)
- Highest cost of funding, but most stable for bank

The Bank B/S - Liabilities

- **Borrowings (เงินกู้ยืม)**: funds from the Federal Reserve System, other banks, and corporations
  - discount loans/advances (from the central bank)
  - fed funds (from other banks)
  - interbank offshore dollar deposits (from other banks),
  - repurchase agreements (a.k.a., “repos”)
  - commercial paper and notes

- **Bank Capital (ส่วนของทุน)**: is the source of funds supplied by the bank owners

The Bank B/S - Assets

- **Reserves (เงินสำรอง)**: funds held in account with the Fed (vault cash as well).
  - **Required reserves (เงินสำรองตามกฎหมาย)** represent what is required by law under current **required reserve ratios (อัตราการสำรองเงินตามกฎหมาย).**
  - Any reserves beyond this area called **excess reserves (เงินสำรองส่วนเกิน).**

The Bank B/S - Assets

- **Cash items in Process of Collection (**รายการระหว่างธนาคาร**)**: checks deposited at a bank, funds from other bank have not yet been transferred.
- **Deposits at Other Banks (**เงินฝากที่ธนาคารอื่น**)**: usually deposits from small banks at larger banks (referred to as **correspondent banking (**การธนาคารตัวแทน**)**).

- Reserves, Cash items in Process of Collection, and Deposits at Other Banks are collectively referred to as **Cash Items** in our balance sheet.

The Bank B/S - Assets

- **Securities (หลักทรัพย์)**:
  - —Government/agency debt
  - —Other securities
- Short-term Treasury debt is a **secondary reserve** because of its high liquidity.

- **Loans (เงินให้กู้ยืม)**: a bank's income-earning assets (not very liquid)
  - —business loans, auto loans, and mortgages

- **Other Assets (สินทรัพย์อื่น ๆ)**: bank buildings, computer systems, and other equipment.

Basics of Banking

- Deposit of $100 check

Assets		Liabilities	
Cash items in process of collection	+$100	Checkable deposits	+$100

First National Bank				Second National Bank			
Assets		Liabilities		Assets		Liabilities	
Reserves	+$100	Checkable deposits	+$100	Reserves	–$100	Checkable deposits	–$100

Basics of Banking

- If we add bank regulations to the picture.
- T-account Analysis:
  - —Deposit of $100 cash into First National Bank

First National Bank			
Assets		**Liabilities**	
Required reserves	+$10	Checkable deposits	+$100
Excess reserves	+$90		

First National Bank			
Assets		**Liabilities**	
Required reserves	+$10	Checkable deposits	+$100
Loans	+$90		

Principles of Bank Management

The bank has 4 primary concerns:

1. Liquidity management
2. Asset management
   - Managing credit risk
   - Managing interest-rate risk
3. Liability management
4. Managing capital adequacy

Principles of Bank Management

Liquidity Management

Reserves requirement = 10%, Excess reserves = $10 million

Assets		Liabilities	
Reserves	$20 million	Deposits	$100 million
Loans	$80 million	Bank capital	$ 10 million
Securities	$10 million		

Principles of Bank Management

Deposit outflow of $10 million

Assets		Liabilities	
Reserves	$10 million	Deposits	$90 million
Loans	$80 million	Bank capital	$10 million
Securities	$10 million		

- With 10% reserve requirement, bank still has excess reserves of $1 million: no changes needed in balance sheet

Liquidity Management

No excess reserves

Assets		Liabilities	
Reserves	$ 0	Deposits	$90 million
Loans	$90 million	Bank capital	$10 million
Securities	$10 million		

Deposit outflow of $10 million

Assets		Liabilities	
Reserves	$ 9 million	Deposits	$90 million
Loans	$90 million	Bank capital	$10 million
Securities	$ 1 million		

- With 10% reserve requirement, bank has $9 million reserve shortfall

Liquidity Management

1. Borrow from other banks or corporations

Assets		Liabilities	
Reserves	$ 9 million	Deposits	$90 million
Loans	$90 million	Borrowings from other banks or corporations	$ 9 million
Securities	$10 million	Bank capital	$10 million

2. Sell securities

Assets		Liabilities	
Reserves	$ 9 million	Deposits	$90 million
Loans	$90 million	Bank capital	$10 million
Securities	$ 1 million		

Liquidity Management

3. Borrow from the central bank

Assets		Liabilities	
Reserves	$ 9 million	Deposits	$90 million
Loans	$90 million	Borrowings from the Fed	$ 9 million
Securities	$10 million	Bank capital	$10 million

4. Call in or sell off loans

Assets		Liabilities	
Reserves	$ 9 million	Deposits	$90 million
Loans	$81 million	Bank capital	$10 million
Securities	$10 million		

- Conclusion: Excess reserves are insurance against above 4 costs from deposit outflows

Asset Management

- Asset Management: the attempt to earn the highest possible return on assets while minimizing the risk.
  1. Get borrowers with low default risk, paying high interest rates
  2. Buy securities with high return, low risk
  3. Diversify
  4. Manage liquidity → hold liquid assets even they generate less returns

Liability Management

- Liability Management: managing the source of funds, from deposits, to CDs, to other debt.
  1. Important since 1960s
  2. No longer primarily depend on deposits
  3. When see loan opportunities, borrow or issue CDs to acquire funds

- Banks manage both sides of the B/S together, whereas it was more separate in the past.
- Most banks manage this via the *asset-liability management (ALM) committee*.

Capital Adequacy Management

Bank capital is a cushion that prevents bank failure. For example, consider these 2 banks:

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

Capital Adequacy Management

- What happens if these banks make loans or invest in securities (e.g. subprime mortgage loans) that end up losing money?
- Impact of $5 million loan loss

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

So, why don't banks want to hold a lot of capital??

- Higher is bank capital, lower is return on equity
  - *ROA* = Net Profits/Assets
  - *ROE* = Net Profits/Equity Capital
  - *EM* = Assets/Equity Capital
  - $ROE = ROA \times EM$
  - Capital $\uparrow$, *EM* $\downarrow$, *ROE* $\downarrow$

- Tradeoff between safety (high capital) and ROE.
- Banks also hold capital to meet capital requirements.

Capital Adequacy Management

Bank Capital Requirements

- Banks are required to hold a certain level of capital (book equity) that depends on the type of assets that the bank holds
- Details of bank capital requirements (Basel I):
  - **Leverage ratio** must exceed 5% to avoid restrictions
  - Core capital must exceed 4% of the banks **risk-weighted assets (RWA) and off-balance sheet (OBS) activities**
  - Total capital (core + loan loss reserves) must exceed 8% of **RWA and OBS**
  - New capital requirements are forthcoming to address problems (such as OBS items) with RWA

Capital Adequacy Management

First National Bank

Assets		Liabilities	
Reserves	$3 m	Checkable deposits	$20 m
Treasury securities	$10 m	Nontransactions deposits	$60 m
Government agency securities	$7 m	Borrowings	$11 m
Municipal bonds	$10 m	Loan loss reserves	$2 m
Residential mortgages	$10 m	Bank capital	$7 m
Real estate loans	$20 m		
C&I loans	$35 m		
Fixed assets	$5 m		

Capital Adequacy Management

- Leverage Ratio = Capital/Assets = $7m/$100m = 7%
- Bank is well capitalized

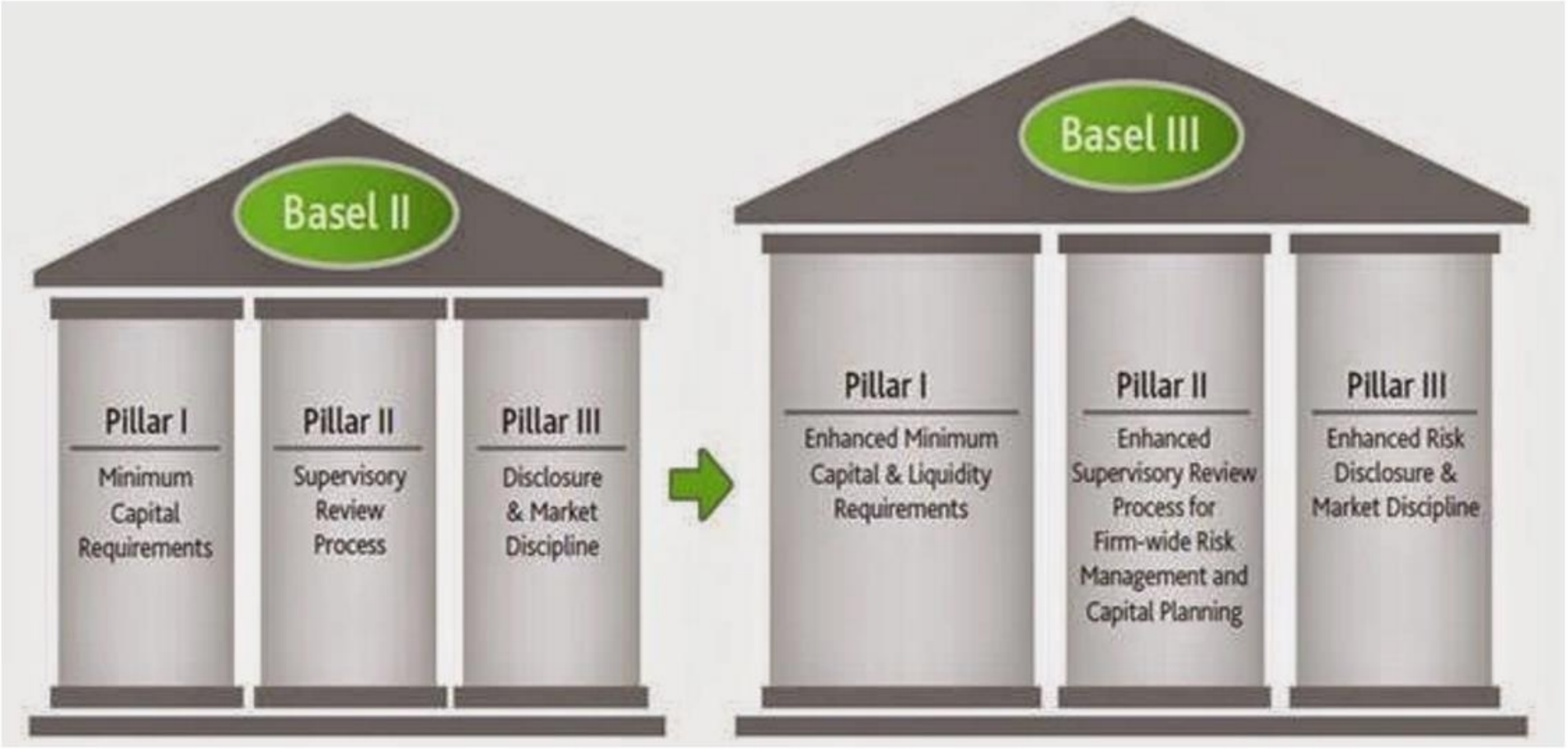
0 × $3 million	(Reserves)
+0 × $10 million	(Treasury securities)
+ .20 × $7 million	(Agency securities)
+ .50 × $10 million	(Municipal bonds)
+ .50 × $10 million	(Residential mortgages)
+1.00 × $20 million	(Real estate loans)
+1.00 × $35 million	(Commercial loans)
+1.00 × $5 million	(Fixed assets)
+1.00 × $20 million	(Letters of credit)
$91.4 million	(Total risk-adjusted assets)

Capital Adequacy Management

- Core Capital Requirement
  = 4% x RWA = 4% x $91.4m = $3.66m
  < $7m of core capital

- Total Capital Requirement
  = 8% x RWA = 8% x $91.4m = $7.31m
  < $9m of total capital (= $7m of core + $2m of loan loss reserves)

Capital Adequacy Management



Source: https://indiaspot.wordpress.com/2015/04/23/basel-norms/

Capital Adequacy Management

$$\text{Risk-Based Capital Ratio (\%)} = \frac{\text{Regulatory Capital}}{\text{Risk-Weighted Assets}}$$

Standardized Approach Banking Organizations

RWA = Credit Risk RWA + Market Risk RWA (if applicable)

Advanced Approaches Banking Organizations

RWA = Credit Risk RWA + Market Risk RWA (if applicable) + Operational RWA

Source: https://www.capgemini.com/resource-file-access/resource/pdf/basel_iii_comparison_of_standardized_and_advanced_approaches.pdf

Off-Balance-Sheet Activities (ธุรกรรมนอกงบดุล)

1. Loan sales (การขายสินเชื่อ)
2. Fee income (รายได้จากค่าธรรมเนียม)
   - FX trades (การปริวรรตเงินตรา) for customers
   - Guarantees of debt (การค้ำประกันตราสารหนี้)
   - Brokerage fees (e.g. insurance, mutual funds)
   - Other fees
3. Trading Activities and Risk Management Techniques
   - Financial futures and options
   - FX trading
   - Interest rate swaps

All these activities involve risk and potential conflicts

Measuring Bank Performance

Measuring bank performance requires a look at the income statement:

- Operating Income (รายได้จากการดำเนินงาน)
- Operating Expenses (รายจ่ายจากการดำเนินงาน)
- Net Operating Income (รายได้สุทธิจากการดำเนินงาน)

This is different from a manufacturing firm's income statement.

Banks' Income Statement

Income Statement for All Federally Insured Commercial Banks, 2012

	Amount ($ billions)		Share of Operating Income or Expenses (%)	
Operating Income				
Interest income		445.4		66.2
Interest on loans	352.3		52.4	
Interest on securities	65.1		9.7	
Other interest	28.0		4.2	
Noninterest income		227.4		33.8
Service charges on DA	32.5		4.8	
Other noninterest income	194.9		29.0	
Total operating income		672.8		100.0

Source: Mishkin Table 17.2

Banks' Income Statement

Income Statement for All Federally Insured Commercial Banks, 2012

Operating Expenses				
Interest expense		57.1		11.5
Interest on deposits	36.5		7.3	
Interest on fed funds and repos	2.2		0.4	
Other	18.4		3.7	
Noninterest expenses		388.5		77.9
Salaries and employee benefits	173.4		34.8	
Premises and equipment	41.6		8.3	
Other	173.5		34.8	
Provisions for loan losses		52.8		10.6
Total operating expense		498.4		100.0
Net Operating Income		174.4		
Gain loss on securities		8.9		
Extraordinary items net		–0.1		
Income taxes		–52.6		
Net Income		130.7		

Source: http://www2.fdic.gov/SDI/main..asp.

Source: Mishkin Table 17.2

Recent Trends in Bank Performance Measures

- *ROA* = Net Profits/ Assets
- *ROE* = Net Profits/ Equity Capital
- *NIM* = [Interest Income – Interest Expenses]/ Assets

Year	Return on Assets (ROA) (%)	Return on Equity (ROE) (%)	Net Interest Margin (NIM) (%)
1996	1.19	14.45	4.27
1997	1.23	14.69	4.21
1998	1.18	13.30	3.47
1999	1.31	15.31	4.07
2000	1.19	14.02	3.95
2001	1.15	13.09	3.90
2002	1.30	14.08	3.96
2003	1.38	15.05	3.73
2004	1.28	13.20	3.54
2005	1.30	12.73	3.50
2006	1.28	12.31	3.31
2007	0.81	7.75	3.29
2008	0.03	0.35	3.16
2009	0.08	0.73	3.49
2010	0.65	5.85	3.76
2011	0.88	7.79	3.60
2012	1.00	8.92	3.42

Source: http://www2.fdic.gov/qbp/2012dec/all1a.html.

Source: Mishkin Table 17.3

Managing Credit Risk

- The business of financial institutions is making loans. The risk with loans is the borrower will not repay.

- **Credit risk (**ความเสี่ยงเครดิต**)** is the risk that a borrower will not repay a loan according to the terms of the loan, either defaulting entirely or making late payments of interest or principal.

Managing Credit Risk

Once again, the concepts of **adverse selection** and **moral hazard** will provide our framework to understand the principles financial managers must follow.

Solving Asymmetric Information Problems: financial managers have a number of tools available to assist in reducing or eliminating the asymmetric information problem

Managing Risk

1. **Screening and Monitoring**
   - **Screening** (การคัดเลือก) - Collecting reliable information and calculating “credit score” of prospective borrowers
   - This is used for both consumer and business loans.
     - Consumer loans – Ask for salary, bank accounts and other assets, your outstanding loans, and record of loan
     - Business loans – Evaluate the likely future success of the business

Managing Risk

1. **Screening and Monitoring**
   - **Specialization in Lending** (ความชำนาญในการให้กู้ยืม) helps in screening. It is easier to collect data on local firms and firms in specific industries. It allows them to better predict problems by having better industry and location knowledge.
   - **Monitoring and Enforcement** (การกำกับควบคุม และการบังคับใช้) also helps. Financial institutions write protective covenants into loans contracts and actively manage them to ensure that borrowers are not taking risks at their expense.

Managing Credit Risk

2. **Long-term Customer Relationships** (ความสัมพันธ์ลูกค้าระยะยาว) - Past information contained in checking accounts, savings accounts, and previous loans provides valuable information to more easily determine credit worthiness.

3. **Loan Commitments** (พันธะสินเชื่อ) - Arrangements where the bank agrees to provide a loan up to a fixed amount, whenever the firm requests the loan.

Managing Credit Risk

4. Collateral and compensating balances

- **Collateral** (หลักทรัพย์ค้ำประกัน) - A pledge of property or other assets that must be surrendered if the terms of the loan are not met (the loans are called **secured loans**).
- **Compensating Balances** (ดุลบัญชีชดเชย) – Reserves that a borrower must maintain in an account that act as collateral should the borrower default.

Managing Credit Risk

5. **Credit Rationing** (การปันส่วนเครดิต)

   5.1 lenders will *refuse to lend* to some borrowers, regardless of how much interest they are willing to pay

   - Those with the riskiest investment projects are exactly those that are willing to pay the highest rate
   - The lender would rather not make any loans

   5.2 lenders will only *finance part of a project*, requiring that the remaining part come from equity financing.

   - More borrowers repay their loans if the loan amounts are small

Managing Interest-Rate Risk

- Financial institutions, banks in particular, specialize in earning a higher rate of return on their assets relative to the interest paid on their liabilities.
- As interest rate volatility increased in the last 20 years, interest-rate risk exposure has become a concern for financial institutions.
- 2 tools, **(1) Income Gap Analysis and (2) Duration Gap Analysis**, are used to assist the financial manager in this effort.

Managing Interest-Rate Risk

First National Bank

Assets		Liabilities	
Reserves and cash items	$5 million	Checkable deposits	$15 million
Securities		Money market	
Less than 1 year	$5 million	deposit accounts	$5 million
1 to 2 years	$5 million	Savings deposits	$15 million
Greater than 2 years	$10 million	CDs	
Residential mortgages		Variable rate	$10 million
Variable rate	$10 million	Less than 1 year	$15 million
Fixed rate (30-year)	$10 million	1 to 2 years	$5 million
Commercial loans		Greater than 2 years	$5 million
Less than 1 year	$15 million	Fed funds	$5 million
1 to 2 years	$10 million	Borrowings	
Greater than 2 years	$25 million	Less than 1 year	$10 million
Physical capital	$5 million	1 to 2 years	$5 million
		Greater than 2 years	$5 million
		Bank capital	$5 million
Total	$100 million	Total	$100 million

Income Gap Analysis

- **Income Gap Analysis** - Measures the sensitivity of a bank's current year net income to changes in interest rate.
- Requires determining which assets and liabilities will have their interest rate change as market interest rates change.

Income Gap Analysis: Determining Rate Sensitive Items

Assets

- assets with maturity less than one year
- variable-rate mortgages
- short-term commercial loans
- portion of fixed-rate mortgages (20%)

Liabilities

- money market deposits
- variable-rate CDs
- short-term CDs
- federal funds
- short-term borrowings
- portion of checkable deposits (10%)
- portion of savings (20%)

Income Gap Analysis: Determining Rate Sensitive Items

Rate-Sensitive Assets $= \$5\text{m} + \$\ 10\text{m} + \$15\text{m} + (20\% \times \$10\text{m})$

$RSA = \mathbf{\$32m}$

Rate-Sensitive Liabs $= \$5\text{m} + \$25\text{m} + \$5\text{m} + \$10\text{m} + (10\% \times \$15\text{m}) + (20\% \times \$15\text{m})$

$RSL = \mathbf{\$49.5m}$

if i $\uparrow$ 1% $\Rightarrow$

Asset Income	= +1% × \$32.0m	= +\$ 0.32m
Liability Costs	= +1% × \$49.5m	= +\$ 0.495m
Income	= \$0.32m – \$0.495	= <u>–\$ 0.175m</u>

Income Gap Analysis

If *RSL* > *RSA*, *i* ↑ results in: *NIM* ↓, *Income* ↓

$$GAP = RSA - RSL$$
$$= \$32.0\text{m} - \$49.5\text{m} = -\$17.5\text{m}$$

$$Income = GAP \times i$$
$$= -\$17.5\text{m} \times 1\% = -\$0.175\text{m}$$

This is essentially a short-term focus on interest-rate risk exposure. A longer-term focus uses **duration gap analysis**.

Duration Gap Analysis

- Owners and managers care about interest rate exposure on income, and the impact of interest rate changes on the balance sheet / net worth.
- **Duration Gap Analysis** measures the sensitivity of a bank's current year net income to changes in interest rate.
- Requires determining the duration for assets and liabilities, items whose market value will change as interest rates change.

Duration of First National Bank's A&L

	Amount ($ millions)	Duration (years)	Weighted Duration (years)
Assets			
Reserves and cash items	5	0.0	0.00
Securities			
Less than 1 year	5	0.4	0.02
1 to 2 years	5	1.6	0.08
Greater than 2 years	10	7.0	0.70
Residential mortgages			
Variable rate	10	0.5	0.05
Fixed rate (30-year)	10	6.0	0.60
Commercial loans			
Less than 1 year	15	0.7	0.11
1 to 2 years	10	1.4	0.14
Greater than 2 years	25	4.0	1.00
Physical capital	5	0.0	0.00
Average duration			2.70

Source: Mishkin Table 23.1

Duration of First National Bank's A&L

	Amount ($ millions)	Duration (years)	Weighted Duration (years)
Liabilities			
Checkable deposits	15	2.0	0.32
Money market deposit accounts	5	0.1	0.01
Savings deposits	15	1.0	0.16
CDs			
Variable rate	10	0.5	0.05
Less than 1 year	15	0.2	0.03
1 to 2 years	5	1.2	0.06
Greater than 2 years	5	2.7	0.14
Fed funds	5	0.0	0.00
Borrowings			
Less than 1 year	10	0.3	0.03
1 to 2 years	5	1.3	0.07
Greater than 2 years	5	3.1	0.16
Average duration			1.03

Source: Mishkin Table 23.1

Duration Gap Analysis

- The basic equation for determining the change in market value for assets or liabilities is:

$$\%\text{Change in Value} = -DUR \times \frac{\Delta i}{(1 + i)}$$

- or

$$\text{Change in Value} = -DUR \times \frac{\Delta i}{(1 + i)} \times \text{Original Value}$$

Duration Gap Analysis

- Consider a change in rates from 10% to 11%. Using the value from the previous table, we see:

- Assets:

$$\%\,\text{Asset Value} = -2.7 \times \frac{.01}{(1 + .10)} = -2.5\%$$

- Liabilities:

$$\%\,\Delta\text{Liability Value} = -1.03 \times \frac{.01}{(1 + .10)} = -0.9\%$$

Duration Gap Analysis

- Net Worth:

$$\%\Delta NW = \%\Delta \text{Assets} - \%\Delta \text{Liabilities}$$

$$\%\Delta NW = -2.5\% - (-0.9\%) = -1.6\% \text{ or } 1.6 \text{ million.}$$

- Recall from the balance sheet that the bank has "bank capital" totaling $5m. Following such a dramatic change in rate, the capital would fall to $3.4m.

Duration Gap Analysis

- For the bank, with a rate change from 10% to 11%, these equations are:

$$DUR_{gap} = DUR_a - \left(\frac{L}{A} \times DUR_l \right)$$

$$\%\,\Delta NW = -DUR_{gap} \times \frac{\Delta i}{(1 + i)}$$

Duration Gap Analysis

- Another version of this analysis, which combines the steps into two equations, is:

$$DUR_{gap} = DUR_a - \left(\frac{L}{A} \times DUR_l\right)$$
$$= 2.7 - \left(\frac{95}{100} \times 1.03\right)$$
$$= 1.72$$

$$\%NW = -DUR_{gap} \times \frac{\Delta i}{(1 + i)}$$
$$= -1.72 \times \frac{.01}{(1 + .10)}$$
$$= -.016, \text{ or } -1.6\%$$

Managing Interest-Rate Risk

- Strategies for Managing Interest-Rate Risk
  - In example above, shorten duration of bank assets or lengthen duration of bank liabilities
  - To completely immunize net worth from interest-rate risk, set $DUR_{gap} = 0$

$$\text{Reduce } DUR_a = 0.98 \rightarrow DUR_{gap} = 0.98 - \left(\frac{95}{100} \times 1.03\right) = 0$$

$$\text{Reduce } DUR_l = 2.80 \rightarrow DUR_{gap} = 2.7 - \left(\frac{95}{100} \times 2.80\right) = 0$$

Managing Interest-Rate Risk

- Problems with GAP Analysis
  - Assumes slope of yield curve unchanged and flat.
  - Manager estimates % of fixed rate assets and liabilities that are rate sensitive (which can be wrong).
  - These problems lead to more advanced analyses, e.g. scenario analysis, value-at-risk analysis.