PRINCIPLES OF BANK MANAGEMENT

Textbook to accompany ProBanker

by

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PRINCIPLES OF BANK MANAGEMENT

Financial institutions play a very important role in the allocation of capital in an economy by serving as conduits between savers and users of capital. Although different kinds of financial institutions perform this function, the bulk of the intermediation process around the world is provided by a combination of commercial, savings and cooperative banks (equivalent to credit unions in the U.S.). The banks accept deposits primarily from savers (individuals) and make loans to users (individual and businesses). Principles of Bank Management covers the basic foundations and principles in the allocations of deposits, loans and investments by commercial banks in a regulated and competitive market.

In recent years, the traditional business of banking has expanded beyond loans and deposits. Today banks offer customers multiple services including foreign exchange, letters of guarantees, leases, credit cards, insurance, asset management and securities trading services. The current banking landscape in the U.S. covers the whole gamut; from small banks offering deposit and loan services to large multinational banks offering a range of sophistication instruments such as asset-backed securities, interest rate swaps, options and futures contracts and capital lease financing. The basic model underlying the management of all banking services however is still the same; maximize shareholder (or stakeholder) returns by increasing the spread between borrowed and invested funds.

The textbook provides a comprehensive understanding of the day-to-day decisions required for commercial bank management, including pricing of loans and deposits and management of risk exposures such as interest rate, credit risk and market risk. Other topics include measurement of bank performance, deposit insurance, securitization, evolution of regulatory standards, and off-balance sheet activities.

The book is intended for upper level undergraduate or MBA students. The prerequisite for the course is an introductory accounting and finance course.

The book is best supplemented with ProBanker, a simulation program designed for students to experience the complexities of running a bank in a competitive environment. As students familiarize themselves with new concepts and tools in each chapter, they will have the opportunity to experience the impact of implementing them in a real world setting.

The use of simulation as a supplementary tool enhances the learning experience in a classroom. An important learning outcome is the realization that individual decisions have extended and dissipative impact on an organization. In ProBanker, players make financial decisions to run a large, medium or small-sized financial institution, without being burdened by excessive “institutional detail” that can obfuscate the basic analytical principles.

Players will attempt to maximize their bank's market value in a competitive environment, while observing regulatory restrictions on deposit pricing, capital adequacy, and accounting for loan performance problems. ProBanker incorporates operating costs, loan loss and nonperforming reports, and the opportunity to set advertising levels for individual bank products, confronting students with a level of realism that cannot be attained through assigned readings or textbooks. In short, it provides a rigorous “hands-on” learning experience.

We hope you will enjoy the textbook.

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Chapter 1 – FINANCIAL INTERMEDIATION

Introduction

Financial intermediation is the process of channeling funds between savers and users in an economy. The task is performed by a variety of financial institutions and their success is essential to the efficient allocation of capital in an economy. If capital is channeled to the most productive investments, economic profits and social welfare is maximized for both the firm and society. This chapter will provide a brief overview of the various financial institutions that play a critical role in the financial intermediation process, with a special emphasis on commercial banks. Subsequent chapters will elaborate on performance measures, risk management and regulatory requirements of commercial banks.

Financial Institutions

The major institutions that perform financial intermediation include commercial banks, investment banks, insurance companies, mutual funds, pension funds and specialized finance companies.

Commercial Banks are depository institutions that accept short-term deposits, usually from small savers, and issue medium or long-term loans. This mismatch of maturities allows them to earn a positive net interest income, defined as the spread between the higher interest income from loans and the lower interest expense on deposits, a process defined as maturity intermediation. This 'maturity intermediation' comes at risk because of the constant threat of withdrawals from depositors, requiring management to structure their portfolios defensively to withstand such shocks.

Examples of commercial banks include JP Morgan, Citibank and Bank of America in the United States.

Figure 1

Commercial banks are considered "asset transformers" because they convert short term liabilities (deposits) into long-term assets (loans). Historically banks kept their loans on their books till the principal was repaid. However, the past few decades has seen a transformation of the financial services sector as financial innovation has increased the scope of bank products and services. One such innovation is securitization where banks originate loans and sell them to investors instead of keeping them till maturity. Securitization has changed the primary function of banks, from "asset transformers" to "brokers" by originating loans in "Main Street" and selling them to 'Wall Street."

Other new and expanding services offered by commercial banks include bridge financing, project financing, real estate financing, custodial services, letters of credit, foreign exchange, leases, options, futures, and swaps. Several of the services are off-balance sheet activities and generate fee income instead of interest income. For some banks, fee income can exceed interest income and account for a substantial portion of total revenues.

Investment Banks are non-depository institutions that perform a variety of services for corporations, usually on a contract basis, such as underwriting bonds and stocks, facilitating mergers, assisting in corporate restructurings, and managing wealth. They are considered "brokers" because their principal function is to link borrowers and lenders. Unlike commercial banks, once the services are provided, their relationship with their client is over till the next contract.

The United States has a well-developed primary and secondary capital market. Large and mid-sized firms can be assured of an orderly process in the issuance of securities, under the regulatory eyes of the Securities and Exchange Commission (SEC). In contrast, European and Asian firms borrow predominantly from commercial banks. This trend is slowly changing as their financial markets improve in sophistication and more firms opt to borrow directly from capital markets.

Figure 2

Investment banks also engage in proprietary trading, i.e. trading for their own account instead for clients. The products include foreign exchange, derivatives, options, swaps and commodities.

Insurance Companies perform a different kind of financial intermediation by collecting premiums to insure individuals and companies against damages to lives, property, and other liabilities. There are two major categories of insurance, life and health insurance and property-casualty. Life and health insurance protects individuals against untimely death, accidents and health while property-casualty protects individuals and firms against losses to property or injuries as a result of man-made or natural forces. The premiums are invested in the capital markets to ensure that earnings are sufficient to cover projected payouts as well as leave a residual for shareholders.

To determine the appropriate premiums, insurers not only have to forecast the likelihood of adverse events (usually with probability models) but also the scale of losses when the adverse events occur. For example, in the case of automobile insurance, the rate of accidents can vary by age groups. Drivers in the 18-25 age group have the highest accident rates and therefore pay a much larger premium. The severity of the losses per accident however is similar for all age groups.

As shown in Table 1.1, life insurance firms in the United States in 2015 held total financial assets of $6.350 trillion while property-casualty companies held $1.591 trillion. Of them, approximately 50 percent of the assets were held in debt securities. They include open market paper, government, corporate, foreign and municipal bonds, and agency securities such as Fannie Mae and Freddie Mac. The total liabilities in the table represent the expected payouts based on models that predict the likelihood of adverse events and the expected losses to individuals and companies.

Table 1.1			
U.S. Insurance Obligations - 4th Quarter 2015 (in billions)			
	Total Liabilities	**Total Financial Assets**	**Of which debt securities**
Life Insurance	**$5,958.50**	**$6,350.00**	**$3,085.20**
Property Casualty	$897.00	$1,591.30	$971.20
Total	$6,855.50	$7,941.30	$4,056.40
Source: Federal Reserve Statistical Release. March 10, 2016			

Mutual Funds solicit funds from investors, pension funds and corporations and invest them in capital markets to generate returns commensurate with their risk preferences. Mutual funds are registered under the Investment Company Act of 1940 and fall under the supervision of the Securities and Exchange Commission (SEC). The investment activities are also covered by the Securities Act of 1933, Securities Exchange Act of 1934 and the Investment Advisors Act of 1940.

A variety of mutual funds are available to investors and are classified by maturity, style, company size, and geography. Most funds are invested in portfolios of stocks and bonds for long-term returns. In contrast, money market mutual funds invest primarily in short-term securities with maturities of less than one year, such as commercial paper and bankers' acceptances. Fund style can be classified as growth or revenue; growth funds seeks to invest in new companies that have the potential to expand rapidly while revenue funds seek to invest in mature companies that provide stable earnings and dividends. Fund strategy can be broken down to large cap, mid cap and small cap, where cap refers to market capitalization. Funds are also classified by geography, domestic and international. International funds invest in stocks and bonds of firms in a single country or a group of countries.

As Table 1.2 shows, total mutual funds exceeded $15.6 trillion in 2015 with money market mutual funds accounting for about 17% of the total. Assets were divided between stocks and debt securities in roughly the same proportion. Some of the well-known mutual funds include Vanguard, Fidelity, T. Rowe Price, Pimco and Franklin Templeton.

Table 1.2			
Mutual Funds - 4th Quarter 2015 (in billions)			
	Total Financial Assets	**Of which debt securities**	**Of which corporate equities**
Money Market Mutual Funds	$2,715.70	$1,561.20	**$0.00**
Mutual Funds	$12,843.40	$5,061.90	$7,327.00
Total	$15,559.10	$6,623.10	$7,327.00
Source: Federal Reserve Statistical Release. March 10, 2016			

Pension Funds are established by companies and government agencies to collect retirement savings from employees, usually deducted from their salaries, and invested in capital markets to provide pension benefits upon retirement. Pension funds play a big role in financial markets due to the size of the assets accumulated over many years.

At the end of the fourth quarter of 2015, total pension liabilities exceeded $18 trillion, of which $14.3 trillion were invested in the stock and bond market, as shown in Table 1.3. The remainder is unfunded indicating a current shortfall between expected revenues and payouts, based on current projected rates. The projections are based on several variables that include interest rates, GDP, tax rates, stock market performance etc.

There are two types of pension funds, and are differentiated by the form of payout to the retirees.

a) **Defined benefit plans** stipulate the income and other benefits that will be received by the retiree. Hence, the employer bears the risk of ensuring sufficient funds are invested to fulfil the expected payments.
b) **Defined contribution plan** stipulate contributions that will be made by the employer to the retiree's fund. The employer is not responsible once the funds have been invested. The income and other benefits received by the retiree will depend on the performance of the fund, effectively transferring the risk from the employer to the employee.

For defined pension benefit plans, the expected payouts are determined by a combination of economic projections and demographic patterns. Two important demographic variables are life expectancy and sex. Life expectancy has been increasing over the last century for both sexes. If individuals continue to love longer, the expected payouts for defined contribution plans will be higher. In addition, women are expected to live longer than men.

The management of pension funds is similar to insurance companies, especially defined benefit plans. The liabilities and assets of the fund have to be estimated regularly using forward-looking information to monitor for shortfalls and surpluses. Additional funds may have to be injected to ensure that the funds are balanced for the long run. For defined contribution plans, managers will advise individuals on how to estimate their future requirements and assess shortfalls in their current contributions.

Table 1.3

U.S. Pension Obligations - 4th Quarter 2015 (in billions)

	Total Liabilities	**Funded by Assets**	**Unfunded**
Private Pension Plans	**$8,553.50**	$2880.50	$297.30
Federal Government Pension Plans	$3,757.50	$1,512.20	$1,815.10
State and Local Governments Pension Plans	**$5,786.30**	$3,622.10	$1,685.80
Total	$18,097.30	$8,014.80	$3,798.20

Source: Federal Reserve Statistical Release. March 10, 2016

Specialized Finance companies, or non-bank financial companies, provide financing to specific sectors of the economy and include commercial and residential real estate, automobiles, capital equipment, durables and factoring. The process is similar to lending by commercial banks except that loans are usually collateralized with the purchased or leased assets. Many large manufacturers have their own financing subsidiaries. For example, Boeing provides financing through its subsidiary, Boeing Capital Corporation, and General Electric (GE) through its subsidiary, GE Capital. The financial crisis of 2008 has prompted several companies to spin off their financing subsidiaries. In 2013, GMAC, the finance subsidiary of General Motors, was spun out as a separate bank, Ally Financials. In 2015, GE announced it will sell off GE Capital by 2017.

Among the largest non-company owned specialized finance companies in the United States are CIT Group and ORIX USA (a subsidiary of ORIX Japan). Some finance companies specialize in providing loans based on accounts receivables, called factors. If a company has a formal contract to supply goods and services to a company, it can borrow from a factor (bank) once the goods have been shipped or the services performed, using the expected receivables as collateral.

Shadow Banking

Borrowers can also receive loans from non-specialized finance companies and this group includes department stores, small retail stores such as furniture stores, payday loans, and other money-lenders. Lending by non-bank institutions that are not under the supervision of regulators is now defined as shadow banking, a new word coined for this sector of lending.[1] Shadow banks do not fall under the jurisdiction of traditional regulators and are able to provide financing to individuals and business that are not serviced by traditional banks. If traditional banks are not present in a community or traditional banks refuse to lend to risky customers, non-banks can play a positive role as an alternative source of funding provided they do not engage in predatory practices. There is a however a risk that an increase in non-bank lending can trigger systemic risk to the economy since they hold less capital than financial institutions supervised by central banks.

The Federal Reserve estimates that two-thirds of the $24 trillion private-sector funding for commercial businesses in 2015 came from non-banks. In addition, 50% of consumer loans were made by non-banking institutions. Shadow banking is also a big problem in other countries. China's shadow lending assets have been estimated by Moody's Investors services at $7 trillion in 2015, equal to about two-thirds of the economy.[2] Brazil's shadow banking has been estimated at $1 trillion out of a $2.5 trillion GDP

Since non-bank institutions operate with few, if any, regulations, the risk posed by shadow banking has become a source of concern to regulators. Part of the growth in shadow banking has been blamed on increased regulation of commercial banks in the aftermath of the 2008 crisis.

Importance of Financial Companies

Financial institutions form an important component of the economy of every country. In addition to providing financing and an efficient payments system, they also contribute to the economy by providing employment and generating taxes for the government. In the U.S., the contribution of the finance and

[1] The term has been attributed to Paul McCulley of PIMCO, a large bond fund, in 2007 when describing the sale of loans repackaged as bonds. See "How Shadow Banking Works", The Economist, February 1, 2016.
[2] "China's Shadow Banking Evolves to Dodge Crackdown", Bloomberg News, February 24, 2016.

insurance sectors to gross domestic output has averaged around 7.2% over the last eight years, as shown in Table 1.4. If we include the real estate sector, rental and leasing sectors, the percentage increases to about 17% of the economy.

Since financial services account for nearly twenty percent of gross output, its impact on the economy is significant, making the responsibilities of the central bank in managing monetary policy and the payment systems a vital task if they are to successfully manage the growth of a country.

Table 1.4

Financial Services as a Percent of Gross Domestic Output (in $ billions)

	2008	2009	2010	2011	2012	2013	2014	2015
All industries	$26,826	$24,657	$26,094	$27,536	$28,663	$29,572	$30,971	$31,387
Finance and Insurance (FI)	$1,979.9	$1,854.3	$1,888.8	$1,907.1	$1,962.8	$2,080.1	$2,181.7	$2,274.8
FI as percentage of Gross Output	7.38%	7.52%	7.24%	6.93%	6.85%	7.03%	7.04%	7.25%
Finance, insurance, real estate, rental, and leasing (FIRRL)	$4,614.8	$4,420.7	$4,522.5	$4,618.7	$4,797.3	$5,020.4	$5,298.9	$5,539.0
FIRRL Output as a Percentage of Gross Output	**17.20%**	**17.93%**	**17.33%**	**16.77%**	**16.74%**	**16.98%**	**17.11%**	**17.65%**

Source: Bureau of Economic Analysis, April 2016

Commercial Banking

Commercial banks form the backbone of the financial system in nearly every country. They operate in nearly every town and city in a country. The history of banking begins with money lenders who charged interest rates in both in cash and kind as a reward for bearing risk. The word “bank” comes from the Latin word “Bancu” meaning bench and refers to the seating in a Roman forum where money lenders used to congregate for business. Moneylending as a profession was frowned upon by most religions institutions and usury or the practice of charging of interest rates was often banned. Without interest rates however capital will not flow to the most productive sectors of the economy and can lead to misallocation of resources. Owners of capital have little incentives to lend if they are not compensated for bearing the risk of non-payment.

Needless to say, moneylenders and bankers always found ways to work around religious and government restrictions. In the case of usury, the agreements were often structured to avoid explicit payments of interest. One form of financing to work around usury is to enter into an agreement with a borrower to buy an asset and sell it later at a higher price. As an example, assume an individual needs to borrow $10,000 at 10% to purchase an automobile. The borrower plans to repay the loan at the end of the year.

1. A traditional bank will lend $10,000 and expect to receive $11,000 at the end of the year. The additional $1,000 will be categorized as interest payment.
2. An alternative approach is for the lender to buy the car and rent it to the borrower for the year, at $500 per month, for a total of $6,000. The agreement will also commit the borrow to purchase the car from the lender at $10,400 at the end of the year. Thus, although no explicit interest payment is involved in the agreement, the lender receives $11,000 at the end of the year. This structure is commonly used in Islamic finance since Islam prohibits interest payments.

As trade flourished and empires began to expand in the Middle Ages, formal financial institutions replaced individual money lenders. Among the famous bankers were those belonging to the Medici family in Italy, whose model for banking eventually moved north to Germany and the United Kingdom. The oldest bank in existence today is the Banca Monte dei Paschi di Siena, founded in 1472, the third largest banking group in Italy.

Commercial Banking in the U.S. 1781 - 1913

Commercial banking in the United States did not take its modern form until 1790 when Treasury Secretary Alexander Hamilton proposed the formation of a central bank similar to the Bank of England. Prior to American independence, there were a number of currencies in circulation because the British monarchy did not allow the printing of currency. They included gold and silver coins belonging to England, Spain, Portugal and France and paper money issued by local governments such as Massachusetts and Rhode Island. After independence, the Continental Congress authorized the opening of the first bank, Bank of North America. It opened in 1781 but closed a year later. In 1784, Bank of New York and the Massachusetts Banks were chartered, making them the oldest banks in the United States (BNY Mellon and Bank of America, respectively).

Commercial banks in the United States were mostly regulated by state governments except for brief periods in history when attempts were made to create a central bank. In 1791, Alexander Hamilton chartered the First Bank of the United States to serve as a central bank but it lasted only till 1811 when Congress refused to renew its charter. The Second Bank of the United States was chartered in 1816 and also lasted 20 years because President Andrew Jackson refused to renew its charter in 1836. The lack of a central bank led to the growth of state chartered banks which required only the permission of the state government to operate within its jurisdictions. The expansion of state chartered banks led to a proliferation of bank notes as each bank issued its own notes. By 1860 there was an estimated 10,000 different bank notes in circulation. The civil war provided an impetus for Congress to pass the National Banking Acts of 1863 and 1864. It created the Office of the Comptroller of the Currency and a national charter for banks. The OCC not only supervised national chartered banks but also issued bank notes with the seal of the Treasury Department that eventually became the national currency.

State chartered banks were initially averse to switching over to a national charter because of the larger capital requirements and the prospect of being supervised by a national agency. In addition, many banks were reluctant to change their names because the new law required them to include “National” such as ‘First National,” “Second National,” etc. in their names. In March, 1865, Congress passed a 10% tax on notes issued by state chartered banks. The tax led to a surge of nationally chartered banks and the

eventual dominance of the national currency over state bank notes. The number of state chartered banks declined from 1,600 in 1860 to about 300 in 1866.[3]

The growth of national chartered banks however was short-lived as state governments relaxed the rules even further for state charters. Lending limits were reduced, collateral requirements were broadened and fee for bank examinations were reduced. By 1900, state banks once again exceeded the number of national banks. Although national charter resulted in more uniform banking practices, bank runs continued to occur in the late 1800s. The panics of 1873, 1893 and 1907 not only led to bank runs but also to major recessions. The 1907 panic eventually led to creation of the Federal Reserve System (Fed) in 1913, a national central bank.

Commercial Banking in the U.S. 1913 - present

Ironically, the creation of the Fed resulted in one of the biggest banking crisis in history a mere 16 years later. Partial blame fell on the Fed for allowing credit to expand rapidly during the 'roaring 20s,' and then abruptly ending it before the bubble burst in August 1929. The Fed were also reluctant to expand credit in the aftermath of the crisis and this inaction has been blamed for intensifying the crisis. The Great depression that followed led to the failure of approximately 9,000 banks and the stock market lost over 80% of its value. The banking system was stabilized after the inauguration of President Roosevelt in 1933 who implemented a range of reforms in the banking and securities markets. Two major pieces of regulation that changed the nature of banking in the United States was the separation of commercial and investment banking and the introduction of deposit insurance.

Commercial and Investment Banks – The Glass-Steagall Act

In most countries, commercial and investment banking services are provided by the same bank. Historically, it was the same in the United States until the enactment of the Glass-Steagall Act of 1934, which separated commercial and investment banking activities. The law was passed after the Pecora Commission that investigated the causes of the Great Depression identified potential conflict of interests between the two activities.

A prominent example highlighted by the Pecora Commission was the case of Chase Securities and General Theatres and Equipment (GTE). In 1929, GTE acquired Fox Motion Pictures that was partially financed by Chase National Bank. In 1930, Chase Securities Company underwrote $23 million of common stock and $30 million of debentures for GTE, and used the proceeds to pay back the $15 million loan. As GTE continued to experience financial problems, Chase Securities underwrote an additional $30 billion in the following year. A year later GTE went bankrupt. The commission pointed to the potential conflict of interest because proceeds from the issuance of debentures and shares by Chase Securities were used to pay off the loans held by its subsidiary, Chase National Bank. Did Chase Securities and Chase National Bank know of the deteriorating financial condition of GTE?[4]

For the next 60 years, the separation of commercial and investment banking appeared to have worked well for the financial industry. Although they were several banking crises in the interim, none of them

[3] Source: "A Short History," Office of the Comptroller of the Currency. United States Department of the Treasury. Available at http://www.occ.gov/about/what-we-do/history/OCC%20history%20final.pdf

[4] Wigmore, Barrie, The Crash and Its Aftermath: A History of Securities Markets in the United States, 1929-1933, Westport, CT: Greenwood Press, 1985.

were related to investment banking activities. In 1999, after years of lobbying, the Gramm-Leach-Bliley Act was passed. It overturned the Glass-Steagall Act and broke the barriers between commercial and banking activities. Less than 10 years later, the country experienced the Great Recession of 2008, resulting in the failures of several prominent investment and commercial banks. Several commercial banks that failed were engaged in proprietary trading activities that were long the purview of investment banks. They included packaging and trading of credit default swaps (CDS) and collateralized debt obligations (CDO), later identified as the culprit instruments for the market failure in 2008.

The aftermath of the financial crisis of 2008 saw the passage of the Dodd-Frank Act in 2010. The broad legislation covered many facets of the financial services industry and has been compared to the sweeping legislations of 1933 and 1934. Among the many rules is the Volcker Rule named after Paul Volcker, former Chairman of the Federal Reserve Board. It would curb some of the investment banking activities of commercial banks. Although there is no direct evidence to indicate that the elimination of the Glass-Steagall Act contributed to the crisis, critics have argued that since the government provides an insurance against deposits, they had a responsibility to curb excessive risk-taking activities of banks. Some of the banned activities include proprietary trading, ownerships of hedge funds and private equity firms, and over-the-counter trading of credit default swaps.

Deposit Insurance

Another major reform of the Banking Act of 1933 was the creation of the Federal Deposit Insurance Corporation (FDIC). It guaranteed deposits of up to $2,500 in the event of a bank failure. It was in response to the wide-spread devastation of depositors who lost an estimated $1.3 trillion in the years 1930-33. As Table 1.5 shows, there were over 5,700 bank failures in 1921-29 followed by 9,200 bank failures in the 1930-33 period. The introduction of deposit insurance in 1934 resulted in only 9 banks failures that year. The success of deposit insurance can be evaluated by examining the dramatic decline in bank failures between 1943 -1974, less than seven failures per year.

Table 1.5 - Number of Bank Failures

Year	No. of Banks		Year	No. of Banks		Year	No. of Banks
1921	506		1929	1530		1939	60
1922	366		1930	2293		1940	43
1923	646		1931	1453		1941	15
1924	775		1932	4000		1942	20
1925	617		1933	9		1943-63 (21 years)	Less than 5
1926	975		1935	25		1964-74 (11 years)	Less than 7
1927	669		1936	69			
1928	498		1937	75			
1928	659		1938	74			

Source: FDIC - A History of Confidence and Stability

Unfortunately, deposit insurance has one shortcoming, lack of monitoring by depositors. In the days before deposit insurance, depositors had to exercise caution in their selection of banks. They had incentives to monitor the performance of their local bank, recognizing that their well-earned money could

be lost forever if their bank failed. Keeping an eye on the bank was not an option, it was a necessity. With deposit insurance, there are few incentives for depositors to worry about the condition of their bank. If their bank failed, the FDIC would reimburse their deposits. The lack of monitoring by depositors provides incentives to bank manager to take on excessive risk, and this behavior is termed moral hazard.

Excessive risk-taking as a result of moral hazard has been blamed for many of the banking excesses since the 1980s, including the financial crisis of 2008. There are no easy solutions to resolve the moral hazard problem with deposit insurance. One solution is to make banks pay more for deposit insurance if they undertake risky investments. In 1991, Congress passed the Federal Deposit Insurance Corporation Improvement Act (FDICIA) imposing a risk-based premium for deposit insurance. Banks that are inadequately capitalized are made to pay a larger fee for deposit insurance, similar to the pricing by insurance companies. Unfortunately, the higher premiums did not prevent the excessive risk-taking of banks in the run up to the 2008 financial crisis. Table 1.5A shows the increase in bank failures in the years following the 2008 recession.

Table 1.5A

Number of Bank Failures since 2008

2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Total**
25	**140**	**157**	**92**	**51**	**24**	**18**	**8**	**515**

Source: https://www.fdic.gov/bank/historical/bank/

Too Big to Fail (TBTF)

Along with deposit insurance, another contributing factor to excessive risk-taking is the prevalence of "Too Big to Fail," defined as the reluctance of governments and central banks to allow big banks to fail because of its potential widespread impact on the rest of the economy. The impact is stronger if the financial institutions are interconnected and the failure of one bank results in the failure of many more banks. In recent years, the businesses of large multinational financial institutions have also become interconnected globally. A failure of one large bank in a country can therefore impact banks in other countries leading to a broader shock, as witnessed in the financial crisis of 2008. The Dodd -Frank Act of 2010 has addressed this issue of TBTF by attempting to reduce the probability of large banks failing. They require large banks to:

a. hold addition equity capital and liquidity to withstand shocks in an economy.
b. conduct periodic and stringent stress-testing to ensure they can survive a deep recession.
c. prepare a living will that demonstrates they can unwind successfully without disrupting the economy.
d. allow regulators to continually monitor different aspects of their business.

Too Big to Jail

The financial crisis of 2008 generated some new acronyms, especially in the mortgage lending industry where fraud was wide-spread. They include acronyms like NINJA loans (No income, No job, No assets loans where the borrower provided no information), SIVA loans (Stated Income Verified Asset Loans, where the borrower only had to state his or her income), and NIVA loans (No Income Verified Assets loans, where the borrower did not require proof of employment). Years after the end of the recession, the lack of convictions of senior executives of failed banks by the Department of Justice has led to the term 'Too Big to Jail." See the following article for further discussion. http://www.cnn.com/2014/01/06/opinion/calabria-gilbert-too-big-to-jail/

Another goal of the Dodd-Frank Act is to send a signal to shareholders and creditors that the central bank will not tolerate TBTF and will fail large banks in a future crisis. Whether they will actually be allowed to fail will depend on the expected impact of the failure as well as the political will to engage in such an action.

Commercial Banks: Comparing United States with Other Countries

The market structure of U.S. commercial banks differs from those of other countries in several ways. The difference is partly based on its unique historical evolution. Banks emerged in this country that was relatively young and without a tradition of a monarchy or a dominant central bank, unlike its European counterparts.

a) The number of banks continues to remain high in the United States. As Table 1.6 shows, there were over 5,338 commercial banks at the end of 2015. Although this is considerably lower than the peak of over 15,000 banks in the late 1970s, they are higher relative to other countries. In the rest of the world, the banking community consists of a few large banks with branches spread all over the country. Although other countries have cooperatives and savings banks similar to supplement their commercial banks, similar to savings banks and credit unions in the U.S., they account for a small portion of banking assets. Cooperative banks in the European Union, for example, account for 20% of total market share.[5]
b) Most countries have one regulator to supervise their financial institutions. In England, the Bank of England plays a dominant role in banking supervision. In Europe, the European Central Bank (ECB), made up of the central banks of the 28 Euro countries, recently acquired powers to supervise banks at the regional level. In contrast, the U.S. has a multitude of regulators, Fed, OCC, FDIC, SEC and individual state banking regulators.
c) Banking in the U.S. has historically been privately-owned. In other countries, banks are rather government owned or the government has a strong indirect control over its activities. Over the last thirty years, financial liberalization has spread across the globe and most countries have privatized or began the process of privatizing their banking sector.

Table 1.6 - FDIC Insured Institutions as of 12/31/2015 (in millions)

	Number	Total Assets	Total Deposits
Commercial Banks	**5,338**	**$14,893,442**	**$10,064,574**
Savings Institutions	**844**	**$1,074,481**	**$840,391**
Total FDIC-Insured Institutions	**6,270**	**$15,967,923**	**$10,904,965**
U.S. Branches of Foreign Banks	**9**	**$105,646**	**$44,970**
Total FDIC-Insured Institutions	**6,279**	**$16,073,569**	**$10,949,935**

Source: https://www.fdic.gov/bank/analytical/qbp/2015dec/dep3c.html

The core functions of commercial banks are the same across countries. Commercial banks earn interest income on loans and fee income on other services. They incur interest expense on deposits and other

[5] See the European Association of Cooperative Banks. Available at http://www.eacb.coop/en/eacb/about_us.html.

borrowings. Banks have an intimate relationship with borrowers because of the frequent transaction services associated with checking and savings accounts. As a lender, they have an advantage of having private information that is unavailable to other financial institutions. The next section examines the balance sheet and income statement of a commercial bank.

Organizational Structure of U.S. Banks

Bank Concentration

Table 1.6 shows that there were 5,338 commercial banks in the U.S. as of December 2015. The large numbers of banks can be explained by the historic clash in philosophy on power sharing between federal and state governments. Thomas Jefferson led the group that preferred to cede more powers to the States while Alexander Hamilton's group was in favor of a strong federal government. The McFadden Act of 1927 tried to give more prominence to national banks by requiring states that permitted branches to offer the same treatment to national banks. In spite of the law, interstate banking remained very restrictive and as late as 1978, twelve states practiced unit banking where branches were either restricted or not permitted.[6]

In spite of the large number of banks, a breakdown shows that the top 50 banks control a majority of the assets. For December 2015, Table 1.10 shows that the top 50 banks controlled nearly 74.05% of the total banking assets in the U.S. The top 100 banks controlled 80.64%, an increase of 6.6%.

Table 1.10 – Bank Concentration by Assets, December 31, 2015. Source: FDIC		
	Total assets	Percent of Total Assets
Top 50 Banks	$11,901,999,791.00	74.05%
Top 100 Banks	$12,961,690,947.00	80.64%
All Banks	$16,073,568,189.00	100%

Organizational Forms

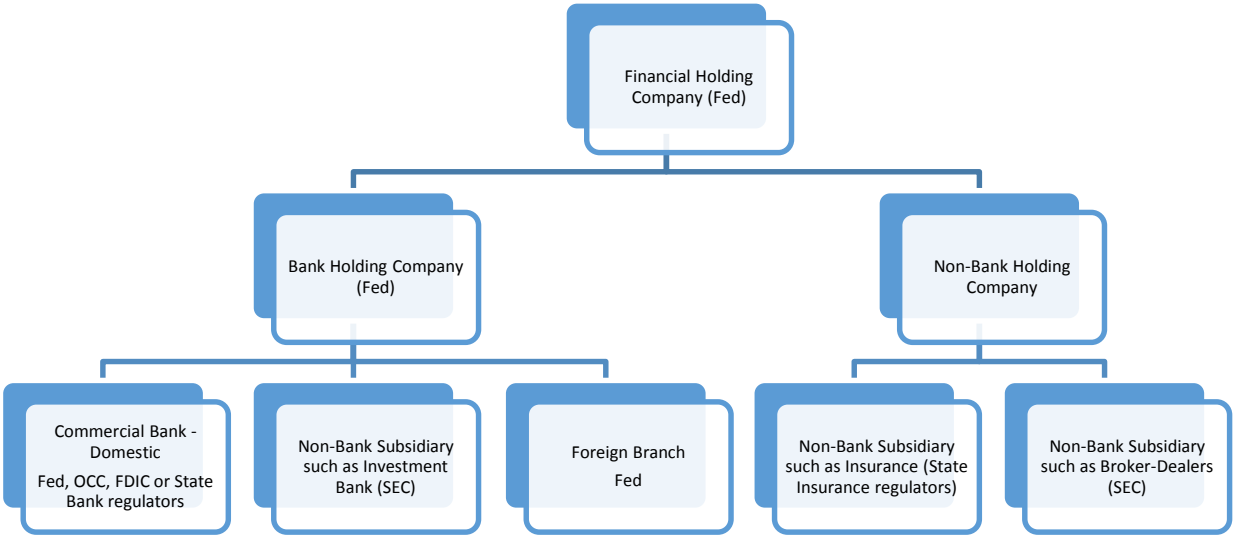
Most banks are organized as bank holding companies (BHCs) as permitted by the Bank Holding Company Act of 1956. A BHC that owns a bank is subject to supervision of the Federal Reserve. It also has to seek approval of the Federal Reserve if it acquires over 5% of another bank. It is allowed to own a nonbanking firm whose activities are closely related to banking, including mortgage banking, consumer and commercial loan servicing, leasing, collection agency, asset management, trust company, real estate appraisal, financial and investment advisory activities, management consulting, employee benefits consulting, career counseling services, and certain insurance-related activities.

Over the years, the law has been modified and weakened to allow banks to gradually engage in non-banking activities by forming separate subsidiaries. The Graham-Leach-Bliley Act of 1999 formally eliminated the separation of commercial and investment banking. Banks were allowed to form financial

[6] The 12 states were Colorado, Illinois, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, Oklahoma, Texas, West Virginia and Wyoming. See Flannery, M. J. "The Social Costs of Unit Bank restrictions" for further details. Available at http://finance.wharton.upenn.edu/~rlwctr/papers/8215.PDF .

holding companies (FHCs) and offer a variety of financial activities including insurance, securities underwriting, and merchant banking. As a result of the 1999 law, large BHCs converted to FHCS and a typical bank holding company looks like the structure shown in Table 1.11.

Table 1.11. Example of a Financial Holding Company.



The main regulatory body responsible for the supervision of the institution is in parentheses. Note that some functional units may be supervised by multiple regulators other than the Federal Reserve Board (Fed) and is shown in parentheses.

In 2012, 80% of banks in the U.S. were held as BHCs. Of these, 73% of banks with assets less than 100 million and 95% with assets greater than $10 billion were held as BHCs. In 2016, there were approximately 512 FHCs, most of which owned BHCs.

Branch versus Subsidiary

If a commercial bank plans to open an office at another location, it has a choice of setting it up as a branch or a subsidiary. A branch is legally an extended office of the parent bank and may be located in another state or in another country. A subsidiary is a separate free-standing entity of its own and is treated as a separately registered company from the parent. At the end of the year, the parent can combine the income statements and balance sheets of all its branches and subsidiaries (provided it has controlling interest) into a consolidated account. From a legal perspective, the lability of a branch has to be assumed by the parent bank. The liability of a subsidiary is separate from the parent bank and claims cannot be made against the parent bank.

An advantage of a branch is that it has direct access to the resources of the parent bank. If the branch of Citibank in London needs funds, the parent bank in New York can send the funds as an intra-office transfer. A similar transfer to a subsidiary on the other hand has to be recorded as a transaction between two separate companies.

Domestic banks have to create subsidiaries when offering non-banking services such as insurance, underwriting, or brokerage services. The removal of restrictions on commercial and investment banking services as a result of the Graham-Leach-Bliley Act of 1999, led to a substantial increase in subsidiaries, especially by large banks. In 2011, JP Morgan had approximately 3,391 subsidiaries, Bank of America had 2,019 subsidiaries and Citigroup had 1,645 subsidiaries, making the management of these organizations a complex task.[7] The financial crisis of 2008 raised concerns on the multiplicity of activities by commercial banks. The Volcker Rule, adopted in the Dodd-Frank Act, attempts to reduce the scope of commercial banks. Specifically, the rule will prohibit banks from engaging in proprietary trading of derivatives and other exotic instruments, and limit the ownership in private equity, hedge funds and other pooled investments to a maximum of three percent. Many banks responded by shedding their subsidiaries. At the end of 2014, JP Morgan reduced their subsidiaries to 49, Bank of America to 103 subsidiaries, and Citigroup to 270. The data raises the question whether the largest banks have actually simplified its operation be merging subsidiaries or are reporting less to the public and regulators.

Foreign banks in the United States also have a choice of opening a branch or subsidiary. An advantage for a foreign bank to open a subsidiary is the availability of deposit insurance from the FDIC which is not offered to foreign branches. As a result, deposit insurance provides foreign subsidiaries access to the retail markets for deposits. Foreign branches on the other hand have to accept deposits only in the wholesale market.

Regulation

Regulatory Agencies

Financial institutions around the globe tend to be highly regulated because of their role in facilitating monetary policy and the payments system. As mentioned earlier, the United States has a multitude of regulators that oversee financial institutions.

Commercial banks are regulated based on whether they are holding companies, national or state chartered, and whether they are considered systemically important. State chartered banks also have a choice of being a member of the Federal Reserve System.

Table 1.12 provides an overview of the major agencies regulating the financial services sectors at the federal level.[8].

Federal Reserve Board (Fed)

The Fed is the regulatory agency with the most jurisdictions because of its power to serve as the lender of last resort. It is the only agency that can provide unlimited liquidity during a period of economic crisis. It regulates financial and bank holding companies, foreign branches of both U.S. and overseas banks and any firm designated as Systemically Important Financial Institutions (SIFIs) by the Financial Stability Oversight Council.

Office of the Comptroller of the Currency (OCC)

[7] Avraham, Dafna , Patricia Selvaggi, and James Vickery, " A Structural View of U.S. Bank Holding Companies," FRBNY Economic Policy Review, July 2012, pp. 65-81.

[8] Murphy Edward, "Who Regulates Whom and How? An Overview of U.S. Financial Regulatory Policy for Banking and Securities Markets," Congressional Research Services, May 28, 2013.

The OCC regulates all nationally chartered banks and thrift institutions and includes the federally chartered branches of foreign banks. In 2015, the OCC supervised 21,535 banking institutions of which 991 were national banks, 415 were federal savings associations and 49 were federal branches of foreign banks, with combined assets of $15.6 trillion.

Table 1.12 Regulators of U.S. Financial Services						
Prudential Bank Regulators		**Securities and Derivatives Regulators**		**Other Financial Services Regulators**		**Policy Coordinating Government Agencies**
Federal Reserve Board (Fed)		**Securities and Exchange Commission (SEC)**		**Federal Housing Finance Agency (FHFA)**		**Financial Stability Oversight Council (FSOC)**
Office of the Comptroller of the Currency (OCC)		**Commodities Futures Trading Commission (CFTC)**		**Consumer Financial Protection Bureau (CFPB)**		**Federal Financial Institutions Examinations Council (FFIEC)**
Federal Deposit Insurance Corporation (FDIC)						**President's Working Group on Capital Markets (PWG)**
National Credit Union Administration (NCUA)						

Federal Deposit Insurance Corporation (FDIC)

The FDIC regulates state-chartered banks and savings banks that are not supervised by the OCC or the Federal Reserve System (approximately 5,388 banks and 844 savings institutions as of December 31, 2015). It currently provides insurance of $250,000 per depositor per bank for a total of 6,279 commercial banks and savings institutions.

National Credit Union Administration (NCUA)

The NCUA regulates nationally chartered and nationally insured credit unions in the U.S. There were 6,021 national credit unions with assets of $1.2 trillion as of December 31, 2015. It also provides insurance of $250,000 on deposits of its member banks, similar to the FDIC.

Securities and Exchange Commission (SEC)

The SEC regulates the securities industry and includes stock exchanges, security broker-dealers, Investment advisors and mutual funds. Their primary task is to ensure that investors have complete information on firms that offer investment products and an orderly market free of insider trading and price distortions.

Commodities Trading Futures Commission (CFTC)

The CFTC regulates trading activities related to the derivatives market such as options, futures and swaps. It fosters transparency among the various related participants such as contract markets, swap execution facilities, derivatives clearing organizations, swap data repositories, swap dealers, futures commission merchants, and commodity pool operators.

Federal Housing Finance Agency (FHFA)

The FHFA regulates approximately 14 government sponsored agencies (GSEs) in the housing market that include Fannie Mae, Freddie Mac and home loan banks. Their mission is to maintain a stable and liquid housing market. In 2015, its responsibility on debt obligations totaled over $5 trillion, making it an important player in the mortgage finance industry.

Consumer Financial Protection Bureau (CFPB)

Newly created under the Dodd-Frank Act of 2010, the mission of the CFPB is to protect American consumers from unfair, deceptive, and abusive financial practices in the financial services sector. For example, it would ensure that consumers are fully informed when they apply for credit card and mortgages.

Financial Stability Oversight Council (FSOC)

Newly created under the Dodd-Frank Act in 2010, the FSOC is responsible for identifying potential systemic risks that may destabilize financial markets in the United States and recommend ways to respond to potential emerging risks. This is a tall order but it is the first attempt at setting up a bureau to monitor all financial activities in an integrated global economy. As of March 31, 2016, it has labelled 45 institutions as Systemically Important Financial Institutions, or SIFIs. They consist of 33 banks and 12 non-banks.

Federal Financial Institutions Examinations Council (FFIEC)

The Council is an interagency body mandated to prescribe uniform principles, standards, and reporting forms for the federal examination of financial institutions by the Fed, OCC, FDIC, NCUA, CFPB, and the State Liaison Committee (SLC) that consists of representatives from the Conference of State Bank Supervisors (CSBS), the American Council of State Savings Supervisors (ACSSS), and the National Association of State Credit Union Supervisors (NASCUS).

President's Working Group on Capital Markets (PWG)

The PWG was established by Executive Order 12631 after the October 19, 1987 stock market crash (Black Friday) when the Dow Jones industrial Index fell over 500 points. The crisis began in Hong Kong and gradually spread over different exchanges across the globe. The high level group consists of the Secretary of the Treasury, the Chairman of the Fed, the Chairman of the SEC, and the Chairman of the CFTC whose mission is to provide periodic updates to the President of the United States.

Other

It should be noted that there are also state regulators that oversee banking, insurance and securities firms operating in their respective states. At first sight, it appears that there are too many regulatory bodies managing the financial system in the United States. At the same time, it is not clear whether a single

regulator would provide a better regulatory oversight in a large market that makes up nearly 18% of GDP. This discussion will continue in the chapter on regulation.

Balance Sheet and Income Statements

Balance Sheet

The balance sheet and income statement of financial institutions differ from those of traditional manufacturing and service companies in several ways. Unlike manufacturing firms, the balance sheet of financial institutions consists of financial assets and liabilities. In the case of manufacturing companies, the bulk of the assets consist of plant and equipment. Table 1.7 shows a hypothetical balance sheet of a manufacturing firm. Current assets make up half the total assets of which inventory is made up of real goods while the rest are financial assets. The remaining half of total assets is plant and equipment. The right side of the balance sheet is made up of financial liabilities and include accounts payable, long term debt and stockholder's equity. The average debt ratio of U.S. firms is around 30% if market values are used and 47.5% if book values are used.

Table 1.7 - Hypothetical Balance Sheet - Manufacturing Firm

Cash and Marketable Securities	$75	Accounts Payable	$75
Accounts Receivables	$125	Notes Payables	$75
Inventory	$200	Accrued Taxes and Wages	$50
Current Assets	$400	Current Liabilities	$200
		Long Term Debt	$200
Fixed Assets		Stockholder's Equity	
- Plant and Equipment	$700	- Par Value (100 shares x $1)	$100
- less Accumulated Depreciation	$300	- Paid-in-Surplus	$200
Net Plant and Equipment	$400	- Retained Earnings	$150
		Total Stockholder's Equity	$400
Total Assets	$800	Total Liabilities and Stockholder's equity	$800

In contrast, the balance sheet of commercial banks is made up of financial assets and liabilities. Table 1.8 shows the assets consist primarily of loans and are categorized by borrower type – consumer, commercial and mortgages. The liabilities consist mainly of deposits, categorized by maturity – demand, time and savings. In addition, commercial banks issue certificates of deposits (CDs) and long term debt to finance their assets. The two major differences in the balance sheets of manufacturing and commercial banks in Tables 1.7 and 1.8 are:

a. The fixed assets of manufacturing firms consist exceed 50% of total assets. Fixed assets are negligible for commercial banks and usually consist of buildings and hardware.

b. The liabilities of commercial banks make up over 90% of total assets making them highly leveraged institutions while those of manufacturing firms are usually less than 50%.

Table 1.8 is modeled on the balance sheet of a typical commercial bank.

Table 1.8 - Hypothetical Balance Sheet - Commercial Bank				
Cash and Due from Banks	$20		Demand Deposit	$200
Deposit with Banks and marketable securities	$200		Savings Deposits	$75
Federal Funds Sold	$50		Tim Deposits (CDs less than $250,000	$275
			Total Deposits	$550
Loans				
- Consumer Loans	$200		Federal Funds Purchased	$125
- Corporate Loans	$200			
- Mortgage Loans	$300		Debt	
Less Allowance for Loan Losses	-$20		Short-term Debt (CDs above $250,000))	$150
Net Loans	$680		Above $250,000)	
			Long-term Debt (Bonds)	$75
Fixed Assets - Premises and other Non-earning Assets	$50		Stockholder's Equity	$100
Total Assets	$1,000		Total Liabilities and Stockholder's Equity	$1,000

As a reference, Table 1.8A and 1.8B show the assets, liabilities and income statement of Citigroup for December 31, 2105.

Table 1.8A shows total assets of Citigroup totaled $1.73 trillion making it the 15th largest bank in the world by assets in 2015 (source: http://www.relbanks.com/worlds-top-banks/assets). Total Loans made up $617 billion and allowances for loan losses totaled $12 billion leaving net loans at $604 billion. Of the total loans, $329.8 billion were consumer loans and $287.8 billion were corporate loans. Other major items include assets belonging to their trading activities ($250 billion), Investment Assets ($299 billion) and federal funds and repurchase agreements ($220 billion).

On the liability side, Table 1.8B shows that nearly 60% of Citigroup's liabilities were made up of deposits ($907.9 billion). The rest of the liabilities were short-term borrowings ($21 billion), long-term borrowings ($201 billion) and short term federal funds and repurchases agreements ($146 billion). Stockholders equity amounted to $223 billion or about 13% of total assets.

Table 1.8A – CITIGROUP – Consolidated Balance Sheet –December 31, 2015		
CONSOLIDATED BALANCE SHEET	*Citigroup Inc. and Subsidiaries*	
	December 31,	
In millions of dollars	**2015**	2014
Assets		
Cash and due from banks (including segregated cash and other deposits)	**$20,900**	$20,900
Deposits with banks	**112,197**	128,089
Federal funds sold and securities borrowed or purchased under agreements to resell (including $137,964 and $144,191 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**219,675**	242,570
Brokerage receivables	**27,683**	28,419
Trading account assets (including $92,123 and $106,217 pledged to creditors at December 31, 2015 and December 31, 2014, respectively)	**249,956**	296,786
Investments:		
Available for sale (including $10,698 and $13,808 pledged to creditors as of December 31, 2015 and December 31, 2014, respectively)	**299,136**	300,143
Held to maturity (including $3,630 and $2,974 pledged to creditors as of December 31, 2015 and December 31, 2014, respectively)	**36,215**	23,921
Non-marketable equity securities (including $2,088 and $2,758 at fair value as of December 31, 2015 and December 31, 2014, respectively)	**7,604**	9,379
Total investments	**$342,955**	$333,443
Loans:		
Consumer (including $34 and $43 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**329,783**	369,970
Corporate (including $4,971 and $5,858 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**287,834**	274,665
Loans, net of unearned income	**$617,617**	$644,635
Allowance for loan losses	**(12,626)**	(15,994)
Total loans, net	**$604,991**	$628,641
Goodwill	**22,349**	23,592
Intangible assets (other than MSRs)	**3,721**	4,566
Mortgage servicing rights (MSRs)	**1,781**	1,845
Other assets (including $6,121 and $7,762 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**125,002**	122,122
Total assets	**$1,731,210**	$1,842,181

Source: https://www.citigroup.com/citi/investor/data/k15c.pdf?ren=inApp

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Table 1.8B – CITIGROUP – Consolidated Balance Sheet –December 31, 2015

CONSOLIDATED BALANCE SHEET (Continued) *In millions of dollars, except shares and per share amounts*	*Citigroup Inc. and Subsidiaries* December 31, **2015**	2014
Liabilities		
Non-interest-bearing deposits in U.S. offices	**$139,249**	$128,958
Interest-bearing deposits in U.S. offices (including $923 and $994 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**280,234**	284,978
Non-interest-bearing deposits in offices outside the U.S.	**71,577**	70,925
Interest-bearing deposits in offices outside the U.S. (including $667 and $690 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**416,827**	414,471
Total deposits	**$907,887**	$899,332
Federal funds purchased and securities loaned or sold under agreements to repurchase (including $36,843 and $36,725 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**146,496**	173,438
Brokerage payables	**53,722**	52,180
Trading account liabilities	**117,512**	139,036
Short-term borrowings (including $1,207 and $1,496 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**21,079**	58,335
Long-term debt (including $225,293 and $26,180 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**201,275**	223,080
Other liabilities (including $1,624 and $1,776 as of December 31, 2015 and December 31, 2014, respectively, at fair value)	**60,147**	85,084
Total liabilities	**$1,508,118**	$1,630,485
Stockholders' equity		
Preferred stock ($1.00 par value; authorized shares: 30 million), issued shares: **668,720 as of December 31, 2015** and 418,720 as of December 31, 2014, at aggregate liquidation value	**$16,718**	$10,468
Common stock ($0.01 par value; authorized shares: 6 billion), issued shares: **3,099,482,042 as of December 31, 2015** and 3,082,037,568 as of December 31, 2014	**31**	31
Additional paid-in capital	**108,288**	107,979
Retained earnings	**133,841**	117,852
Treasury stock, at cost: **December 31, 2015—146,203,311** shares and December 31, 2014—58,119,993 shares	**(7,677)**	(2,929)
Accumulated other comprehensive income (loss)	**(29,344)**	(23,216)
Total Citigroup stockholders' equity	**$221,857**	$210,185
Noncontrolling interest	**1,235**	1,511
Total equity	**$223,092**	$211,696
Total liabilities and equity	**$1,731,210**	$1,842,181

Source: https://www.citigroup.com/citi/investor/data/k15c.pdf?ren=inApp

Income Statement

Tables 1.9A and 1.9B show the hypothetical income statement of a manufacturing and commercial bank. Gross profits represent the profits generated from sales less manufacturing costs and exclude other operating expenses. In the case of commercial banks, it is equivalent to the net interest margin or the interest earned on loans less the interest paid on deposits. Operating expenses are similar for both industries and include write-offs; uncollectible bills in the case of manufacturing firms and defaults in the case of commercial banks. Banks also set aside provision for future losses, based on the expected probability of default on their loans. In contrast, manufacturing firms write off uncollectible revenue only after they have been incurred.

Table 1.9A - Hypothetical Income statement - Manufacturing Firm (in 000s)			**Table 1.9B Hypothetical Income Statement - Commercial bank (in 000s)**	
Sales	$1,000.00		Interest Income	$1,000.00
Cost of Good Sold	-$300.00		Interest Expense	-$400.00
Gross Profit	$700.00		**Net Interest Revenue**	$600.00
Operating expense			Net fee and other income	$100.00
- Selling expenses	-$100.00		**Total Revenues**	$700.00
- General and Administrative	-$150.00		Operating expense	
- Research and development	-$50.00		General, Administrative, and Marketing	-$300.00
Income from Continuing operations	$400.00		Provision for Loan Losses	-$50.00
Provisions for taxes (40%)	-$160.00		Income from Continuing operations	$350.00
Net income	$240.00		Provisions for taxes (40%)	-$140.00
			Net income	$210.00
# of shares	$100.00		**# of shares**	$100.00
Earnings per share	$2.40		**Earnings per share**	$2.10

Table 1.9C shows the income statement of Citigroup in 2015. Net interest revenue (net interest income minus net interest expense) of Citigroup was $46.6 billion in 2015. As a large multinational diversified bank, non-interest revenue totaled $29.7 billion and includes commissions and fees, insurance premiums and sales of investment assets. Total provisions for credit and other losses was about $7.9 billion while other operating expenses (which included marketing and advertising expenses) was about $43.6 billion, leaving a net income of $17.2 billion.

Table 1.9C - CITIGROUP - Consolidated Statement of Income - December 31, 2015			
CONSOLIDATED STATEMENT OF INCOME	*Citigroup Inc. and Subsidiaries*		
	Years ended December 31,		
In millions of dollars, except per share amounts	**2015**	2014	2013
Revenues[1]			
Interest revenue	**$58,551**	$61,683	$62,970
Interest expense	**11,921**	13,690	16,177
Net interest revenue	**$46,630**	$47,993	$46,793
Commissions and fees	**$11,848**	$13,032	$12,941
Principal transactions	**6,008**	6,698	7,302
Administration and other fiduciary fees	**3,648**	4,013	4,089
Realized gains on sales of investments, net	**682**	570	748
Other-than-temporary impairment losses on investments			
Gross impairment losses	**(265)**	(432)	(633)
Less: Impairments recognized in AOCI	**—**	8	98
Net impairment (losses) recognized in earnings	**$(265)**	$(424)	$(535)
Insurance premiums	**$1,845**	$2,110	$2,280
Other revenue	**5,958**	3,227	3,106
Total non-interest revenues	**$29,724**	$29,226	$29,931
Total revenues, net of interest expense	**$76,354**	$77,219	$76,724
Provisions for credit losses and for benefits and claims			
Provision for loan losses	**$7,108**	$6,828	$7,604
Policyholder benefits and claims	**731**	801	830
Provision (release) for unfunded lending commitments	**74**	(162)	80
Total provisions for credit losses and for benefits and claims	**$7,913**	$7,467	$8,514
Operating expenses[1]			
Compensation and benefits	**$21,769**	$23,959	$23,967
Premises and equipment	**2,878**	3,178	3,165
Technology/communication	**6,581**	6,436	6,136
Advertising and marketing	**1,547**	1,844	1,888
Other operating	**10,840**	19,634	13,252
Total operating expenses	**$43,615**	$55,051	$48,408
Income from continuing operations before income taxes	**$24,826**	$14,701	$19,802
Provision for income taxes	**7,440**	7,197	6,186
Income from continuing operations	**$17,386**	$7,504	$13,616
Discontinued operations			
Income (loss) from discontinued operations	**$(83)**	$10	$(242)
Gain on sale	**—**	—	268
Provision (benefit) for income taxes	**(29)**	12	(244)
Income (loss) from discontinued operations, net of taxes	**$(54)**	$(2)	$270

Net income before attribution of noncontrolling interests	**$17,332**	$7,502	$13,886
Noncontrolling interests	**90**	192	227
Citigroup's net income	**$17,242**	$7,310	$13,659
Basic earnings per share[(2)]			
Income from continuing operations	**$5.43**	$2.21	$4.26
Income (loss) from discontinued operations, net of taxes	**(0.02)**	—	0.09
Net income	**$5.41**	$2.21	$4.35
Weighted average common shares outstanding	**3,004.0**	3,031.6	3,035.8
Diluted earnings per share[(2)]			
Income from continuing operations	**$5.42**	$2.20	$4.25
Income (loss) from discontinued operations, net of taxes	**(0.02)**	—	0.09
Net income	**$5.40**	$2.20	$4.34
Adjusted weighted average common shares outstanding	**3,007.7**	3,037.0	3,041.6

(1) Certain prior-period revenue and expense lines and totals were reclassified to conform to the current period's presentation. See Note 3 to the Consolidated Financial Statements.
(2) Due to rounding, earnings per share on continuing operations and discontinued operations may not sum to earnings per share on net income.

Source: https://www.citigroup.com/citi/investor/data/k15c.pdf?ren=inApp

Summary of the Chapter

1. Financial intermediation, the process of channeling money from savers to users, is undertaken by a variety of financial institutions including commercial banks, investment banks, insurance firms, mutual funds, pension funds and several other specialized financial companies.

2. The financial sector in the United States accounts for 7.2% of gross domestic output in 2015. If we include real estate, rental and leasing, the share increases to 17% of gross domestic product. Commercial banks are the primary institutions that handle the daily transactions among the general population and therefore form the backbone of the financial system in any economy

3. In the 1800s, commercial banking in the U.S. consisted of a large number of small independent banks scattered across the country and regulated primarily by state governments. Attempts to impose a federal central bank failed on two occasions till the creation of the Federal Reserve Board in 1913. A history of conflict between the federal government and individual states in regulating banks explains the large number of banks in the United States, exceeding 15,000 in in the late 1970s.

4. Although the creation of the Federal Reserve Board (Fed) provided uniform regulatory standards across the country, its era is marked by two great failures, the Great Depression in 1929 and the Great Recession in 2008.

5. Three unique features that distinguish commercial banks from other financial institutions are the presence of:

    a. Deposit insurance
    b. Potential conflict of interest between commercial and investment banking activities
    c. Too Big to Fail

6. The balance sheet of commercial banks differs from traditional manufacturing firms in two ways. Commercial banks are highly leveraged with equity representing less than 10% compared to nearly 50% for manufacturing firms. The assets of commercial banks are primarily financial while those of manufacturing plants are fixed assets and inventory.

7. The organizational structure of commercial banks in the U.S. consist of one or more commercial banks owned by a bank holding company (BHC) or a financial holding companies (FHC). The latter is allowed to hold non-banking subsidiaries.

8. The financial sector of the United States is managed by multiple agencies, both at the federal and state level. They include the Federal Reserve Board (Fed), Office of the Comptroller of the Currency (OCC), Securities and Exchange Commission (SEC), Commodities and Futures Trading Commission (CFTC) and the Federal Deposit Insurance Corporation (FDIC).

End of Chapter Questions.

a) Explain how banks have transformed the commercial lending business from asset transformation to brokerage services.

b) Explain how insurance firms, pension funds and mutual funds perform the intermediation function in an economy.

c) How can commercial banking and investment banking result in a conflict of interest?

d) What was the major outcome of the National Currency Act of 1863?

e) What are the key differences between commercial banks in the U.S. and overseas?

f) Explain Too Big to Fail (TBTF). What role did it play in the recent financial crisis?

g) What are the two key differences between the balance sheets of manufacturing and financial firms?

h) Distinguish between a bank holding company and a financial holding company.

i) How would you describe the regulatory structure of the U.S. financial system?

j) Explain the difference between a subsidiary and a branch.

2

Chapter 2 - Introduction to ProBanker

This chapter will introduce ProBanker Simulation, an experiential learning tool to supplement the textbook. The simulation is designed to enhance a student's understanding of managing a financial institution by allowing students to run a bank in a simulated environment. It is firmly grounded in sound financial and microeconomic principles. The simulated environment, although complex and realistic, is sufficiently stylized to be readily understood. It is a web-based program where students, working solo or in teams, input a range of decisions on deposits, loans, bonds, and capital. The inputs include interest rates, advertising expenses, purchases and sales of bonds and certificates of deposits, loan standards and dividends. Once the simulation is run, the results can be reviewed and discussed with the instructor before inputting the decisions for the following quarter.

Setting up your account

The first step in accessing ProBanker is to activate your account. Your instructor will email you registration instructions and supply you a code specific to the course. If you have any trouble registering, please send an email to support@probanker.com. A complete description of the game and explanation of the variables is provided in the student manual available in the Help menu (top right corner).

Create a game

Once your account is activated, it is time to play around with the solo version of a bank tiled "Autosim". As a reminder, the results obtained in Autosim may differ a competitive game for the same set of inputs because demand and supply schedules are affected by the decisions of your competitors. In Autosim, you have only one competitor, the computer.

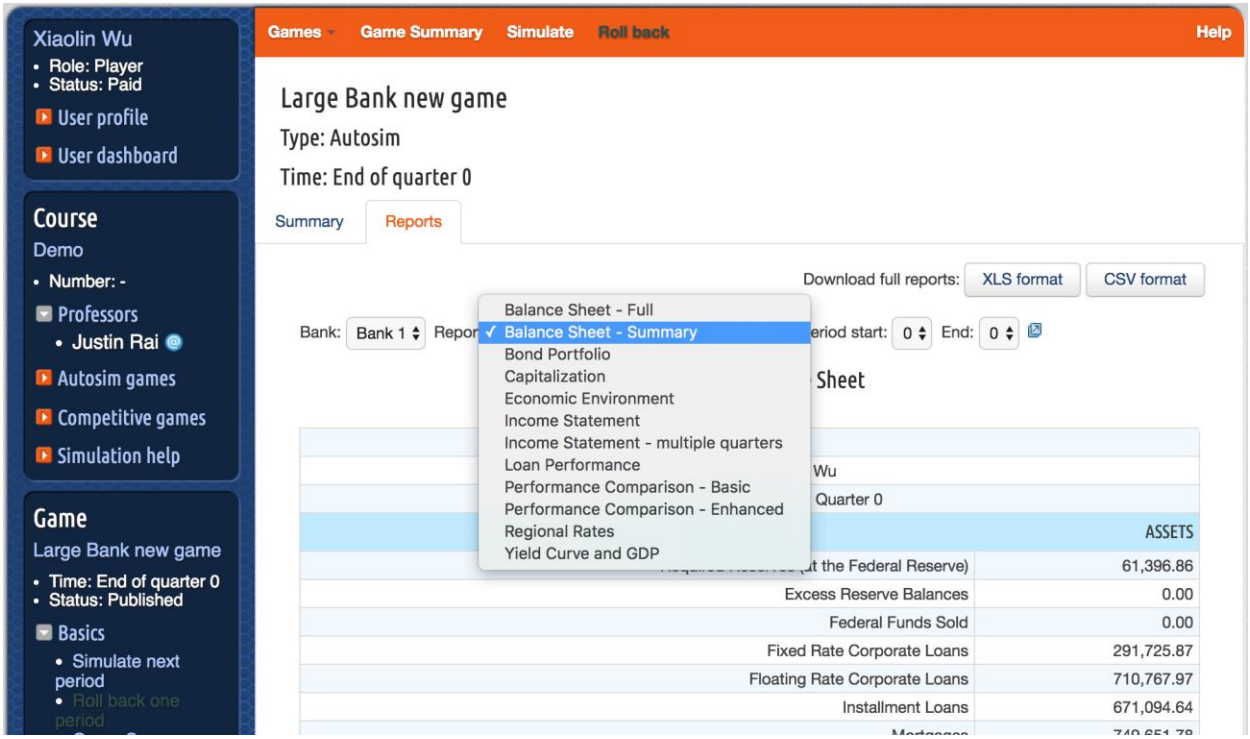
Step 1

1. Create a personal Autosim.
   a. Click on New Games and New Autosim.
   b. Select Sample Large Bank template.
   c. Type your name for the new Autosim under New game's name. Example "John Roger's Autosim."
   d. Click on Create Game.
   e. You can create (and delete) as many Autosims as you wish.

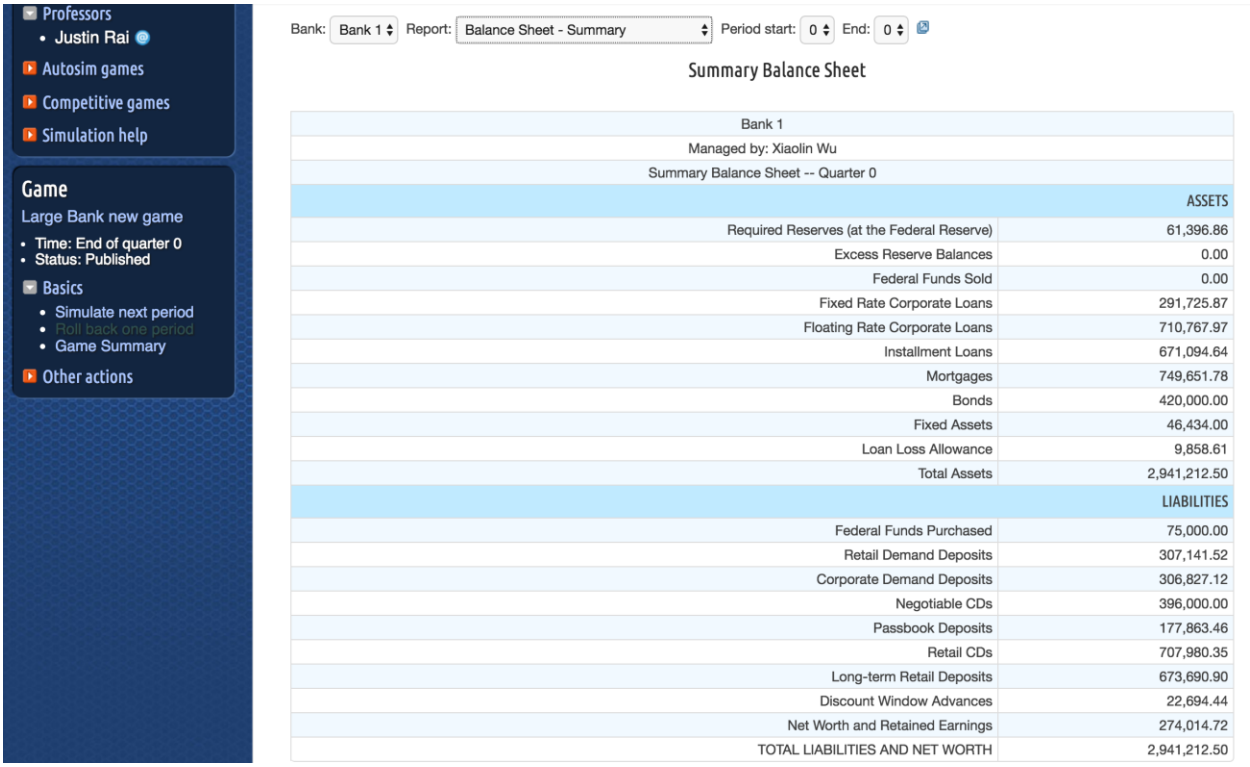
2. To access your newly created game.
   a. Click on the "Courses" on left tab and select your course.
   b. Click on "Games."
   c. Select your newly created game.
   d. Click on "Play Bank."

3. There are two drop-down boxes – 'Decisions" and "Reports"
   a. Click on Reports and the dropdown menu will appear.

b. There are a total of 12 reports available for review after each simulation.
c. Click on the first report “Balance Sheet – Summary.”

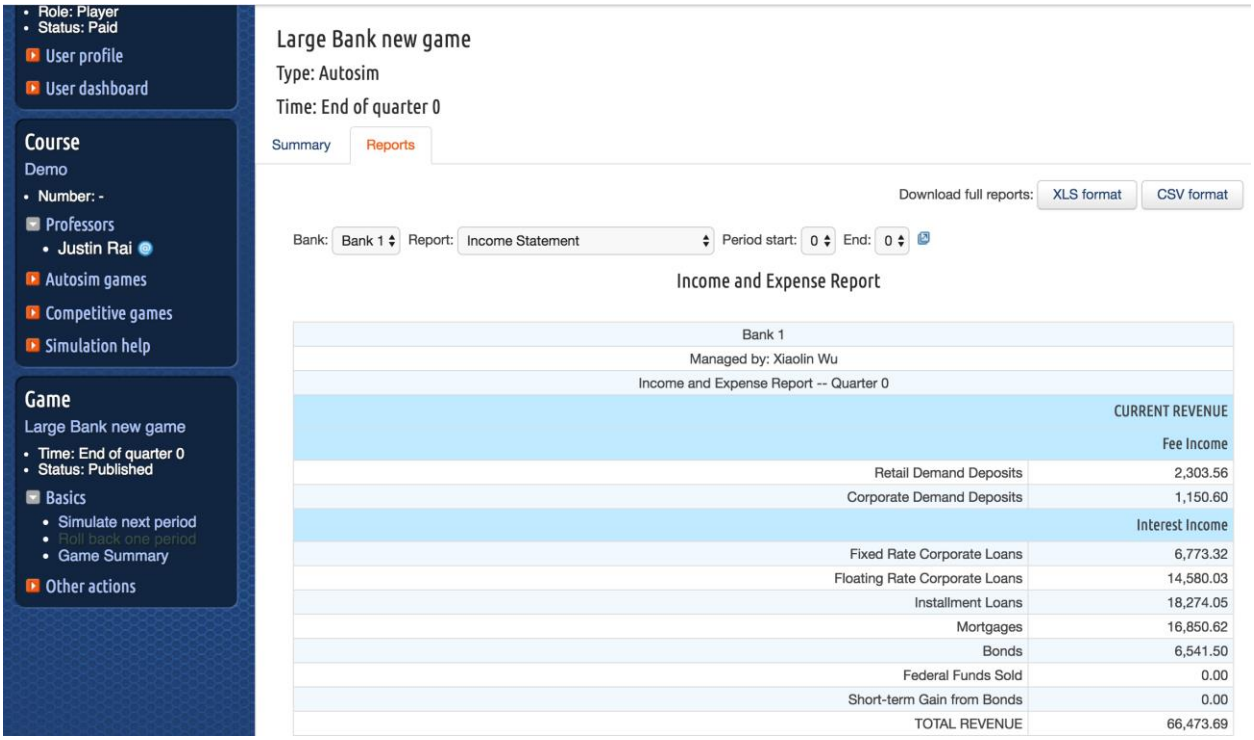


The summary balance sheet is shown below.



The Summary Balance Sheet shows that total assets of the bank are 2.941 billion with fixed-rate loans of $291.7 million and floating-rate loans of $710.8 million. The next figure shows that retail demand deposits amounted to $307.1 million while retail CDs (certificate of deposits) exceeded $707.9 million.

d. Next click on "Income Statement."



The income statement shows the bank generated $66.5 million in revenues with installment loans generating the highest revenues at $18.3 million.

As you progress through the game, it will be important to familiarize yourself with all the reports. The team that pays close attention to the reports usually performs the best in the competitive game.

Basic Model of a Commercial Bank

This section will explain the basic model of a commercial bank. It will highlight the tradeoff between increasing or decreasing the interest rates. The same model is applied in ProBanker except there are several kinds of loans and deposits.

Assume a bank has one type of loan and one type of deposit. With a starting equity and deposit, it funds a loan portfolio. Any funds not loaned is invested in government bonds (G-Bonds). We ignore noninterest operating costs, loan losses, income taxes, or leverage decisions for the moment.

Assets	Liabilities
G-Bonds	Deposit
Loans	**Equity**

The bank has to determine the appropriate loan interest rate. Following a traditional demand schedule, customers are expected to borrow more if loan rates are lower, ceteris paribus. At higher loan rates, each

dollar lent is more profitable, but demand for loans will be lower. If the rates are lowered, each dollar returns only a small profit, but demand for loans are higher.

Deposits also respond to interest rates but in the opposite direction. Offering higher deposit rates generate higher deposits but interest expenses are also higher.

G-Bonds differ from loans and deposits. Rather than setting an interest rate on bonds, the bank only chooses the quantity of bonds to buy. Bonds are available to a bank in a perfectly elastic supply. In other words, bond yields remain fixed no matter the quantity of bonds purchased by the bank. Why do banks purchase G-Bonds? There are two reasons:

1. G-Bonds offset any imbalances between the demand for bank loans and the volume of deposits supplied to them.
2. Banks can reduce the overall risk of their asset portfolio by substituting G-bonds for loans.

Equity is the shareholder's capital. Shareholders paid in some capital when the bank was initially formed (or in conjunction with subsequent "seasoned equity issues"), and the bank has retained some of its earnings. Equity's claim on bank earnings is the residual or profits defined as loan and bond interest income less deposit expenses.

- Revenues = Loan interest income + Interest on G-Bonds
- Expenses = Interest paid on deposits
- Profit = Revenues – Expenses
- Return on Equity (ROE) = Profit / Equity

Management is expected to provide a reasonable (risk-adjusted) return on shareholders' equity.

Setting loan and deposit rates

Managers affect profits by choosing the appropriate interest rates on the loan and the deposit. We illustrate the main idea by considering two alternative decision sets.

- Decision Set "A"
- Loan rate: If R_L = 10% then customers will demand $80 of loans.
  Deposit rate: If R_D = 6% then customers will supply $105 of deposits.
- Decision Set "B"
- Loan rate: If R_L = 8% then customers will demand $130 of loans.
  Deposit rate: If R_D = 7% then customers will supply $145 of deposits.

Assume that the bank has equity of $25. The bank's balance sheet will depend on the decisions it makes.

If Bank Choses Decision 'A"	If Bank Chooses Decision Set "B"
Loans = $80 Deposits = $105 **G-Bonds= $50 Equity = $25** **(Residual)**	**Loans = $130 Deposits = $145** **G-Bonds = $40 Equity = $25** **(Residual)**

In each balance sheet, the government bond portfolio serves as the "plug" account: any available funds that are not used for customer loans will be invested in a portfolio of G-Bonds. If the government bond rate is 5%, here are the two banks' annual income statements.

	If Bank Choses Decision 'A"		If Bank Chooses Decision Set "B"
Interest Revenue			
From Loans	($80)(10%) = $8.00		($130)(8%) = $10.40
From Bonds	($50)(5%) = $2.50		($40)(5%) = $2.00
Interest Expense			
On Deposits	($105)(6%) = $6.30		($145)(7%) = $10.15
Profit	= $4.20		= $2.25
ROE	= 16.8%		= 9.00%

Which of these decisions (Set "A" or Set "B") makes the shareholders better off? In other words, which Decision Set provides the higher ROE?

It seems clear that shareholders would prefer the bank's managers to choose Decision Set "A". This makes their bank smaller, but more profitable.

Comparing these two alternative decision sets illustrates some general issues.

- Higher loan rates attract fewer borrowers.
- Higher deposit rates attract more savers.
- Government Bond portfolio adjusts to accommodate the bank's preferred level of loans and deposits.

Operating Costs

In addition to interest earnings and interest expenses, a real bank's income statement has operating costs, or "noninterest expenses." For example:

- Banks pay loan officers to make and monitor loans.
- Banks provide depositors with services in addition to paying explicit interest.
- Buying and selling government bonds generates transaction (brokerage) costs.

Let's approximate operating cost as a constant proportion of the associated dollar balances. Suppose

- Loans cost 0.5% per year to originate and maintain.
- Deposits cost 0.25% per year to originate and maintain.
- Government bonds cost 0.1% to maintain.

Further assume that the bank continues to set the same loan and deposit rates, even though this would probably not be optimal. The previous income statement is now revised to include "Noninterest Expense" as shown below.

If Bank Chooses Decision Set "A"	
Interest Revenue	
From Loans	($80)(10%) = $8.00
From Bonds	($50)(5%) = $2.50
Interest Expense	
On Deposits	($105)(6%) = $6.30
Noninterest Expense	
Account Costs	($80)(0.5%) + ($105)(0.25%) + ($50)(0.1%) = $0.7125
Profit	=$3.4875
ROE	0.1395 or 13.95%

Summary of the Chapter

A bank earns two forms of income from its assets.

1. Interest Income from loans
2. Non-interest fee income (to be discussed later)

A bank incurs two forms of expenses

1. Interest expenses on deposits
2. Non-interest costs that include operating costs

The next chapter will elaborate further on assets, liabilities, interest income and expenses.

3

Ch. 3 – Assets and Liabilities of Commercial Banks

Introduction

This chapter discusses the various assets and liabilities of a commercial bank and the measurements of performance of financial institutions. Chapter 1 highlighted briefly the differences in the balance sheet and income statement of manufacturing and financial firms. Financial institutions generate revenue primarily from financial securities while manufacturing firms generate revenue from real (hard) assets. In the case of a commercial bank, the major source of revenue is the *net interest margin* (NIM), defined as interest income less interest expense. The second major source is *non-interest fee income,* defined as non-interest income less non-interest expense. The effective management of net interest margin and net non-interest income is essential to the successful growth of a commercial bank.

The chapter begins with an examination of the various assets and liabilities of a typical commercial bank and the income and expenses generated by them, which together determine the overall performance of the financial institution.

Assets and Liabilities of a Commercial bank

Assets

Table 2.1 shows the major assets of a hypothetical commercial bank. They comprise of cash, short- and long-term loans, and fixed assets.

Cash and Due from Banks are liquid assets kept by the bank for normal operating purposes and to satisfy regulatory reserve requirements. They consist of the following:

1. **Cash in vault:** Banks experience continuous deposits and withdrawals every day in their branches and automated teller machines (ATMs). Banks have to maintain sufficient cash (liquidity) to meet routine as well as large and unexpected withdrawals.
2. **Deposits with other banks:** Banks maintain accounts with correspondent banks to service the transaction needs of their clients. A correspondent banking relationship is preferred when the business needs of their clients do not justify opening an office in that location. Large banks maintain correspondent relations with banks throughout the world. Small banks will approach the large banks if they need to send or receive payments from overseas.
3. **Deposits with the Federal Reserve Bank (Fed):** All banks have an account with the Fed for transaction purposes and to meet minimum reserve requirements for demand deposits (to be elaborated in Chapter 4). They also hold excess reserves with the Fed if they are unable to lend any surplus money at the end of the day in the interbank market, discussed next.

Table 3.1

Total Assets of a Hypothetical Bank (in 000's)		
		Amount
Cash and Cash Due		$45,000
Federal Funds Sold		$55,000
Loans, held for Investment		
Consumer Loans		$95,000
- Individual Loans	$40,000	
- Auto Loans	$35,000	
- Credit Cards	$30,000	
Commercial and Industrial Loans		$120,000
- Commercial	$62,600	
- Trade	$64,400	
Real Estate Loans		$128,000
- Residential Mortgages	$53,000	
- Commercial Mortgages	$41,000	
- Construction	$38,000	
Loans, held for Sale		$12,000
- Student Loans	$12,000	
Total Gross Loans		$455,000
Allowance for Loan Losses		($5,000)
Loans, Net		$450,000
Fixed Assets (Premises) and other non-earning assets		$50,000
Total Assets		$500,000

Federal Funds (commonly referred to as Fed Funds) are loans between banks in the U.S., usually lent overnight but can have maturities extending up to 30 days. The name is a misnomer in that neither the federal government nor the Federal Reserve is involved in the intermediation process; the name evolved primarily because private banks loaned their excess reserves held at the Federal Reserve Bank to each other.

If a bank at the end of the day estimates that it may be short of funds, it has the option of borrowing from the Federal Reserve discount window or from other banks. Borrowing from the Federal Reserve usually entails the risk of coming under their radar and banks often avoid approaching the discount window. Banks instead prefer to borrow from other banks directly or through brokers. The process today is fully automated and trades are performed over the Fedwire (a payment system of the Federal Reserve Board). Federal Funds sold indicates the bank is a lender while Federal Funds purchased indicates it is a borrower.

Fed funds trading began as early as 1921 when banks loaned their excess reserves held at the Federal Reserve Bank of New York to other banks short of funds. The volume of lending has grown steadily ever since and today fed funds form an integral component in the liquidity management of a bank. Small banks around the country are generally net lenders while large banks are usually net borrowers. Some large banks make a market buying and selling Fed Funds and hence their balance sheet will show both federal

funds purchased and sold, as shown in Citigroup's balance sheet in Chapter 1. Since Fed Funds are unsecured, the rates are slightly above the Treasury bill rates. Most Fed Funds are loaned for 24 hours from the settlement time and are referred as "regular returns". Banks also borrow in the evening and return them in the morning. These are termed "early returns" and cost a few basis points cheaper.

Major types of Loans

Table 2.1 show two broad categories of loans.

Loans, Held for Investment are held by the bank till maturity and the principal is fully repaid. These loans provide a steady source of interest income and are profitable as long as the bank manages to keep its funding costs low. For accounting purpose, **loans held for investment** can be reported at amortized value (book value)

Loans, Held for Sale are slated for resale, either for securitization (where loans are bundled and sold to investors in Wall Street) or sold directly to investor groups such as hedge funds. Once the packaged loans are sold, the bank reuses the money to make additional loans. They have to be reported at the lower of the fair market value or the amortized cost (book value).

From the above two categories, loans can be broken down by type of borrower, of which the three major types are consumer, commercial and real estate.

Consumer loans can be broken down into two categories, non-revolving and revolving.

Non-revolving (or installment loans) have fixed maturity and payments. Once a loan is approved, any additional borrowing requires a new loan to be negotiated. Consumer loans used to acquire durable assets such as automobiles, boats and mobile homes are secured by the purchased assets. Loans other than for purchases of durable assets are usually unsecured and include student and individual loans. Although unsecured, these loans may be secured by third party guarantees that promise to pay the loans in the event the primary borrower defaults.

Interest rates on installment payments may be fixed or floating**.** The distinction is a follows:

Fixed Rate loans require the borrower to only pay interest that is fixed for the life of the loan. The periodic payments may differ based on the terms of the loan. If a loan is non-amortizing, only interest is paid each period and the principal paid at maturity. For an amortizing loan, payments are the same for each period consisting of both interest and principal payments.

An example is shown below for a 5-year 1,000 loan with annual payments at a fixed rate of 8%.

	0	1	2	3	4	5
Non-Amortizing	-1,000	$80	$80	$80	$80	$1080

	0	1	2	3	4	5	
Amortizing	-1,000	$250.46	$250.46	$250.46	$250.46	250.46	-

The amortized loan payments are estimated as follows:

$$PMT = \frac{PV}{\frac{[1-(1+r)^{-t}]}{r}}$$

Using a calculator, PV=-1000, I/YR=8, 5=N, Compute PMT = 250.46.

In a fixed-rate loan, the lender bears the risk of interest rate changes. If interest rates increase, the cost of borrowing may increase and reduce net interest income. One the other hand, if interest rates decline, the lender will benefit from the cheaper cost of borrowing.

Variable (Floating) Rate loans require the borrower to pay interest based on a benchmark rate plus a risk premium. If the benchmark rate increases, the borrower pays more and if it decreases, pays less. The risk premium will depend on several factors and is primarily based on the borrower's ability to pay. The benchmark rate can be the 1-year U.S. Treasury bill rate or a global rate benchmark such as the Libor (London interbank offer rate). With variable rates, the borrower bears the risk of interest rate changes.

The example below shows a five-year non-amortizing $1,000 loan with variable interest rate set at Libor + 2% risk premium. The interest rate is reset every year. Interest payments are made at the end of the year based on the benchmark rate at the beginning of the year. For this example, we assume Libor rates were 5% in year 0 (beginning of year 1), 6% in year 1 (beginning of year 2) and 7% in year 2, 3, and 4. The payments will be as follows:

	0	1	2	3	4	5
Non-Amortizing	-1,000	$70	$80	$90	$90	$1090

ADD-ON Interest

For some loans, interest is often charged as add-on interest. This practice was pervasive in several sectors, especially the durable goods sector, but has declined over the years as larger retailers began to offer financing through retail credit card companies. However, they are still used in the sued car sector as well as by small finance companies. It should be noted that add-on and effective interest rates are different. Effective interest rates are higher and if they are not reported to the borrower, it can be considerd as predatory pricing. An example is shown below.

Assume you purchase a car for $21,000 at an interest rate of 5.99% for 3 years. What are the 36 monthly payments?

Interest per year = $21,000 x .0599 =$1,257.90
Interest for 3 years = $1,257.90 x 3 = $3,773.70

Total payment = $21,000 + $3,773.70 =$24,773.70
Monthly payments= $24,773.70/36 = $688.16 (688.15833 to be precise)

What is the effective interest rate?

$\$21{,}000 = \$688.16 * \frac{(1-(1+r)^{-36}}{r}$ and solve for r.
Using your calculator: -21000=PV, 36=N, 0=FV, 688.15833=PMT, CPT PV.

The effective interest rate is .922072 x 12 = 11.06%

As can be seen, the add-on and effective interest rates can be quite far apart.

ADD-ON Charges

Another kind of add-on charge is the interest added in the purchases of new cars by automotive dealers that provide financing to customers. When purchasing a new car, customers have the choices of financing, direct financing by commercial banks and credit unions, captive dealer financing and indirect dealer financing. Among the three, indirect dealer financing adds on additional interest to the loans obtained from banks. As a result, their activities have come under the scrutiny of the Consumer Financial Protection Bureau (CFPB), a new watchdog created under the Dodd-Frank Act of 2010 to protect consumers against financial fraud. The three forms of financing are listed below:

Commercial banks and credit unions:

Car purchasers can obtain loans directly from their banks or credit unions. They usually have their loan approved by the bank and then they shop for the preferred car. The full payment for the car is made to the dealer and the customer repays the loan to the bank directly.

Captive finance companies.

Several car companies have their own financing subsidiaries. They include General Motors, Honda Financial Services, BMW Financial Services. The captive finance companies make loans to the car purchaser and serves just like a commercial bank.

Indirect financing

Most dealerships offer financing through arrangements with several bank and credit unions. The agreement usually allows dealers to add-on interest to the rates provided by the banks. For example, a bank may offer to lend money for particular risk class of customers at 4.99%. A dealer may add 2% to the rate and charge the customer 6.99%.

Assume a customer purchases a car for $20,000 and is eligible for the 4.99% loan. If the terms if the loan are for 48 months, the monthly payment will be:

-20,000 PV, 48=N, 4.99/12=0.4158=I/YR, 0=FV. Cpt PMT = $460.50 per month.

However, with the add-on 2%, the monthly payment will be:

-20,000 PV, 48=N, 6.99/12=0.5825=I/YR, 0=FV. Cpt PMT = $478.83 per month.

The CFPB has cracked down on a number of cases involving add on interest by dealer, as shown in the article below.

CFPB orders Fifth Third to pay $18 million for auto loan discrimination; cap dealer reserve at 1.25%

Automotive News: UPDATED: 9/28/15 5:15 pm ET

Fifth Third Bancorp reached an $18 million settlement with the Consumer Financial Protection Bureau and U.S. Department of Justice to resolve charges that it discriminated against African American and Hispanic borrowers, the CFPB said Monday.

The bureau's enforcement action calls for Fifth Third to:

• Pay $12 million into a settlement fund that will be distributed to potentially harmed African-American and Hispanic borrowers whose auto loans were financed by Fifth Third between January 2010 and September 2015. "Fifth Third will receive credit of between $5 million and $6 million for remediation it has already provided to harmed consumers whose auto loans were financed by Fifth Third from January 2010 through June 2015," a CFPB statement said. "Fifth Third will then pay any additional funds necessary into the settlement fund to bring its total payment to harmed consumers to $18 million."

• Pay to hire a settlement administrator to distribute the funds to affected customers.

• Limit dealer reserve -- the percentage of interest a dealership is allowed to add to an auto loan as a fee for arranging the loan -- to 1.25 percentage points above the lender's wholesale buy rate for loans of 60 months or fewer and to 1 percentage point for loans with terms longer than 60 months. Fifth Third also has the option to offer dealers nondiscretionary compensation, the statement said. The CFPB said the bank had allowed dealers to add as much as 2.5 percent to consumers' interest rates.

Fifth Third, based in Cincinnati, issued its own statement today, saying: "When considering whether to purchase a contract from a dealer, Fifth Third does not receive or consider any information about a consumer's race or ethnicity. Fifth Third takes the assertions by the CFPB and DOJ very seriously and has agreed to the terms in the orders, which include changing its dealer compensation policy and reimbursing impacted customers in the amount of $18 million. In entering into these settlements, Fifth Third is not paying any civil penalties."

An investigation by the CFPB and the Department of Justice evaluated Fifth Third's indirect auto-lending program for compliance under the Equal Credit Opportunity Act. The agencies said that minority borrowers -- African American and Hispanic borrowers -- paid higher interest rates on auto loans than other similarly situated borrowers. From January 2010 through September 2015, thousands of minority borrowers were charged on average $200 more for their auto loans than non-Hispanic white borrowers, the CFPB said.

Fifth Third is the second auto lender to limit dealer reserve as the result of a CFPB enforcement action. In July, American Honda Finance Corp. agreed to cap dealer reserve at 1.25 percent for loans lasting 60 months or fewer and at 1 percent for loans longer than 60 months. As part of the settlement, Honda agreed to pay $24 million to potentially affected consumers.

In December 2013, Ally Financial settled with the CFPB without limiting dealer reserve. Ally paid $98 million -- $80 million in consumer compensation and $18 million in penalties -- under a consent agreement with the CFPB and Justice Department. The settlement administrator began contacting potentially affected customers to distribute their funds in July.

Fifth Third also reached a separate $3.5 million settlement with the CFPB, including a $500,000 civil penalty, for what the CFPB described as deceptive marketing of credit card add-on products.

You can reach Hannah Lutz at hlutz@crain.com

Revolving loans are lines of credit made available to consumers that can be drawn down on demand. They can be in the form of credit cards or lines of credit tied to the checking account. Credit cards specify a maximum amount that can be borrowed on demand. Minimum payments are required each month but the borrower can continue to borrow as long as the total outstanding is within their approved limits. Lines of credit work in a similar fashion. Customers can draw down funds at their discretion up to the maximum limit and repay in installments over time. The only difference is that banks may charge a small fee for the unused portion of the credit limit.

Total consumer loans in the U.S. amounted to $3.59 trillion in March 2016 with non-revolving loans accounting for $2.64 trillion and revolving loans for $951.6 billion.[9]

There were over 424.35 million credit cards held by individuals in 2015. The average number of credit cards held by an individual approached two in 2015. Business loans in the U.S. by commercial banks totaled $2.04 trillion in April 2016 and formed an important source of credit for small and medium size firms. The default rates are usually higher than consumer loans, and as a result incur higher interest rates than consumer loans. Although riskier, the high interest rates generate large profits to commercial banks.

Commercial Loans

Commercial loans, also referred to as business loans or commercial and industrial (C&I) loans, are made to commercial entities that include proprietorships, partnerships and corporations for use in managing their business such as inventory financing, working capital management, purchase of equipment and other assets. They also include loans to individuals as long as they are used for business purposes and not for personal expenditures or investments.

Commercial loans cover a range of industries from retail to manufacturing. They do not include loans for agricultural production, financial institutions or those secured by real estate.

Commercial loans in the U.S. by commercial banks totaled $2.04 trillion in April 2016 and form an important source of credit for small and medium size firms.[10]

Real Estate Loans

In April 2016, real estate loans ($3.95 trillion) made up 44.8% of the total loan portfolio of U.S. commercial banks, of which 53.3% were in residential real estate loans ($2.1 trillion), the rest in commercial real estate loans.[11] In general, real estate loans of most banks can make up a substantial part of their loan portfolio. All real estate loans are backed by land and buildings and therefore are considered less risky than unsecured commercial or consumer loans. However, the real estate market can be volatile and during recessionary periods, may result in substantial foreclosures and defaults.

Residential Real Estate Loans are primarily mortgages based on one- to four- family or multifamily housing. Multifamily is defined as a residential property composed of five or more dwelling units and in which no more than 20 percent of the net rentable area is rented to, or to be rented to non-residential tenants. Most residential mortgages have long maturities, 30-year mortgages are common, and are financed with down payments of 20% or more, i.e., loan to value (LTV) ratio of less than 80%. Borrowers

[9] http://www.federalreserve.gov/releases/g19/current/

[10] FRED Economic Data, Federal Reserve Bank of St. Louis.

[11] https://www.federalreserve.gov/releases/h8/current/#fn1

may put down less than 20% if they are insured, either by selected agencies of the government like the Veterans Affairs (VA) and the Federal Housing Agency (FHA) or through private mortgage insurance (PMI).

Commercial Real Estate Loans are loans that are collateralized by real estate to primarily five sectors, retail, industrial, hospitality and residential (loans made for construction of residential property). They are usually income producing, such as rental apartments, but can also be non-income producing, such as land. Loans are also specialized within the five sectors, and can differ based on business type and payment features. For example, within the retail sector, commercial loans vary based on whether they are large retail malls, strip centers without a major grocery chain, neighborhood shopping centers, and high-end specialty etc.

Construction Loans are loans for construction of property including the infrastructure to support the property of development. Construction loans can be risky because its success depends on the different stages of the project. A typical lending schedule includes financing the acquisition of land, development of the land for construction, and finally the construction of the property. All phases carry the risk of delays which can extend the maturity of the loan beyond the stated maturity.

Student Loans

Table 2.1 list student loans under Loans for Resale. They are consumer loans provided to students, usually guaranteed by the parents or legal guardians. Total student loan outstanding was $1.26 trillion in March 2016.[12] There are two kinds of student loans, federal government loans and private loans. The Federal government provides two kinds of loans, direct and Perkin loans. Both loans together are usually insufficient to cover the total costs of attending college. Private loans make up the remaining and are provided mostly by commercial banks. The interest rates are usually higher with maturities of five, ten and 15 years. Interest and principal payments can be deferred to six months after graduation. Banks justify the high student loan rates on the high default rates. In 2016, the 90 days or more delinquent rate on student loans was 11.0%, much higher than credit cards at 2.15% and auto loans at 3.5%. [13]

Allowance of Loan Losses

Banks set aside reserves for potential losses on their loans every quarter. They have to ensure that they have sufficient reserves if they have to write off (charge-off) a defaulted loan. Determining the amount of potential losses can be difficult as it requires banks to monitor and forecast the financial condition of their borrowers regularly. Once the expected losses are estimated, they will be deducted from current income and added to **Allowance for Loan and Lease loss (ALLL)** as a contra account in the balance sheet. Net loans are defined as total gross loans less allowances for loan losses, as shown earlier in Table 2.1.

The amount added to ALLL is deducted from current net income and is termed **Provision for Loan and Lease Losses**. The amount is determined by management based on their expectations on the credit conditions of their clients which can be influenced the general economic conditions in the industry sector as well as the general economy. If a bank misprices its loans, it will experience above-average defaults and exceed its expected losses. If a loan stops paying interest for 90 days, a bank has to report it as impaired. Under IFRS 9 to be implemented in 2018, a bank does have to wait till a loan is delinquent before

[12] Quarterly Report on Household Debt and Credit, Federal Reserve Bank of New York, February 2014.

[13] https://www.federalreserve.gov/releases/chargeoff/delallsa.htm

classifying it as impaired. It can also make periodic review of its loans to determine if any will be impaired in the future. They need to take into account the following factors in reviewing loans:

1. Adverse Classifications
2. Nonaccrual Loans
3. Past Due Loans
4. Charge-off History
5. Loan Concentration Levels
6. Relevant Economic Factors

Hence loan losses allowances impact both the income statement and the balance sheet.

Example: Allowance for loan and Lease Losses (ALLL)

A review of a bank's loan performance over the last five years shows that the average loan losses is 1.64% for its auto loans and 3.61% for its consumer loans. The bank currently has auto loans of $1,000,000 and $4,000,000 of consumer loans.

a) If the bank determines that the optimal rates for its auto and consumer loans are 6% and 8%, respectively, what rates should it charge to compensate for its expected losses?
Answer: The bank should charge 6.10% = [6 / (1 - .0164)] for auto loans and 8.30% = [8/ (1 - .0361)].

b) What amount of reserves should it add to its Allowance for Loan and Lease Losses to cover its expected losses for the year?
Answer: It should set aside a total of $160,800 = $16,400 (.0164 x $1,000,000) + $144,400 (.0361 x $4,000,000).

c) Assume the Allowance for Loan and Lease Losses at the beginning of the year is $465,600? The bank adds $160,800 as Provisions to Loan and Lease Losses. At the end of the year, its expected losses are lower and the bank records a charge-off of only $105,000. What is the new Allowances for Loan and Lease Losses in the balance sheet?
Answer: $521,400 = $465,600 + $160,800 - $105,000

The ALLL is an estimate and will never be precise but it has to be the best estimate evaluated by management. Two accounting principles serve as a guide to the methodology and estimation of ALLL.

1. ASC 310 (FAS 114)
2. ASC 450 (FAS 5)

ASC 310 is used to estimate losses on individual loans whenever the proportion of losses are clearly identifiable. ASC 450 covers the rest of the loans where some general criteria is established.

There are three methods to determine the status of a loan.

1. Present value of the expected future cash flows method.
2. Fair value of the collateral method.
3. Observable market price of the loan (very difficult).

The goal of a bank is to estimate ALLL as close as possible to the realized losses every quarter. As losses are incurred, they will be charged off, while ensuring sufficient balances are available to absorb future expected and unanticipated losses. If banks underestimate the losses, they may have to resort to emergency funding from the government through the discount window. In addition, the announcement of larger than estimated loan losses usually impacts the stock price of banks negatively.

Net Fixed Assets

The fixed assets of banks are usually limited to the office premises of its headquarters and its branches, furniture and equipment. Net fixed assets are reported as gross fixed assets less depreciation. If banks choose to lease most of their assets, their fixed assets can be negligible and total assets will be composed primarily of financial assets.

Liabilities

The bulk of bank liabilities are in the form of deposits followed by debt and equity capital. Commercial banks are unique in that they are highly leveraged and have equity as low as 5% of total assets.

Table 3.2		
Total Liabilities and Stockholder's Equity - Hypothetical Bank (in 000's)		
		Amount
Demand Deposits		$90,000.00
NOW accounts		$130,000.00
Saving Accounts		$ 50,000.00
Time Deposits (CDs)		$130,000.00
- Below 100,000	$80,000.00	
- Above 100,000	$50,000.00	
Short Term Borrowings		$30,000.00
- Federal Funds Purchased	$15,000.00	
- Repurchase Agreements	$15,000.00	
Long Term Borrowing		$45,000.00
- Subordinated debt		
- Loan from Government (FHLB)		
Shareholder's Equity		$25,000.00
- Common Stock	$1,000.00	
- Additional Paid in Capital	$15,000.00	
- Retained Earnings	$9,000.00	
Total Liabilities and Stockholder's Equity		$500,000.00

In comparison, if a manufacturing firm has debt exceeding 50% of total assets, it would be considered risky from the perspective of bondholders and stockholders. Commercial banks are able to maintain high leverage ratios because of the deposit insurance provided by most central banks. In the U.S., the Federal Deposit Insurance Corporation (FDIC) insures up to $250,000 of deposits per individual. A simplified balance sheet of a mid-size commercial bank is shown in Table 3.2.

We begin with a description of transaction accounts, defined as deposit accounts that allow depositors to make withdrawals upon demand. Withdrawals include payments or transfers via checks, debit cards, automated teller machines (ATMs), or any electronic devices including telephones and online. Demand deposits and NOW (negotiable order of deposit) accounts are the two main transaction accounts of commercial banks.

Demand deposits

Demand deposits (DD) are accounts held by customers for transaction activities that can be withdrawn at any time without restrictions. The main features of DD accounts are:

a) No maturity
b) Payable on demand (unless the check or payment is still in process)
c) May be interest-bearing
d) No limits on the number of withdrawals or transfers

Since demand deposits are payable on demand, they are subject to bank runs. Most central banks require banks to set aside reserve requirements against demand deposits (to be described in chapter 4).

NOW Accounts

NOW (negotiable order of withdrawal) accounts are similar to demand deposits except for two differences.

a) The bank has the right to demand a 7-day notice for any withdrawal, although they are rarely enforced.
b) NOW accounts are available only for individuals, governmental units, and nonprofit organizations but not for corporations.

Savings Account

Saving accounts are interest bearing deposits and similar to NOW accounts in that banks have to impose a minimum of seven days' advance written notice for an intended withdrawal. However, it differs from NOW accounts in that banks limit a maximum of six "convenient" withdrawals per month. The definition of "convenient" includes transfer from savings to checking accounts, pre-authorized transfer and telephone transfers. However, withdrawals from ATM machines or transfers made at branches can be excluded since they are not deemed "convenient." If an individual violates the minimum convenient withdrawals, the account will be reclassified as a NOW account; if a business violates the rule, it will be reclassified as demand deposits since businesses cannot own NOW accounts.

Time Deposits

Time deposits have fixed maturities and pay interest. They require a minimum maturity of seven days from the date of deposit termed "reservation of right." Any withdrawals before will be subject to penalties that includes a minimum of six days of simple interest payments. Individual or corporations are allowed to hold time deposits.

The other features of time deposits may include:

a) requirement of least seven days' prior written notice of intent to withdraw funds
b) payments of interest greater than savings account.
c) accounts can be negotiable or nonnegotiable, transferable or nontransferable certificate, instrument, passbook, book entry, or other similar instrument.
d) club accounts (such as Christmas club or vacation club accounts).

Time deposits usually pay higher interests than savings and NOW accounts. In addition, the longer the maturity, the higher the interest rates.

Certificates of Deposit (CDs)

CDs are short-term, fixed-maturity debt issued by commercial banks and is the most popular form of time deposits. They are insured by the FDIC up to a maximum of $250,000, providing small investors protection against the likelihood of a bank failure. In addition, the rates offered are higher than those of savings deposits. The maturities can range from three months to ten years.

Interest on a CD is calculated on the face value and is payable upon maturity. In most cases, investors tend to let the interest compound over time to receive a higher yield at maturity. Two interest rates are reported, nominal and the average percentage yield (APY); the latter includes the compounding of interest on interest.

An example of CD offerings by PenFed Bank is provided below. Some conditions on their offerings include:

- Interest (or dividends) is compounded daily and is paid monthly. The nominal rate is 1.10% and the APY is 1.11%. It is estimated as follows:

  APY= $(1+ r/m)^t - 1.0$
  Where m= number of sub-periods, t= maturity, and r = nominal rate.
  APY=$(1+ .011/360)^{360} -1.0=0.0111$ or 1.11%

  Alternatively, you can compute the APY in your calculator by inputting -$1=PV, 0=PMT, 1.10/360=I/Y, 360=N, and solve for or compute FV. The result is 1.01106 or 1.11%. Calculators with effective interest rate will input 1.10= NOM%, 360=N and solve for EFF% to get 1.106 or 1.11%.

- The higher the compounding (number of sub-periods), the higher the APR.
- Six-month CDs are subject to simple interest. In other words, if the nominal rate is 1%, they will receive exactly one-sixth of 1/2% every month.
- Since CDs are time deposits, they are subject to a penalty for early withdrawal. In the case of CDs with maturities between six months and four years, approximately 180 days of interest will be forfeited.
- They are insured up to the maximum of $250,000 under the current limits of the FDIC.

Example: CD rates and conditions offered by PenFed, May 2016.		
Term	Dividend Rate	APY
6 Month	0.60%	0.60%**
1-Year	1.10%	1.11%
2-Year	1.30%	1.31%
3-Year	1.30%	1.31%
4-Year	1.30%	1.31%
5-Year	1.40%	1.41%
7-Year	1.40%	1.41%
Benefits		
Dividends are compounded daily and paid monthly for maximum returns.		
Savings federally insured to at least $250,000 and backed by the full faith and credit of the United States Government. Automatic renewals available.		
We will establish your certificate on the day we receive your application and funding. Once purchased, the rate is locked in for the term of your certificate.		
****6 Month certificates earn dividends on simple interest basis. All other certificate dividends are compounded daily. Choose your dividends: monthly or maturity.**		
Three payment options		
1. Add dividends to certificate. 2. Have dividend sent to you in check form.		
3. Transfer dividends to Regular Share, checking, or Money Market Savings Account).		
Early Redemption Penalties		
Penalties are imposed for early withdrawal of money market share certificates. This will reduce earnings on the account. You must provide your request in writing.		
6-month Money Market Certificates: If redeemed within 90 days of the issue date or any renewal date, all dividends will be forfeited. If redeemed thereafter, but before the maturity date, dividends for the most recent 90 days will be forfeited.		
Certificates having a term greater than 6 months up to and including 4 years; If redeemed thereafter, but before the maturity date, dividends for the most recent 180 days will be forfeited.		

Negotiable versus Non-negotiable CDs

CDs are fixed-maturity debt, meaning that the holder of the CD cannot redeem the CD for cash from the issuer prior to maturity. As a result, retail CDs are considered non-negotiable. Without a secondary market, investors must typically hold non-negotiable CDs until they mature. The CDs offered by most banks to retail investors are non-negotiable.

However, another class of CDs exist that are negotiable. Negotiable CDs provide investors with an alternative to early redemption, namely the ability to sell the debt to other investors in a secondary market. Negotiable CDs are primarily large-denomination securities issued to (and traded by) other banks and large investors. They are typically offered in denominations of $100,000 to $10 million (although the common denomination is $1 million). Negotiable CDs were first issued by the First National City Bank of

New York (now Citibank) in 1961, to make it easier for the bank to borrow from investors seeking flexibility to sell them before maturity.

Short Term borrowing

Many banks also rely on other short-term borrowings from the market to make up any shortfalls in funding. Two most common instruments are federal funds and repurchase agreements.

Federal Funds, described earlier in the introduction to ProBanker, refer to borrowings in the interbank market, usually on an overnight basis. Large multinational and regional banks tend to be net borrowers while small banks tend to be net lenders.

Repurchase Agreements are collateralized loans where investors pledge securities, usually for overnight, in order to receive loans. There are two reasons for borrowing through repurchase agreements instead of federal funds. First, many banks are unable to access federal funds because they may not have the necessary relationship and credit worthiness to borrow from other banks. Second, the rates are lower than fed funds rates since they are collateralized and can reduce the cost of borrowing

Brokered deposits

A new form of deposit that became popular in the 1980s is brokered deposits where deposits larger than the maximum FIDIC insured amounts are split into smaller amounts and deposited in several banks. Assume you have $10 million that you wish to deposit in banks. Since the maximum FDIC insured amount is $250,000 per deposit, the amount can be broken down into individual units of $250,000 and deposited into 40 different banks. There are several brokers that specialize in splitting large deposits and placing them in various banks across the country.

Brokered deposits are a source of concern for regulators because of the moral hazard problem. Banks with brokered deposits have incentives to take on additional risk. Traditional banks, especially in small towns, obtain deposits from their local surrounding community. The familiarity and intimate relationship with local depositors makes it less likely for managers to misuse funds. In contrast, if the bank receives substantial sums of brokered deposits from outside the local area, the incentives to engage in riskier activities is higher. A study by the FDIC found that non-performing loans are much higher for banks with brokered deposits.[14] The FDIC, after the financial crisis of 2008, has made it difficult for banks with inadequate capital or weak performance to accept brokered deposits.

Income and Expenses

Interest and Non-interest Income

The net interest income of a commercial bank is comparable to the gross profit of a manufacturing firm; it represents revenues less expenses of the core products or services of the firm. In the case of banks, net interest income Is the interest earned on loans less the interest paid on deposits. Non-interest income is generated by providing services other than traditional loans.

[14] Study on Core Deposits and Brokered Deposits, Submitted to Congress pursuant to the Dodd-Frank Wall Street Reform and Consumer Protection Act, July 8, 2011. Federal Deposit Insurance Corporation.

Net Interest Margin (NIM)

The net interest margin is the difference between revenues generated by the loans of a commercial bank less the interest expenses on deposits and other borrowings, expressed as a percentage of total assets. As an example, if a bank borrows $100 in deposits at 4% and lends it at 8%, the net interest income is $4, $8 interest income less $4 interest expense. Net interest margin, sometimes referred to as the spread on a loan, is expressed as a percentage of the total loan or $4 /$100 = 4%.

Table 3.4 shows the net income earned by U.S. banks in 2016, categorized by size. Banks with $50 million to $300 million in assets and with over three office locations earned a spread of nearly 4% while larger banks with assets greater than $3 billion earned slightly lower at about 3.47%. Interest expenses are low for all banks ranging from 0.40% for smaller banks to 0.31% for large banks, reflecting the low cost of deposits. Deposits provide a valuable and cheap source of funding for banks. The NIM ranges from 3.15% for large banks to 3.57% for the smaller group of banks.

Net Non-Interest Income

In contrast, large banks generated more non-interest income than small banks (0.95% against 0.72%) and incurred lower non-interest expenses (2.50% against 3.51%). Overall, net non-interest income is negative, ranging from -1.55% for large banks to -2.79% for small banks. After adjustment for loan loss provisions and taxes, the net income as a percent of total assets (or return on assets, ROA) is 1.47 percent for large banks and 0.72 percent for small banks.

Table 3.4 Net Income of U.S. Commercial banks by Size of Assets in percent, March 2016

	> $3 billion	$1 -3 billion	$300 million - $1 billion	$100 -300 million (> 3 offices) metropolitan	$50 -100 million (> 3 offices) metropolitan
Interest income	3.47	3.72	3.93	3.95	3.90
Interest Expense	0.31	0.35	0.40	0.37	0.33
Net interest Income (NIM)	3.15	3.36	3.53	3.57	3.54
Non-Interest income	0.95	0.84	0.73	0.62	0.72
Non-Interest expense	2.50	2.76	2.85	3.10	3.51
Net Non-Interest Income	(1.55)	(1.92)	(2.12)	(2.48)	(2.79)
Provision for Loan Losses	0.16	0.11	0.09	0.07	0.07
Realized Gains and Losses on Sale of Securities	0.01	0.02	0.02	0.02	0.01
Pre-tax Net Operating Income	1.47	1.41	1.39	1.09	0.72
Net income after taxes (ROA)	0.97	0.96	1.03	0.84	0.57
No. of Banks in sample	231	353	1216	591	93

Source: UBPR 2016 Peer Group Average Report, www.FFIEC.gov

Interest Income

Interest income is generated by loans. Loans make up the bulk of the assets for commercial banks. The interest charged on loans varies by several characteristics: borrower type, maturity, payment options on interest and principal, and other additional features.

1. Borrower type: In most balance sheets of banks, loans are categorized by two borrower types, consumer and corporate. Consumer loans are made to individuals and may include installment, credit card, mortgages and real estate loans. Corporate loans are loans to businesses and include installment loans, mortgages and real estate, revolving credit lines and asset-backed loans.
2. Maturity: Most consumer loans are short term with the exception of mortgages which commonly have maturities of 30 years. Corporate loans are generally medium-term and most firms have lines of credit that allow them to draw down their loans when required.
3. Payment options on interest: Payments of interest on loans may be fixed or variable (floating). Floating rates loan are priced based on a benchmark rate plus a risk premium. If the rates are fixed, the lender takes on the risk of a potential increase in interest rates. If the rates are floating, the borrower is exposed to interest rate increases.

4. Payment options: Loans payments may be amortizing or non-amortizing. In an amortizing loan, the payments are equal for every period (monthly, quarterly etc.) till maturity. The interest and principal payments vary per month. Over the life of the loan, interest payments gradually decline and principal payments gradually increase. A variation of an amortizing loan is where the principal payments are fixed every period and interest payments vary, declining over time. In contrast, a non-amortizing loan pays only interest every period and the full principal is paid at the end of the year.

Example: Estimating Interest and principal payments on loans

Assume a borrower is given the following options for payment of a $100,000 loan.

a) 10-year amortizing loan paying annual interest rates of 12%.
b) 10-year non-amortizing loan with principal payment at maturity.
c) 10-year loan with interest payments only for year 1-6 and principal payments of $25,000 in years 7, 8, 9, and 10.

What are the annual payments per year?

a) PVA $_{n=10,\ r=12}$ (X) = 100,000 or using calculator (BA II Plus): -100,000=PV, 10=N, 12=I/YR, 0=FV, CPT PMT = $17,698.42.

b) $12,000 interest per year for 10 years and $100,000 in year 12.

c) See below

	0	1	2	3	4	5	6	7	8	9	10
Interest		12000	12000	12000	12000	12000	12000	12000	9000	6000	3000
Principal		0	0	0	0	0	0	25000	25000	25000	25000
Total		12000	12000	12000	12000	12000	12000	37000	34000	31000	28000

Interest Rates

The interest rates for loans and deposits are determined by the demand and supply of credit. The minimum loan rates are bounded by the term structure of interest rates for U.S. government bonds, to be discussed in chapter 4. The lower bound for loans are the U.S. government bond rates because of the risk of default for corporate or consumer loans. In contrast, the deposit rates can be lower than U.S. government bond rates. Customers would accept lower deposit rates than government bond rates because of the benefits provided by banks such as withdrawal on demand and check writing privileges.

The premium charged over the government bond rates for loans will depend on the several characteristics of the loan, including loan type, maturity, expected default rate, amount of collateral and other individual borrower specific factors. The banking industry uses the standard five C's to determine the loan rates for consumers; capacity, character, capital, collateral and condition to determine the appropriate interest rates.

Capacity: is the earnings capacity of the borrower to repay the loan and includes current income and wealth. After deducting fixed expenses such as rent, mortgage, auto, and insurance etc., an estimate of a borrower's residual income will determine the appropriate amount and interest rate of the loan. Mortgages typically require that the loan payment by an individual not exceed 28% of gross income (salary, bonuses and other income) and loan plus other fixed payments not exceed 6%. Other fixed payments include real estate taxes, home insurance and other debt payments.

Character: is a subjective measure of the willingness of the borrower to repay the loan. A loan officer will evaluate the candidate's prior record for defaults and late payments to determine the likelihood of future delinquency. It may include obtaining character references from third parties such as suppliers and customers of the borrower. The goal is to determine the ability of the borrower to conduct business in good faith as well as the aptitude to exhaust all repayment avenues before declaring default.

Capital: is the amount of assets that will serve as a buffer in the unlikely event that the borrower is unable to maintain his or her earnings. It serves as a cushion in lean times and assures the lender that the borrower has additional assets to substitute current earnings.

Collateral: are assets that serve as a substitute for payment in the event the borrower is unable to make payments. Collateral can be physical or financial assets or in the form of guaranty by third parties. The relationship is negative, i.e., higher the collateral, the lower the interest rates. The type and quality of collateral will also be important in determining interest rates. Highly liquid financial assets, such as government bonds, will result in lower interest rates compared to hard assets such as land, equipment or inventories.

All collateral is subject to changes in value. For example, an increase in interest rates can reduce the price of government bonds. Similarly, hard assets such as inventories can be subject to change in value depending on demand for the product. For example, oil rigs serving as collateral for oil companies can fall in value if demand and prices for oil decline drastically.

Condition: is the overall economic environment that can impact the payment ability of the borrower. It encompasses a number of macro-economic variables such as GDP, inflation, interest rates, exchange rates as well as industry-specific factors such as the availability of substitutes, innovation, domestic and foreign competition, and quality. Changes to any of the factors can impact the demand for the product or service and eventually the repayment capacity of the borrower.

The combination of the above factors will determine the exact risk premium to be charged on a loan.

Interest Expense

The interest expense on deposits has a lower bound of zero for demand deposits and rates increase gradually based on maturity and withdrawal features. In some countries, regulators establish the maximum and minimum rates on loans and deposits. In the U.S., Regulation Q, enforced in 1933, forbade interest on demand deposits and restricted the amount paid on savings and time deposits.[15] There are pros and cons in limiting interest rates on deposits.

1. PRO: Central banks impose restrictions on deposits to prevent unscrupulous or failing banks to offer high interest rates to lure money. Banks paying high deposit rates have incentives to invest in riskier assets to repay their obligations.
2. CON: Restrictions on deposits rates may not reflect the supply of money in the market. Banks may be forced to seek alternate funding during periods of high interest rates. Any impediment to the free flow of funds ultimately leads to misallocation of capital in an economy.

In the U.S., interest rate restrictions on savings and time deposits were removed in the late 1980s and demand deposits in 2011.

Income from other assets

In addition to loans, U.S. banks earn come from several other assets, most of them short-term investments. Banks normally deposit their unused funds with their central banks as excess reserves. Most central banks do not pay interest on reserves. The Fed is one of the few exceptions that pays 0.25% interest on reserves since 2008. A few countries such as Denmark, Norway, Switzerland and Japan, pay negative interest rates on some of the excess reserves. This phenomenon of negative interest rates happens rarely and will be discussed in the next chapter. Short term investments include lending to other banks (fed funds), lending against collateral (repurchase agreements or "repos"), and investing in government and corporate bonds. An advantage of holding government bonds is banks do not have to hold capital against these investments because they are considered risk-free (will be elaborated further in the chapter on capital). Since government bonds form a major component of assets globally, we discuss them below in detail.

Government Bonds

All countries issue bonds primarily to fund the shortfalls in their budgets. It is repaid through revenue generated by personal and corporate taxes. The U.S. government issues Treasury bonds, notes and bills to finance its budget deficit. In 2015, the total collections for the U.S. from taxes amounted to $3.25 trillion but its expenditures were $3.69 trillion, leaving a shortfall of $439 billion. The deficit was funded by issuing debt. The total outstanding debt of the U.S. government as of September 30, 2015 is $18 trillion. The main sources of revenues for 2015 were Individual income taxes (47.43% or $1.54 trillion), Social Security and Other Payroll taxes (32.78% or $1.06 trillion) and Corporate income taxes (10.59% or $344 billion). The main expenditures were expenses related to Medicare ($546 billion), social security ($888 billion), defense ($591 billion), health ($482 billion) and interest on debt ($223 billion).[16]

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[15] Most countries eliminate interest rate restrictions when they liberalize their financial markets. Among them is China which eliminated minimum loans rates in 2013 and the ceiling of deposit rates in 2015.

[16] https://www.fiscal.treasury.gov/fsreports/rpt/combStmt/cs2015/outlay.pdf.

The Bureau of Fiscal Service (BFS) under the Department of Treasury is responsible for the issuance of government securities via periodic auctions. The five major securities issued by the U.S. government are listed below:

1. Treasury bills are short-term securities with fixed rates and maturities ranging from four to 52 weeks. The bills are sold at a discount. [17]
2. Treasury Notes are coupon-bearing bonds with fixed rates and maturities of two, three, five, seven and ten years. Interest is paid semiannually.
3. Treasury bonds are long-term coupon-bearing bonds with 30 year maturities. Interest is paid semi-annually.
4. Floating rate bonds have been issued since January 1, 2014. Interest is paid quarterly based on the 13-week Treasury bill rate.
5. Treasury Inflation Protected Securities (TIPs) are marketable securities whose principal is adjusted based on the Consumer Price Index. TIPS are issued with maturities of five, ten and 30 years and pay interest semiannually.

In addition, the government also issues a number of savings bonds, aimed primarily at the small savers.

Treasury bills are short-term government securities with maturities of 4, 13, 26 and 52 weeks. The BFS issues 4, 13 and 26 week bills once a week, and 52 week bills once every four weeks. The bills can be purchased two ways:

1. TreasuryDirect – Individuals and entities can bid on auctions directly through the portal.
2. TAAPS –Institutions can bid directly through TAAPS (Treasury Automated Auction Processing System).

Two forms of bidding exist for all government securities.

1. Non-competitive bidding. An individual or entity requests a fixed amount and will receive the bills at the rate determined at the auction. The maximum amount is $5 million.
2. Competitive bidding. An individual or entity is allowed to bid competitively stating the amount and rates they are willing to accept. The Treasury will award the bids beginning with the highest bidder (lowest interest rate) and go down the list till the desired amount is fulfilled. The rate paid by all bidders (competitive and non-competitive) will be at the lowest rate that cleared the bid. This kind of auction is called Dutch auction. The maximum amount that can be bid by one institution is 35% of the offering amount.[18]

An example will highlight the Dutch auction process for U.S. government securities. Assume the following bids were received by the BFS for a planned issue of $1,000,000 of 13-week T-Bills.

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[17] Treasury sometimes issues cash management bills that vary in maturity, from a few days to few weeks, often to fund short-term liquidity needs.

[18] In 1991, Salomon Brothers was indicted for bidding over 35% of the offering amount, forcing its top five executives to resign. The firm was saved from bankruptcy by Warren Buffet who took charge as chairman and chief executive for an annual salary of $1. His $700 million investment eventually paid off when it was sold to the Traveler's group for $1.7 billion.

Non-competitive Bids

1. A total of 6 *non-competitive* bids amounting to $200,000 was received.

Competitive Bids

1. A total of five *competitive* bids was received.
    a. $250,000 at 3.1%
    b. $300,000 at 3.0%
    c. $175,000 at 2.9%
    d. $300,000 at 2.8%
    e. $200,000 at 2.7%

Since only $800,000 will be allocated to the competitive bidders, the minimum rate which will clear $800,000 is 3.0%. All the winners will receive this rate including the non-competitive bidders. The highest bidder at 3.0% will only receive $125,000 out of the $300,000 requested.

Pricing of T-Bills

A T-Bill is priced at a discount, that is, the price is equal to the face value less a discount. For example, if a six-month T-Bill with a face value of $100 is purchased at a 10% annual discount, the buyer will pay $95 (5% for six months) and received $100 at maturity.[19]

Price = Face Value – Discount.

For the above example: Price = $100 – (.05)*($100) = $100 - $5 = $95.

It should be noted that a 5% discount is not the same as the yield or return earned by the investor. The realized return will always be higher. The realized return for the above example is:

Return = ($100 - $95)/$95 = 0.05263 or 5.26%

Another example

Assume that interest rate on a 182-day, $1 million face value, T-Bill is currently selling at a discount rate of 3.25%. What will be the price of the T-Bill?

The formula for estimating the price of a T-Bill is as follows:

$$P = F - \frac{d * t}{360} * F$$

$$P = 1{,}000{,}000 - \frac{.0325*182}{360} * 1{,}000{,}000$$

P = 1,000,000 – 16,430.56

P = 983,569.44

[19] Nearly all interest rates are quoted per annum (p.a.) in the financial markets; 10% p.a. means 5% for six months.

What is the return on the T-Bill if the investor purchases at the above price and holds till maturity? The investor will receive $1,000,000 in 182 days.[20]

$$Return = \frac{(1{,}000{,}000 - 983{,}569.44)}{983{,}569.44} * \frac{360}{182} = 3.304\%$$

Taxes: Interest on T-Bills is taxable at the federal level but is exempt from state and local taxes.

Relationship between Interest Rates and Prices

The primary relationship between interest rates and prices of fixed-income securities including Treasury bonds and Treasury bills is negative. As interest rates increase, the price of bonds decrease, and conversely, if interest rates fall, the prices of bonds increase.

Take the example of the T-bill. If the discount rate increases, the price will decrease as *d* in the numerator increases in the formula:

$$P = F - \frac{d * t}{360} * F$$

This inverse relationship is important because if interest rates are anticipated to increase, holders of bond portfolios can expect to incur a loss as prices decline. Similarly, if market participants expect interest rates to decline, bond prices will increase.

Banks hold government bonds for two reasons:

1. **Liquidity**: It provides them with the flexibility to sell them on short notice. During a crisis, it is easier to sell government bonds than corporate bonds.
2. **Risk:** It reduces the overall risk of its portfolio. As will be studied later, banks have to keep higher amounts of capital if their portfolio risk is higher.

Timing of the purchases and sales of bonds will depend on their expectations of interest rates. In the case of banks:

1. If interest rates are expected to increase, banks may consider selling their current portfolio to take advantage of the expected decline in prices and purchase them when interest rates increase and bond prices fall.
2. Conversely, if interest rates are expected to fall, banks should consider purchasing bonds now with the anticipation of selling them later when interest rates fall and bond prices increase.

Measures of Performance

The predominant measures of bank performance are the return on assets (ROA), return on equity (ROE) and net interest margin (NIM).

[20] The number of days convention for estimating interest payments on Treasuries and CDs in the U.K is (actual number of days)/365 in contrast to the U.S. (actual number of days)/360.

ROA (Return on Assets)

ROA is defined as net income over total assets and provides a measure of the use of the assets (loans) of a bank. Take the following example. Bank A receives $70 in deposits at 5% and together with $30 in equity makes a loan of $100 at 7%. We will ignore taxes for the moment.

Bank A			
Loan 7%	$100	**Deposit 5%**	$70
		Equity	$30
Total Assets	$100	**Total Liab and SE**	$100

Net Income = 100(.07) - $70 (.05) = $3.50

ROA = $3.50/100 = .035 or 3.5%
ROE = $3.50/30 = .0.1167 or 11.67%

Take a look at Bank B. It makes $100 loan at 7% with $90 in deposits at 5% and only $10 in equity.

Bank A			
Loan 7%	$100	**Deposit 5%**	$90
		Equity	$10
Total Assets	$100	**Total Liab and SE**	$100

Net Income = 100(.07) - $90 (.05) = $2.50

ROA = $2.50/100 = .025 or 2.5%
ROE = $2.50/10 = .0.25 or 25%

Although its ROA is lower by 1%, its return on equity is much higher at 25%. Thus, both ROA and ROE have to be evaluated to obtain a true measure of the performance of the bank.

1. Lower ROA implies its assets are not generating as much profits, either because of low rates on the loans or high rates on the deposits.
2. The lower the equity capital, the higher the ROE. However, lower the equity capital, the higher the risk of the bank.

Finally, take a look at Bank C.

Bank C			
Loan 7%	$100	Deposit 3.888%	$90
		Equity	$10
Total Assets	$100	Total Liab and SE	$100

Net Income = 100(.07) - $90 (.03888) = $3.50

ROA = $3.50/100 = .035 or 3.5%
ROE = $3.50/10 = .0.35 or 35%

Bank C has the same ROA as Bank A but its ROE is substantially higher than both Bank A and B. Not only did they reduce the deposit rates but also lowered the amount of equity.

Performance of U.S. Banks

Table 3.5 shows the average key performance measures of U.S. banks in 2016. Large banks had higher ROA, with the exception of the smaller banks ($1 billion-300 million). The very small banks had the lowest ROA. Besides the very small banks, ROE of banks ranged between 7-10 percent. Banks with assets greater than $3 billion had ROE of 8.62% while those between $1-3 billion had 9.2%. Finally, NIM ranged between 3-4% and was higher for smaller banks. Banks greater than $3 billion had average NIMs of 3.39% while those between $50-100 million averaged 3.85%

Table 3.5 Key Performance Measures of U.S. Commercial banks by Size of Assets in percent, 2016

	> $3 billion	$1-3 billion	$300 million - $1 billion	$100-300 million (> 3 offices) metropolitan	$50-100 million (> 3 offices) metropolitan
Return on Assets (ROA)	0.97	0.96	1.03	0.84	0.57
Return on Equity (ROE)	8.62	9.20	9.64	7.76	5.23
Net Interest Margin (NIM)	3.39	3.59	3.75	3.83	3.85
No. of Banks in sample	231	353	1216	591	93
Source: UBPR 2016 Peer Group Average Report, www.FFIEC.gov					

Risk-Adjusted Performance Measures

The above performances measures provide one side of the picture of the financial health of the bank. It is also necessary to examine the riskiness of the bank in order to fully evaluate their performance. it is possible for a bank to lend to very risky clients and increase their spreads to earn excess returns. In the long run, this could hurt shareholders when the risky loans begin to default. Hence, it is necessary to include a measurement of risk in performance measures. Risk-adjusted performance measures, such as RAROC, will be discussed in a later chapter.

Summary of the Chapter

This chapter describes in detail the various assets and liabilities of a financial institution. The main earning assets of a typical commercial bank are commercial loans, consumer loans and mortgages. Consumer loans include credit cards, individual loans, and auto loans. Commercial and industrial loans are loans to business entities and to individuals engaged in business activities. Mortgage loans include residential, commercial and construction loans. Loans are also categorized by those held for investment and those held for sale. Loans held for sale recognize that banks plan to sell the loans in the near future, either for securitization (where loans are bundled and sold to investors) or to investor groups such as hedge funds.

Liabilities include demand deposits and represent the cheapest source of funds for banks followed by NOW accounts. The other deposits are savings and time deposits. Time deposits are usually in the form of certificate of deposits (CDs). CDs below $250,000 are insured by the Federal Deposit Insurance Corporation (FDIC). Banks also issue negotiable CDs, usually in denominations of $1,000,000. The benefit of negotiable CDs is that it can be sold to other investors. However, it is not covered by FDIC insurance.

The various features of loans and deposits affect their pricing. Loans are priced as fixed or floating. In a fixed-rate loan, the lender bears the interest rate risk. In a floating-rate loan, the borrower bears the interest rate risk. If collateral is pledged, either directly or through third-party guarantees, loan rates can be reduced.

Banks also invest in government bonds. In the U.S., government bonds are made up of T-Bonds, T-notes and T-Bills. The Bureau of Financial services auctions governments regularly throughout the year.

Three commonly used performance measures of banks are the return on assets (ROA), return on equity (ROE) and the net interest margin (NIM). Both ROA and ROE can be increased by higher leverage; however, it makes the banks riskier. NIM represents the core earnings of banks and usually range between 3-4% for most banks.

End of Chapter Questions

1. What are Fed funds and what role do they play in commercial banking?

2. Distinguish between loans held for investments and loans held for sale.

3. A borrower has the option of accepting a fixed rate loan for five years at 10% or a floating rate loan of LIBOR plus 3%. Assume the current LIBOR rate is 6%. If the floating rate loan was chosen, did the borrower make the right decision if the LIBOR rates over the next four years are 6.5, 7.0, 7.5, and 7.75 percent? Note that the LIBOR rate at the beginning of the year is used to determine the payment at the end of the year.

4. A borrower can borrow a fixed-rate loan at 8.5% for six years or a floating-rate loan at LIBOR plus 2%. Assume the current LIBOR rate is 7%. After some consideration, he chooses the fixed rate loan. Did he make the right decision if the LIBOR rates over the next five years were 5.5, 6.0, 7.0, 6.25 and 8.5 percent?

5. What is the difference between demand deposits and NOW accounts?

6. A bank offers a Certificate of Deposit (CD) at a rate of 6% compounded monthly. Another bank offers 5.90% compounded daily. Which rate is better for the investor?

7. A CD is offered by a bank at a rate of 3.95% compounded quarterly. Another bank offers 3.91% compounded daily. Which rate is better for the investor?

8. Assume that interest rate on a 182-day, $1 million face value, T-Bill is currently selling at a discount rate of 4.15%. What is the price of the T-Bill? What is the realized or holding period return of the bond?

9. A 330-day T-Bill is currently selling at a discount rate of 3.97%. by investor in 330 days. What will be the price of the T-Bill with a face value of $2 million? What is the return on the T-bill if the investor holds till maturity?

10. Assume a borrower is given the following options for payment of a $100,000 loan.
    5-year amortizing loan paying annual interest rates of 8%.
    5-year non-amortizing loan with principal payment at maturity paying annual rates of 8%.
    5-year loan with interest payments only for year 1-3 and principal payments of $50,000 in years 4 and 5.
    Show the payments for all three loans.

11. The following options were given to a borrower for payment of a $250,000 loan.
    10-year amortizing loan paying annual interest rates of 9%.
    10-year non-amortizing loan with principal payment at maturity paying annual rates of 10%.
    10-year loan with a 9.5% interest rate. The borrower only pays interest for 5 years. In year 6, he will begin to pay principal payments of $50,000 every year till year 10.
    Show the payments for all three loans.

12. Explain the standard five C's used by the banking industry to determine the loan rates for consumers.

13. Distinguish between competitive and non-competitive bids when purchasing Treasury bonds in the U.S.

14. Explain the relation between ROA, ROE and NIM as measures of performance of a bank.

ProBanker Assignment 1

This assignment will

a. Study the impact of advertising on volumes of loans and deposits.
b. Determine the provisions to loan loss allowance.
c. Assess the impact of the costs of deposit insurance on the overall costs of funds.

For this exercise, we will create a new Autosim and call it "Your Name Assignment 1".

Please note that in Autosim you are playing solo against the computer. If you are in a competitive game, the results can be different because demand and supply are affected by the decisions of your competitors.

Assignment 1A:

1. Create a personal **Autosim**.

    a. Click on *Games*.
    b. Click on *New Autosim game*.
    c. Select ***Assignments*** *Regional Bank* template in *using template.*
    Note: *Make sure* ***NOT*** *to choose* ***Sample*** *Regional Bank template.*
    d. Type a name for the new Autosim in *New game's name*
    e. Example "John Roger Assignment 1A"
    f. Click on *Create Game*

2. Input decisions to your new Autosim. There are four categories of decisions – '**Account *Quantities, Account Interest Rates, Advertising*** and ***Other Decisions.***

    a. Click on *Games.*
    b. Select your newly created Autosim.
    c. Click on *Play bank.*

3. **Account Quantities** – Input the following and leave the rest as zeroes.

a.	Target Reserves for Deposit	$25,000
b.	Federal Funds Purchased	$25,000
c.	360-days CDs to Issue	$50,000
d.	New 8-quarter Bonds to Purchase	$15,000

4. **Account Interest Rates** – Leave as is (9.30, 4.00, 11.00, 9.00, 6.00, 5.00, 7.50, 0,0)

5. **Advertising -** Leave as is (150, 80, 410, 580, 290, 140, 60)

6. **Other decisions** – Leave as is (0, 1, 0, 0, 100, 100)

7. *Simulate next period* (on left side of the screen). After a few seconds, you will notice a flicker and it should say **End of Period 1.** You are ready to review the results.

8. Review the results by clicking on Reports. Alternatively, you can download the results from the Excel file '*Download full reports'* in Excel.

9. Record the results of Quarter 0 and 1 in the shaded cells of the table below. Estimate the percent change from Q0 to Q1 in the shaded cells and answer the questions below.

Answer the following questions:

1. What is the percentage change in installment and mortgage loans?
2. What is the percentage change in corporate and retail demand deposits, passbook, retail CDs and long-term retail deposits?
3. Explain the amount in loan loss allowance (you will have to obtain the Provision for loan losses from the income statement).
4. Estimate the FDIC Insurance Premium using information from the income statement and balance sheet? Explain.

Assignment 1B

10. Create another **Autosim**.

a. Click on *Games*.
b. Click on *New Autosim game*.
c. Select *Assignments Regional Bank* template in *using template.*
Note: *Make sure* ***NOT*** *to choose Sample Regional Bank template.*
d. Type a name for the new Autosim in *New game's name*
e. Example "**John Roger Assignment 1B**"
f. Click on *Create Game*

11. Input decisions to your new Autosim. There are four categories of decisions – '**Account *Quantities, Account Interest Rates, Advertising*** and ***Other Decisions.***

d. Click on *View Games.*
e. Select your newly created Autosim.
f. Click on *Play bank.*

12. Account Quantities – Input the following and leave the rest as zeroes.

a.	Target Reserves for Deposit	$25,000
b.	Federal Funds Purchased	$25,000
c.	360-days CDs to Issue	$50,000
d.	New 8-quarter Bonds to Purchase	$15,000

13. Account Interest Rates – Leave as is (9.30, 4.00, 11.00, 9.00, 6.00, 5.00, 7.50, 0,0)

14. Advertising –Increase the advertising expenses by **25%**.

a.	Advertising installment loans	187.50
b.	Mortgage Loans	100.00
c.	Retail demand deposits	512.50
d.	Retail corporate deposits	725.00
e.	Retail CDs	362.50
f.	Passbook savings	175.00
g.	Long-term Retail Deposits	75.00

15. Other decisions – Leave as is (0, 1, 0, 0, 100, 100)

16. *Simulate next period* (on left side of the screen). After a few seconds, you will notice a flicker and it should say **End of Period 1.** You are ready to review the results.

17. Review the results by clicking on Reports. Alternatively, you can download the results from the Excel file '*Download full reports*' in Excel.

18. Record the results of Quarter 1 in the shaded cells of the table below. Estimate the percent change from Q0 to Q1 in the shaded cells and answer the questions below.

Answer the following questions:

5. What is the percentage change in installment and mortgage loans?
6. What is the percentage change in corporate and retail demand deposits, passbook, retail CDs and long-term retail deposits?
7. Explain the differences between Assignment 1A and 1B as a result of advertising. How effective was the advertising expenses?

ASSETS	Q0	Q1 Without Change in Advertising	Q1 With Change in Advertising	Percent Change W/o Advertising	Percent change with Advertising
Required Reserves (at the Federal Reserve)					
Excess Reserve Balances (at other commercial banks)				.	
Federal Funds Sold					
Fixed Rate Corporate Loans					
Floating Rate Corporate Loans					
Installment Loans					
Mortgages					
Bonds					
Fixed Assets					
Loan Loss Allowance					
Total Assets					
LIABILITIES					
Federal Funds Purchased					
Retail Demand Deposits					
Corporate Demand Deposits					
Negotiable CDs					
Passbook Deposits					
Retail CDs					
Long-term Retail Deposits					
Discount Window Advances					
Net Worth and Retained Earnings					
TOTAL LIABILITIES AND NET WORTH					

4

Chapter 4 – CENTRAL BANKS

Introduction

Central banks play an important role in the financial system of an economy. Their primary responsibility is to issue national currency, manage monetary policy and maintain financial stability. The history of modern day central banks is relatively new and evolved into their current form only in the late 19th century. Prior to that, the responsibility of issuing currency and maintaining financial order was at the purview of the ruling monarchs. Gold and silver was the primary currency of exchange for most countries (kingdoms) and the stamp of the rulers on the metals provided some certification and trust for use as a medium of exchange. Gold and silver became the preferred choice of metals because of its properties – durability, consistency, homogeneity, transportability and divisibility. It was also sufficiently scarce for production to be limited in quantity. A disadvantage of using precious metals as a medium of exchange was the ease of debasement. Coins could easily be melted and mixed with cheaper metals. Debasement occurred frequently in history, especially during periods of war, when the supply of metals was scarce. It includes several notable regimes including Nero in 60 CE (60 AD) and Henry VIII (mid-1500). Debasement usually led to the disappearance of pure gold and silver coins from the market, leaving only debased coins in circulation. This replacement forms the basis of Graham's Law that states "bad money drives out the good money."

Paper money came into circulation in Europe in the 1600s. Marco Polo introduced paper as early as the thirteenth century from China where paper money was already in circulation.[21] It took over 400 years for paper currency to gain acceptance in Europe. Accepting paper money requires a bigger hurdle than precious metals. It required "trust" in the issuing institution that it would honor its obligation to exchange paper for gold or silver on demand. As bank notes became accepted, many banks issued their own notes. Over time, the most trustworthy banks survived and became the major institutions of the country. The most dominant of them would eventually become the central bank with the blessing of the ruling monarchy. By the end of the 19th century, most governments decreed the power to one bank for the issuance of national currency. By the beginning of the 20th century, as commerce became global, central banks took on the added responsibility of ensuring price stability and growth.

The oldest central is the Sveriges Riksbank of Sweden which was established in 1668, but it did not receive formal authority to issue national currency until 1897. Similarly, the Bank of England was established in 1694 but their role as a sole national body in charge of monetary policy and issuance of currency was formalized only in 1946 when it was nationalized.

Monetary Policy

The mandate of most central banks is to maintain a stable financial system. The numerous financial crises in the 1800s and first half of the 1900s, including the Great Depression and the collapse of the German

[21] There is new evidence to suggest that Marco Polo never went to China but instead only traded merchandise from China.

currency, Reichsmark, resulted in an improved understanding of the role of money and banking in a global and industrialized world. Central banks began to expand their mission to include price stability, full employment, stable interest rates and liquidity management.

The current goals of the Federal Reserve System (Fed) reflect the responsibility of a modern day central bank:

- To conduct monetary policy by influencing money supply and interest rates and achieve maximum employment, stable prices, and moderate long-term interest rates.
- To supervise and regulate banks and ensure the safety and soundness of the nation's banking and financial system and protect the credit rights of consumers.
- To maintain the stability of the financial system and contain systemic risk.
- To provide financial services to depository institutions, U.S. government, official foreign institutions, and ensure an efficient payments system.

Monetary policy has to be complemented by a sound fiscal policy, administered usually by the executive branch of the government. In the United States Congress and the White House manage fiscal policy. The financial recession of 2008 demonstrated the importance of monetary policy; quantitative easing by the Fed and to some extent by the European Central Bank (ECB), played a big role in calming global markets and sustaining growth. The same cannot be said for politicians in Europe and the United States as fiscal policies continued to lag behind monetary policy.

Tools of Monetary Policy

The Federal Reserve has three tools at its disposal to implement monetary policy.

1. Open market operations
2. Reserve requirements
3. Discount rate

All three tools influence the money supply, credit availability and the amount of reserves held by banks in the economy.

Open Market Operations

The Fed uses open market operations as its main tool for conducting monetary policy. Since 1995, the Fed has targeted the federal funds rate to meets its objective. Prior targets have included borrowed and non-borrowed reserves of banks. We begin first with an explanation of federal funds, the primary target of the Fed.

Federal Funds or Fed Funds

Federal funds refer to loans between banks in the United States, usually for overnight borrowing. The name federal is a misnomer in that it is neither associated with the Federal Reserve or the federal government. It began in the early 1920s when banks discovered they could lend their excess reserves held at the Federal Reserve Bank to other banks, instead of leaving them idle. The process was simple because it entailed only a transfer of reserves between accounts at the Federal Reserve, hence the term federal funds. It is a very active market and the fed funds desk is usually busy in the evenings as banks get a better estimate of the amount of excess or deficit funds available for overnight borrowing and lending. Traditionally, smaller banks are lenders while the larger multinational banks in the big cities are net borrowers.

The Interbank Lending Scandal in London

In London, the interbank lending rate for dollars between banks is called LIBOR or the London Interbank Offer Rate. LIBOR is tied to the pricing of over $300 trillion worth of securities. Many adjustable-rate mortgages and loans are priced at LIBOR plus a premium. If LIBOR increases, the borrower has to pay more on the reset (repricing) date. If LIBOR decreases, the borrower pays less. Some financial instruments are repriced to LIBOR rates daily while others are repriced once a year, such as mortgages.

The LIBOR rate used to be determined daily by a select group of 18 large banks in London. Each bank submitted rates at 11:00 AM to Thomson Reuters on behalf of the British Bankers Association (BBA). Thompson Reuters disregarded the top and bottom 25 percent of the submitted rates and at 12 noon GMT reported the average of the remaining rates as the reference LIBOR rate for that day.

In 2012, a scandal broke out when it was revealed than many rate-setters who submitted LIBOR rates daily on behalf of their institutions were influenced by their colleagues sitting at trading desks of various LIBOR related securities. Several of the major banks were fined record amounts, $1.5 billion for UBS, $622 million for RBS and $451 million for Barclays. The BBA made significant changes to the reporting requirements but the damage was too extensive and they gave up their role of reporting daily LIBOR. On January 31, 2014, the responsibility for the administration of LIBOR was handed over to Intercontinental Exchange Benchmark Administration Ltd (IBA), following the investigation and recommendation by the Wheatley Review. In turn, IBA established a LIBOR Oversight Committee that includes members of the Federal Reserve, the Swiss National Bank and the Bank of England.

Targeting the Fed Funds (FF)

How does the Fed target the FF rate when the interest rate is set between two private banks? It achieves its goal by buying and selling U.S. government securities to indirectly influence the FF rate. An example illustrates the case. Assume the Fed sets a target of 2.5% for the FF rate. Assume a slowing economy or excess liquidity in the market puts a downward pressure on the rates, from 2.5% → 2.2% → 2.0% etc. The Fed's open market committee will instruct its traders to sell government securities to primary dealers and banks and remove the excess liquidity from the system. Sales of government securities will decrease its prices and increase interest rates. Banks initially willing to lend to other banks as federal funds will switch to the higher yielding government securities, forcing the FF rate to increase back to 2.5%.

Similarly, the Fed will reverse the operation if the FF rate increases from the targeted rate. They will purchase securities and inject liquidity into the financial markets. The Fed is therefore able to influence rates in the private FF markets by purchasing and selling government securities.

Reserve Requirements

Most banks will set aside cash to protect themselves against sudden withdrawals by their clients. Assume a bank accepts $20 from 5 depositors for a total of $100 each and makes a loan of $100.

Bank A			
		Deposit A	$20
		Deposit B	$20
Loan	$100	Deposit C	$20
		Deposit D	$20
		Deposit E	$20
Total Assets	$100	Total Liab and SE	$100

Once the loan is disbursed, it faces the risk that one of the depositors may request a withdrawal. It will not be a problem if it can easily replace the deposit, perhaps by offering a higher interest rate. However, if it is unable to attract the $20 deposit, it faces the likelihood of a default or a bank run. Prudent banks set aside sufficient reserves to protect themselves against unexpected withdrawals.

In most countries, central banks mandate a minimum reserve requirement for deposits for two reasons:

1. it reduces the likelihood of bank runs. Even small bank failures can have widespread disruptive effects on the local economy. It also removes the temptation for banks to take on additional risks by lending aggressively.
2. Central bank uses reserve requirements as a monetary tool to affect money supply (to be explained later in the chapter).

How much cash reserves should a bank hold to protect itself again sudden withdrawals? Bankers usually base their decision on past history and experience. Withdrawals are most likely going to be affected by two criteria, types of deposit and the general level of interest rates.

Types of deposit

Demand deposits usually do not pay interest and are kept by corporations and individual for transaction purposes. Since there is no penalty for early withdrawals, it is necessary for banks to keep cash reserves for unanticipated withdrawals. The relationship between interest rates and withdrawals from demand deposits is positive. If interest rates are low, withdrawals are less likely to occur. However, if interest rates rise, clients may consider moving their excess cash into interest-bearing deposits. Most countries require their banks to hold reserve requirements for demand deposits.

Savings deposits are small deposits held primarily by individuals for easy access with an opportunity to earn a modest interest. Savings accounts have been the mainstay for small and mid-sized commercial banks. It provides a stable source of funding because the rates of withdrawal are very low. The Fed does not require reserve requirements for savings deposits but many other countries impose them.

Time deposits are deposits with fixed maturities and offer higher interest rates than savings accounts. In most cases, there is a penalty for early withdrawal. As a result, the rates of withdrawals are lower and hence the amount of cash reserves required is lower. The Fed does not require any reserve requirements for time deposits but several countries require them.

General level of interest rates

The general level of interest rates plays a role in the withdrawal rates of deposits. In a low interest rate environment, there is less likely to be withdrawals from demand deposits as well as other accounts. On the other hand, as interest rates increase, withdrawals are likely to increase, beginning with demand deposits and other low interest paying accounts. In a very high interest rate environment, corporations and individuals prefer to keep low balances in their demand deposit accounts.

Reserve Requirements as a tool for monetary policy

Central banks use reserve requirements to also affect monetary policy and the total money supply in the system. The Fed has not used the reserve requirement as a monetary policy tool for a long time but central banks of other countries, including China and India, use it frequently. By raising the reserve requirement, the central bank lowers the amount of money in circulation. Conversely, decreasing the reserve requirement increases the money supply through the multiplier effect. A simple example will illustrate the case.

Table 4.1 assumes a bank receives $100 in demand deposits. The reserve requirement (RR) is 10%. With RR = 10%, it will be able to lend a maximum of $90. Assume the borrower who received the loan deposits the amount in Bank 2. With RR = 10%, Bank 2 will be able to lend only 90% of the amount or $81. Assume the cycle continues, that is, Bank 3 lends $72.90 and Bank 4 lends $65.61 etc.

Table 4.1 - Deposit Multiplier when RR = 10%				
Bank 1				
Reserve Requirements	$ 10.00		Deposits	$ 100.00
Loans	$ 90.00			
Total	$ 100.00		Total	$ 100.00
Bank 2				
Reserve Requirements	$ 9.00		Deposits	$ 90.00
Loans	$ 81.00			
Total	$ 90.00		Total	$ 90.00
Bank 3				
Reserve Requirements	$ 8.10		Deposits	$ 81.00
Loans	$ 72.90			
Total	$ 81.00		Total	$ 81.00
Bank 4				
Reserve Requirements	$ 7.29		Deposits	$ 72.90
Loans	$ 65.61			
Total	$ 72.90		Total	$ 72.90

Total deposits generated with the initial deposit of $100 if all banks succeed in fully lending 90% of their deposits is given by the deposit multiplier:

Total Deposits	= Initial Deposit/RR = $100/.10 = $1,000
Total reserves held by banks	= 10% of $1000 = $100
Total loans distributed	= 90% of $1,000 = $900

What happens if the central bank raises the reserve requirements to 20%? The result is a drainage of liquidity from the economy as banks lend less in each round of the cycle. Table 4.2 shows the net effect of the total loans supplied to the economy.

Table 4.2 - Deposit Multiplier when RR = 20%			
Bank 1			
Reserve Requirements	$ 20.00	Deposits	$ 100.00
Loans	$ 80.00		
Total	$ 100.00	Total	$ 100.00
Bank 2			
Reserve Requirements	$ 16.00	Deposits	$ 80.00
Loans	$ 64.00		
Total	$ 80.00	Total	$ 80.00
Bank 3			
Reserve Requirements	$ 12.80	Deposits	$ 64.00
Loans	$ 51.20		
Total	$ 64.00	Total	$ 64.00
Bank 4			
Reserve Requirements	$ 10.24	Deposits	$ 51.20
Loans	$ 40.96		
Total	$ 51.20	Total	$ 51.20

Total Deposits	= Initial Deposit/RR = $100/0.20 = $500
Total reserves held by banks	= 20% of $500 = $100
Total loans distributed	= 80% of $500 = $400

The total loans in the system have been reduced by the amount of the deposit of $500.

The Fed focuses on the excess reserves held at the Fed by banks to determine the impact on money supply in the economy. The equation for excess reserves is:

$$\Delta \text{ Money Supply} = \frac{\text{Excess Reserves at Fed}}{\Delta RR}$$

Assume the current excess reserves held at the Fed are $100 million and the Fed decreases the reserves requirement from 15% to 10%. The resulting increase in money supply will be

$$\Delta \text{Money Supply} = \$500m/.05 = \$2,500m \text{ or } \$2.5 \text{ billion}$$

The U.S. has not used the reserve requirements as a policy tool for many years. It relies entirely on open market operations and the discount window. Other countries such as China and India make use of reserve requirements extensively. Both countries require reserves of nearly 20% for both demand and time deposits.

Enforcement of Reserve Requirements

How do banks ensure that they are in compliance with the reserve requirements set by the Fed? In the U.S., Regulation D, initially written as part of the Federal Reserve Act of 1913 that established the Fed, determines the amount of reserves to be held by the bank. It has been modified over the years but the current rules are as follows:

1. Reserve requirements are applied only to net transaction accounts, primarily demand deposits and NOW accounts.[22]
2. There are no reserve requirements for time deposits and Eurodollar deposits. They were eliminated in 1990.
3. The reserve requirements are progressive; in 2016, the first $15.2 million requires no reserves; between $15.2 and $110.2 million the requirement is 3%; and above $110.2 million it is 10%.[23]

Banks have a two-week window to estimate its reserve requirement. It begins every second Tuesday and is termed the *computation period*.

Computation period

An example below demonstrates the computation.

Assume a bank estimates its daily transaction accounts as shown in Table 4.3. The average daily transaction deposit is $171 million, based on the sum of $2,394 million over the 14-day period. Note that the Friday, February 14, amount of $166 million is applied to Saturday, February 15, and Sunday, February 16. Similarly, the $170 million on Friday, February 21 is applied to the following Saturday and Sunday.

[22] Net transaction accounts consist of demand deposits, automatic transfer service (ATS) accounts, NOW accounts, share draft accounts, telephone or preauthorized transfer accounts, ineligible bankers acceptances, and obligations issued by affiliates maturing in less than or equal to seven days less amounts due from other depository institutions and less cash items in the process of collection (Source: Federal Reserve Board).

[23] The numbers are adjusted every year by the Fed based on the increases of excess reserves during the year. See https://www.federalreserve.gov/monetarypolicy/reservereq.htm

Table 4.3 Computation Period

	Daily Transaction Deposits and Cash at Vaults (in millions)									
Date	Tue Feb 11	Wed Feb 12	Thu Feb 13	Fri Feb 14	Mon Feb 17	Tue Feb 18	Wed Feb 19	Thu Feb 20	Fri Feb 21	Mon Feb 24
Transaction (Demand) Deposits	$175	$178	$182	$166	$165	$168	$172	$178	$170	$168

Average Transaction Deposits = $2,394/14 = $171

For the above example, the amount of required reserves to be maintained is determined as follows: the first $14.5 million is exempted and the remaining subject to 3% up to $103.6 million and 10% thereafter.

= 0*($15.2m) + .03($110.2m - $15.2m) + .10($171m - $110.2m) = 0 + 2.85 +6.08 =$8.93m

The bank has to ensure that it maintains a daily average of $8.93 million in a combination of Reserves at the Fed and Cash at Vault over the 14-day maintenance period.

Maintenance period

The Fed provides a two-week period for the bank to maintain the required reserves and is termed the *maintenance period*. The period runs from Thursday to Wednesday two weeks after the end of the computation period. Assume the Cash at Vault and the Reserves held at the Fed during the maintenance period is as shown in Table 4.4. Does the bank meet the minimum reserve requirements?

Table 4.4 Maintenance Period

	Daily Cash at Vault and Reserves at the Fed (in millions)									
Date	Thu Mar 13	Fri Mar 14	Mon Mar 17	Tue Mar 18	Wed Mar 19	Thu Mar 20	Fri Mar 21	Mon Mar 24	Tue Mar 25	Wed Mar 26
Cash at Vault	$3.00	$2.50	$3.25	$3.50	$4.00	$2.00	$2.00	$3.00	$3.00	$3.00
Reserves At Fed	$5.82	$5.75	$6.34	$6.12	$6.44	$6.06	$6.01	$6.11	$6.11	$5.95
Total	$8.82	$8.25	$9.59	$9.62	$10.44	$8.06	$8.01	$9.11	$9.11	$8.95

The answer is no because the daily average reserve balance is below the minimum required of $8.93million.

Average = 122.48/14 = $8.75 and is short by 0.181 million (8.749-8.93)

The bank will have to ensure that it has additional reserves of 0.18 x 14 = $2.534 million during the 14-day maintenance period ($2.54m if all decimals are used).

Penalty

What happens when a bank does not meet the two-week average reserve balance requirement? Until 2012, the Fed allowed a bank to be short of its requirement by 4% without facing a penalty as long as it made it up in the next cycle. In addition, if a bank had excess reserves, it could apply a maximum of 4% to the following cycle.

In October 2012, the Fed changed the rules to provide a penalty free zone that amounted to 10% of the reserve balance requirements.[24] Only if the reserves during the maintenance period fell below 10% will a penalty be imposed.[25]

In 2008, the Fed also began to pay interest on reserve requirements. Interest will be paid on reserve balances as well as excess reserves. The rule was originally supposed to become effective on October 1, 2011 but the financial crisis of 2008 propelled the Fed to move it sooner. Since 2008, the Fed has paid 0.25% for both balances.

Discount Rates

All central banks provide liquidity to financial institutions in times of stress and allow them to borrow through the discount window. In the U.S., banks would use the discount only as the last resort. In January 2003, the Fed redefined the lines of credit available under the discount window to make it friendlier for banks to approach the discount window. In the past, if a bank approached the discount window, it would come under the radar of the Fed. This discouraged banks that were genuinely in trouble and studies later showed that most troubled banks accessed the discount window too late. The discount window today is made up of three kinds of credit.

1. Primary credit is available to sound financial institutions and funds are usually lent overnight to relieve temporary shortfalls. Since January 2003, the discount rates were made higher than the fed fund rates. This ensured that banks would approach the discount window only if they were unable to borrow in the fed funds market.
2. Secondary credit is available to banks that cannot qualify for primary credit. Although it means it will be subject to scrutiny from the Fed, troubled banks will have more or less guaranteed access to immediate funds as long as collateral is posted.
3. Seasonal credit has been available for many years and were used by financial institutions that primarily lent to the agricultural and tourism sectors.

Collateral

All discount window borrowings require the posting of collateral. The Fed prefers government securities but will accept other securities. They include:

1. Municipal and corporate bonds
2. Money market instruments and asset-backed securities

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[24] Reserve balance requirement is defined as total reserve requirements minus vault cash.

[25] The deficiency charge is one percentage point above the rate of borrowing under the primary credit facility of the Fed on the first day of the deficient calendar month.

3. Commercial, consumer and real estate loans

Level of Interest rates

As part of monetary policy, the Fed has to ensure that the target set for fed funds are consistent with the general economic activity. If the economy is expanding, interest rates have to be kept at a rate consistent with growth without fueling a bubble. The management of interest rates can prove to be a challenging task for central banks as credit in the economy is sensitive to changes in the general level of interest rates. In this section, we will discuss the Fisher effect and the term structure of interest rates.

The general level of interest rates can vary between regions in an economy as well as between countries. For example, banks in India were offering 9% fixed rates on deposits in March 2014 while U.S. banks at the same time were barely offering 1%. In contrast, banks in the U.S. in the early 1980s were rates as high as 10% for CDs (certificate of deposits). What accounts for the differences in interest rates? The primary determinant of interest rates is the demand and supply for credit. Demand and supply in turn are impacted by the state of the economy and expected inflation. The modeling of the demand and supply schedules for credit can be complex, even in the absence of economic factors. A simple example will illustrate the basic relationship.

Assume in a small island economy there is only one lender of capital. If there is only one borrower, he or she may or may not face a high interest rate. However, if there are several borrowers and one lender, the rate will obviously be higher than when there is one borrower. The reverse will hold true if there are multiple lenders and a single borrower; interest rate is likely to be lower. In a normal market with sufficient borrowers and lenders, there is technically a floor set by the expected inflation rate. A lender will provide credit if the interest rate is equal to or above the expected inflation rate. There may be no lenders even if the lending rate is 30 if the expected inflation rate is 40%. This assumes that the investor has other opportunities for investment where he or she can obtain returns greater than 40%. If not, it may make sense to lend even at 30% (or lower) rather than leaving the cash idle. The dynamics of interest rates gets more complicated as we bring in additional economic and borrower specific variables.

Under normal economic conditions with multiple lenders and borrowers, the lower bound for interest rates is set by the expected inflation rate and the real rate. This relationship is termed the Fisher effect.

Fisher Effect

The Fisher effect provides a lower bound for nominal interest rates. It states that the minimum nominal rate for a risk-free loan or security should equal to the expected inflation rate plus a real rate. Real rates can be zero or negative. The latter can occur during recessions when the demand for credit is low.

A simple (and somewhat corny) example will illustrate the Fisher effect. Assume, you had $100 and were planning to consume 100 chocolate bars at $1 apiece. As you were about to head to the store to make the purchase, you are approached by your friend who wishes to borrow the $100 for a year. You decide to postpone your consumption and lend the money provided you receive an interest on the loan. You determine that the inflation rate over the year is expected to be 10%. In order to ensure that you can consume 100 chocolate bars at year-end, it seems appropriate to charge an interest rate of 10%. However, assume you seek to be rewarded with two additional chocolate bars for postponing your consumption. What interest rate should be charged for the loan? If you said 12%, you are close but not fully correct. That is because if you receive $12 as interest and the price of chocolates increase to 1.10, the amount of chocolates that can be purchased will be less than 102.

$112/$1.10 = 101.82 chocolate bars.

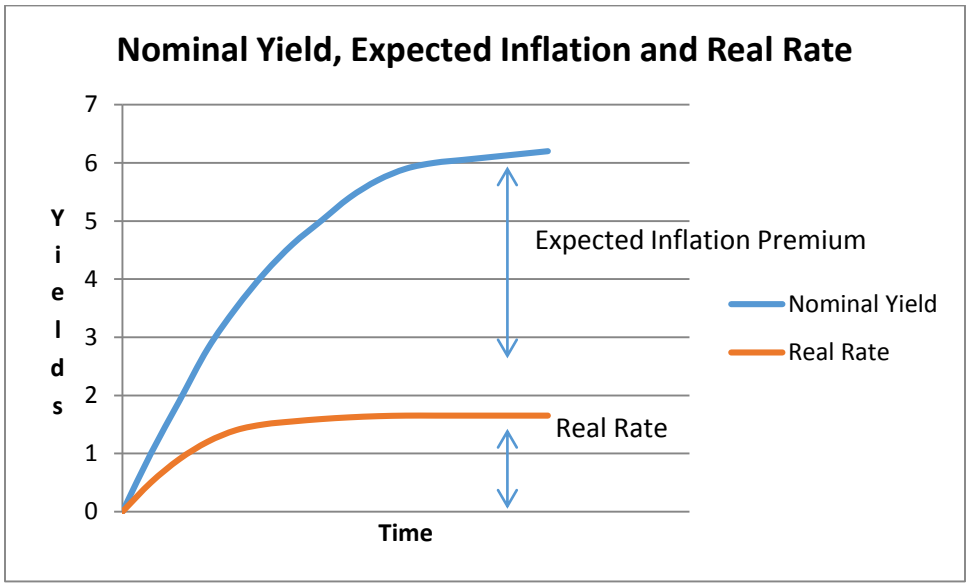

Figure 4.1

Note that the two extra chocolate bars will cost you $2.20 and not $2.00. The formula for the Fisher effect is as follows:

$$(1 + k) = (1 + INFL)*(1 +RR)$$

Where

k = nominal rate

INFL = expected inflation rate, and

RR = Real rate (representing the two extra chocolate bars)

For our example, the appropriate rate to charge is

$$(1 + k) = (1.10)*(1.02) = 1.1220$$

$$k = .1220 \text{ or } 12.20\%$$

The Fisher effect only sets the lower bound for short-term risk-free bonds. The upper bound is unlimited and will be determined by a variety of factors specific to the borrower and general macroeconomic conditions. We will discuss lending rates in the chapter of credit analysis. Figure 3.1 graphs the nominal rate separated by the real rate and the expected inflation rate.

The next section discusses the relationship between short- and long-term interest rates, termed the term structure of interest rates.

Term Structure of Interest Rates

The term structure of interest rates, also called the yield curve, is the relationship between short- and long-term rates. As shown in Figure 3.2, the yield curve is normally upward sloping as shown by the straight blue line.

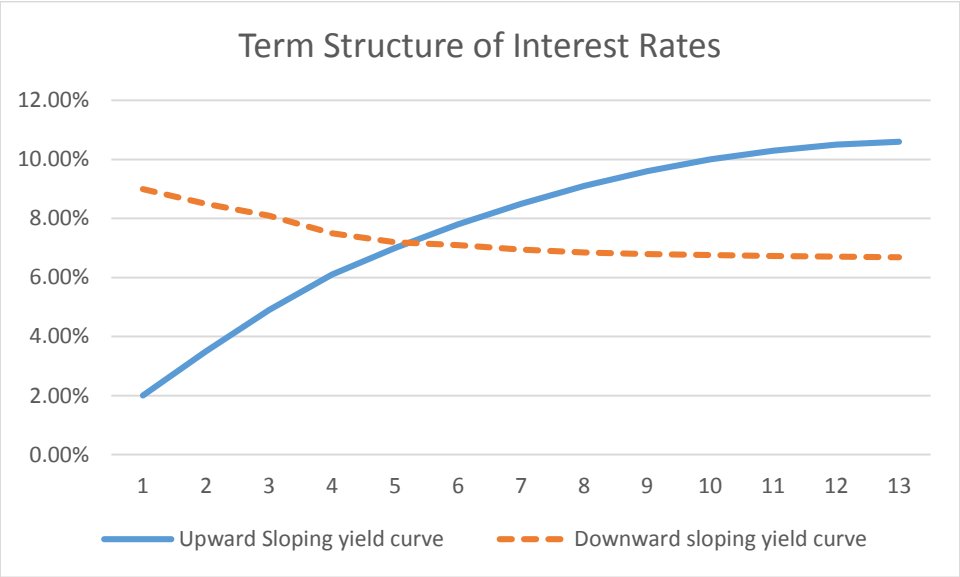

Figure 4.2

The 1-year rate is 2%, 2-year rate is 3.5%, 3-year rate is 4.9% etc. This is exaggerated but it demonstrates that the longer the maturity, the higher the rate demanded by lenders. The yield curve is upward sloping under normal economic conditions. However, there are times when the yield curve is downward sloping indicating that lenders are demanding higher rates for short-term loans, shown by dashed lines. This phenomenon usually occurs during periods of crisis or high uncertainty. For example, between July 2006 and May 2007, the 3-month Treasury rates rose above the 10-year rates as uncertainty on the economy prompted investors to shy away from lending short-term.

A natural question to ask is why the term structure should have any particular "shape" at any point in time. Several theories have been proposed. One theory - the market segmentation hypothesis - asserts that short-term and long-term bonds are effectively different securities. Within each maturity segment, an equilibrium interest rate is determined by the intersection of demand and supply, without regard for the yields on other bonds trading in the market. One problem with this segmented view of the yield curve is that it ignores the possibility that investors will move from one maturity segment to another in return for a sufficiently high expected return.

At the other logical extreme, we find the pure expectations hypothesis (PEH), which states that investors are willing to hold bonds of any maturity, and will invest in the bond offering the highest expected return over the investor's planned holding period. This theory is not as extreme as it initially sounds, because many sophisticated investors actually do evaluate a broad array of bond maturities when they have funds to invest. This view of the term structure is generally called the modified expectations hypothesis (MEH). While emphasizing that investors will actively consider a variety of bond maturities, the MEH points out that they will accept uncertain (risky) returns only if they are compensated by higher expected returns than can be obtained through a riskless investment strategy.

The Pure Expectations Hypothesis (PEH)

The PEH states the long-term rate on a bond is a geometric average of the current short term rate and the expected futures rates. This can be explained with an example of a one- and two-year bond. Assume the current one- and two-year rates on bonds are 8% and 9%, respectively.

You have $1,000 to invest in the bond market for two years. Furthermore, suppose you are risk-neutral, and that bonds pay interest only once per year.[26] Should you purchase a two-year bond today, or purchase a one-year bond today and roll over the proceeds from your initial investment into a second one-year bond?

Buy-and-Hold Strategy. If you purchase the two-year bond and hold it to maturity, you will have $1,188.10 at the end of the second year, as shown below:

$1,000*(1.09)*(1.09) = $1,188.10

Rollover Strategy. If you purchase a one-year bond today at 8%, you will have $1,080 at the end of the first year. The money will have to be reinvested for one more year. What interest rate will it pay? Nobody knows! You must make your investments today on the basis of your expectations about the path of future interest rates - which is why this theory is called the pure expectations hypothesis.

Case A: Suppose that you expect the one-year bond rate to be the same next year as it is today - 8%. Then pursuing the Rollover Strategy will get you $1,166.40 in two years (assuming your expectation about the one-year rate one year hence is correct).

1000*(1 + .08)*(1 + .08) = $1,166.40

If you believed that one-year rate will be 8% or lower, you would prefer the Buy and Hold strategy, i.e. purchase the two-year bond today rather than pursue the Rollover Strategy.

Case B: Suppose, instead, that you expect that market rates will rise over the coming year, so that you believe the one-year rate will be 11%. If you are correct, you will be able to earn 11% on your $1,080 during the second year, giving you a total of $1,198.80 at the end of Year 2.

1000*(1 + .08)*(1 + .11) = $1,198.80

Now, you would prefer the Rollover Strategy to the Buy-and-Hold Strategy.

The formal relation is given below:

$(1 + R_{0,2})^2 = (1 + R_{0,1})\ (1 + f_{1,2})$

where

R_{02} = Current (spot) rate of a two-year bond.

R_{01} = Current (spot) rate of a one-year bond.

f_{12} = forward rate defined as the one-year rate from end of year 1 to end of year 2.

What does this mean about the relation between Treasury bond rates today? If everyone shares your opinion that the forward rate f_{12} = 8%, no one will purchase the one-year bond today. Instead the demand for the two-year rate bond will increase. This will reduce the price of the one-year bond (and increase its rate) and increase the price of the two-year bond (and reduce its interest rate).

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[26] A "risk neutral" investor will always accept a fair bet. For example, he is indifferent between taking $5 for certain and having the chance to flip a coin that gives him $10 for "heads" and nothing for "tails". The evidence is that most people are risk averse: they will accept additional risk only if it is accompanied by a higher expected return.

What if all investors believe in Case B and assume the interest a year from today (f_{12}) will be 11%? Then demand for the two-year bond will decline and drive down its price. As the price of the two-year bond falls, its market yield or interest rate will increase.

If the one-year rate is 8% and the two-year rate today is 9%, the forward rate f_{12} is the rate expected by investors to prevail at the end of the year. It is estimated as follows'

$(1 + f_{12}) = (1 + R_{0,2})^2 / (1 + R_{0,1})$

$= (1.09)^2 / (1.08) = 1.1001$

$f_{12} = 10.01\%$

Investors expect the one year forward rate from period 1 to 2 to be 10.01%.

The above example assumes only one and two year rates. The PEH can be extended to all maturities. The general formula for a Rollover Strategy is:

$(1 + R_{0,n})^n = (1 + R_{0,n-1})(1 + f_{n-1,n})$

For example, if we know the 5-year rate and the three-year rate, we will be able to estimate the two-year rate expected to prevail three years from today, i.e.

$(1 + R_{0,5}) = (1 + R_{0,3})^3 (1 + f_{3,5})^2$

If an investor were to roll over the bonds every year, then the formula would be

$(1 + R_{0,n})^n = (1 + R_{0,1})(1 + f_{12}) (1 + f_{2,3}) (1 + f_{3,4}) \ldots (1 + f_{n-1,n})$

Modified Expectations Theory (MEH)

One problem underlying the PEH equilibrium condition is that all investors are assumed to be risk-neutral. From the above example, if investors expect the one-year rate to be 10.01%, they should be indifferent between holding the one-year rate of 8% or the two-year rate of 9%. However, holding a two-year bond entails a risk because the interest rate may turn out to be lower than 10.01%. If investors are risk-averse, they are likely to demand a higher rate to purchase a two-year bond. On average, most investors are risk-averse and will demand a premium to hold longer term bonds. This can be capured in the formula as follows:

$(1 + R_{02} + mp)^2 = (1 + R_{01}) (1 + f_{12})$

Investors will demand a maturity premium (mp) in order to invest in a long-term bond. The term premium in turn will vary according to maturity and the expected volatility of future inflation rates.

Other premiums

In additional to maturity premiums, investors will demand premiums on other features and characteristics of the bond.

1. Liquidity premium: Bonds that are less liquid may require a liquidity premium (lp). For example, government bonds or AAA-rated bonds issued by IBM are easier to sell than a BB-rated bond.

2. Default premium: Bonds with lower ratings may require an additional default premium compared to those with higher ratings (dp).

3. Foreign exchange: Bonds denominated in other currencies may require an additional premium to compensate for foreign exchange risk (fxp).

4. Tax premium: Bonds that are exempt from taxes may require a negative tax premium. Typically, municipal bonds are exempt for state and local taxes. Conversely, foreign bonds are subject to withholding taxes and investors may demand an additional premium to compensate for the tax disadvantage (tp).

The nominal rate for a given maturity can therefore be expressed as:

(1 + Real rate + Exp. Inflation rate + liquidity premium + default premium + other premiums)

Empirical evidence on effectiveness of Fed Funds targeting

As mentioned earlier, the Fed targets the fed funds rate or the interest rate charged between banks. If short term interest rates change, and if current expectations of future inflation rates are unchanged, there should be a parallel shift in the term structure of interest rates. The relationship is based on the PEH and MEH hypotheses that if forward rates deviate substantially from equilibrium rates, it opens up opportunities for arbitrage and speculation.

Empirical evidence however does not support the ability of the government to influence the whole term structure. There is evidence that the Fed has been successful in affecting short-term rates but not long-term rates which are influenced by other factors such as long-term inflation rates.

Negative Interest Rates

Is it possible to have negative interest rates? In other words, are people willing to lend money even if they will end up with a lower amount at maturity? At first glance, it appears to be illogical. At the minimum, based on the prior discussion on the Fisher effect, a lender should at least be compensated for the expected inflation rate. However, this may not happen if investors and lenders have very limited investments opportunities, especially during recessions. Under such scenarios, it may be logical for investors to pay banks to keep their money safe. As an example, assume a person has $1,000,000 in cash and lives in a small town currently in a recession. The only bank in town with a reputation for honesty is not taking any additional deposits because demand for loans are negligible. It is conceivable for a person to pay the bank to keep the money in its vault rather than under the mattress.

Germany, Denmark, Switzerland and the Netherlands experienced negative interest rates in 2011 during the European financial crisis. As the European crisis spread from Greece to Italy, Spain and Portugal, nervous European investors, including banks, insurance firms, pension funds and mutual funds, found their option to invest in risk-free government bonds limited to a few northern European countries. On December 11, 2011, the Netherlands government sold 107-day bills at a negative yield of 0.007 percent. On December 29, 2011, Denmark sold $308 million (1.8 billion kroner) of 59-day bills at a negative yield of 0.21 percent.[27] This was followed by Germany which sold 3.9 billion euros ($4.98 billion) of 6-month securities at an average yield of negative 0.0122 percent. In other words, investors were willing to park their money with the government and pay a premium instead of depositing them in banks because of the fear that banks themselves may fail.

The negative interest rates in the market eventually led several central banks to adopt negative interest rate policies. Central banks officially began to charge commercial banks for depositing their excess

[27] Various Wall Street Journal articles, January 10, 2012, May 23, 2012, August 10, 2012.

reserves with them. This action was meant to complement the quantitative easing adopted by many countries to stimulate the economy. Negative interest rates is also expected to encourage banks to lend more instead of keeping them as excess reserves. Sweden was the first country to officially adopt the policy in 2009 when it charged banks -0.25 percent for its one-week deposit facility. Although it affected a small portion of bank deposits, it set the path for other countries to follow. Denmark followed in July 2011 by charging banks -0.20 percent on certificates of deposit placed at its central bank, Danmarks Nationalbank. In June 2014, the European Central Bank (ECB) announced it would charge -0.10% for bank deposits.

In December 2014, Switzerland imposed a negative 0.25% rate for large bank deposits (demand deposits that exceed $10 million Swiss Francs). They pursued this strategy primarily to defend their currency pegged at SF 1.20/€. This move is not new to Switzerland as it had experimented with negative interest rates in 1972 when it charged as high as 10% per quarter (40% annually) to deter speculation on the Swiss franc. Finally, in January 2016, the Bank of Japan (BOJ) announced it would charge -0.10 interest on large bank deposits.

As of May 2016, the following central banks have officially implemented negative interest rates.

Country	Rate
Switzerland	-0.75
Sweden	-0.50
ECB	-0.40
BOJ	-0.10
Denmark	-0.65

It is unclear whether negative interest rates have been effective in encouraging lending or prevent the local currency from appreciating. The results as of 2016 are mixed. For example, the Japanese yen rose for a few months after the bank announcement and the European economy remained sluggish two years after the announcement by the ECB.

Deposit Insurance

An important institutional feature that usually falls under the purview of central banks is deposit insurance. Deposit insurance plays a major role in the financial intermediation process because it provides a cheap source of funding for financial institutions. It is a unique feature of modern day banking where deposits are insured against bank failures. Explicit deposit insurance was offered to the general public in 1934 in the aftermath of the Great Depression with the creation of the Federal Deposit Insurance Corporation (FDIC). During the depression, over 9,000 banks failed and bank runs were common throughout the country. The introduction of deposit insurance was a success with only 9 banks failing in 1934. The U.S. was the only country to offer explicit deposit insurance till the 1960s. Thereafter countries began to adopt them one by one and by 2009, over 100 countries provided deposit insurance to their citizens. China is the latest country to offer deposit insurance in 2015.

Background on Insurance

The history of insurance (not necessarily deposit insurance) goes back to the Babylonian period in 3,000 BC when maritime loans were forgiven if ships were lost at sea. A total of 282 clauses were devoted to such loans in the Code of Hammurabi around 1800 BC. In 1236, sea loans were condemned by Pope Gregory IX as usury and their use was prohibited. Needless to say, markets found ways to innovate and provide maritime financing without explicitly violating religious laws. For example, markets developed the cambium nauticum, a bill of exchange that paid off only upon the safe delivery of a ship's cargo. Because

interest was not calculated explicitly, but rather built into the payout of the contingent claim, the cambium nauticum avoided the usury rules. Such agreements eventually led to the creation of modern day insurance contracts.

The first insurance contract on record is dated 1343 in Genoa, Italy, where the insurer was also not a creditor. The tradition of insurance flourished first in Italy and then expanded to Northern Europe where the Hansa trading guilds of Bruges, Belgium, dominated the trade. England became a dominant insurer from modest roots planted in the 16th century. Queen Elizabeth granted Richard Candler the right to establish an insurance office in the Royal Exchange Building in 1574. However, it was Lloyd's coffee shop in Tower Street and later in Lombard Street in 1688 that became London's center for shipping information and maritime insurance. Underwriting and reinsurance risks of all kinds continue to flourish at Lloyds today.

Insurance or Betting

Theoretically, it is important to note that there is a fine line between insurance and betting. Providing insurance requires some quantifiable measure of risk. Only then can contracts be priced in terms of payoffs using probabilistic estimates. For example, estimates for life insurance can be generated based on the expected life of an individual. Although increases in life expectancy in the last 50 years were grossly underestimated, formal statistical techniques are available to estimate the likely life expectancies. Insuring against hurricanes or injury to an NBA basketball player however is more difficult, if not altogether impossible. One can conclude that insuring the injury of a basketball player is more of a wager than insurance.

Thus, an insurance contract is feasible only if the expected outcome can be predicted with some probability.

1. If an expected outcome can be predicted with a certain probability, it is feasible to establish fair insurance rates. The higher the probability of a negative outcome, the higher the premium.
2. If the expected outcome is difficult to predict, the choices are either to decline to offer insurance or charge a very high rate. If the higher rate is accepted, it is still a wager rather than an insurance.

History of Deposit Insurance

The history of deposit insurance in its present form began in New York State in 1829 when the State legislature under Governor Martin Van Buren passed the Safety Act. It required all banks to contribute 6% of their paid-in capital to a fund that would reimburse borrowers of a failed bank. Five eastern states adopted deposit insurance thereafter but none of these schemes survived beyond 1866. In the early part of the 20th century, eight western states introduced deposit insurance but they too succumbed to the agricultural depression of the 1920s.

In spite of the failures of the state deposit guarantee programs, the banking crisis of the early 1930s propelled Congress and the new Roosevelt administration to act. Over 150 proposals were submitted to Congress from 1866-1933 for a national deposit insurance system but they all failed in Congress.[28] In 1933, the Glass-Steagall Act (the Banking Act of 1933) formally established the FDIC and deposit insurance of $2,500 was offered for the first time to the public, effective January 1, 1934. In addition to a coverage

[28] Source; Federal deposit Insurance Corporation. Available at https://www.fdic.gov/bank/historical/brief/brhist.pdf.

ceiling, the initial rules for the FDIC included provisions for depositor coinsurance, and other mechanisms to reduce moral hazard.

Table 4.6

Deposit Insurance coverage in the Unites States (FDIC)	
Year	Amount
1934	$2,500
1934 (July 1)	$5,000
1950	$10,000
1966	$15,000
1969	$20,000
1974	$40,000
1980	$100,000
2008	$250,000

It took a severe crisis like the Great Depression to finally enact a national deposit insurance scheme. The initial rate was set at $0.083 or 8.3 cents per $100 of deposits (1/12 of one percent). Deposit insurance coverage was increased to $5,000 on July 1, 1934 and thereafter increased periodically with the most recent increase in 2008 to $250,000, as shown in Table 4.6.

Coverage Amounts

In the U.S., deposit insurance covers per depositor per account in a bank. A family therefore can receive far more coverage by depositing in different accounts and in different banks. For example, in the U.S., a married couple with one daughter, could accrue a total coverage cap of $2.0 million as a family if both the husband and wife have individual retirement accounts (IRAs) and Keogh private pension plans. The example below highlights the case:

1. $250,000 for his individual deposit account
2. $250,000 for her individual deposit account
3. $250,000 for their joint deposit account
4. $250,000 for their daughter's deposit account held in trust
5. $250,000 for his IRA account
6. $250,000 for his Keogh account
7. $250,000 for her IRA account
8. $250,000 for her Keogh account.

In contrast, the coverage in Europe is €100,000 per depositor per bank. Multiple accounts in one bank is ineligible for coverage beyond the €100,000. However, individuals can still receive additional coverage if they deposit in other banks.

Weaknesses of Deposit Insurance

It is still unclear whether deposit insurance provides positive benefits to society. The results for the U.S. industry is mixed. When deposit insurance was first implemented in the eastern states in 1829, western

states in early 1900s and nationally in 1933, the number of bank failures decline dramatically in the immediate aftermath. However, over time it appears that the failure rates return to pervious levels, if not higher.

In the case of the 1933 FDIC insurance program, the number of failed banks from 1943 to 1974 was in the single digits, as shown below. Thereafter it increased gradually till 1981. Interest rate mismanagement by savings and loans and excessive foreign lending by commercial banks led to a round of massive failures in the 1980s. Bank failures exceeded 100 per year between 1982 and 1992 and reached a peak of 543 failures in 1989. The next wave was during the recent financial crisis with 157 banks failing in 2010. Failures since the 1980s has been attributed to two factors, lack of depositor discipline and moral hazard.

Lack of Depositor Discipline

A major weaknesses of deposit insurance is that depositors no longer have incentives to monitor the activities of the bank. In the old days, when an individual deposited money in a bank, he or she was more than likely to check on the bank once in a while to ensure that the bank manager was around and performing his job adequately. The slightest rumor of a bank having a problem with payments would likely result in a bank run. Deposit insurances reassigns the monitoring process from the depositors to the regulators.

Table 4.7

Number of Bank Failures in the U.S. - FDIC							
Year	No. of failures	Year	No. of failures	Year	No. of failures	Year	No. of failures
2015	8	1994	15	1973	6	1952	3
2014	18	1993	50	1972	2	1951	2
2013	24	1992	180	1971	7	1950	4
2012	51	1991	271	1970	7	1949	4
2011	92	1990	381	1969	9	1948	3
2010	157	1989	534	1968	3	1947	5
2009	140	1988	470	1967	4	1946	1
2008	25	1987	262	1966	7	1945	1
2007	3	1986	203	1965	5	1944	2
2006	0	1985	180	1964	7	1943	5
2005	0	1984	103	1963	2	1942	20
2004	4	1983	98	1962	1	1941	15
2003	3	1982	117	1961	5	1940	43
2002	11	1981	38	1960	1	1939	60
2001	4	1980	22	1959	3	1938	74
2000	7	1979	10	1958	4	1937	75
1999	8	1978	5	1957	1	1936	69
1998	3	1977	5	1956	2	1935	25
1997	1	1976	17	1955	5	1934	9
1996	6	1975	12	1954	2		
1995	8	1974	4	1953	2		

Joshua Forman, the main architect behind the first deposit insurance scheme of New York State in 1829, recognized that depositors may no longer monitor banks when deposit insurance was offered. He proposed that banks receiving the privileges of deposit insurance accept the following:

1. Create a board of supervisors to monitor the activities of banks.
2. Restrict the kinds of investments banks could undertake to ensure they did not lend in risky sectors.

When the bill was signed into law, the supervisory board requirement was added but the restriction on investments was omitted. The subsequent failure of the deposit insurance scheme can be attributed to the lack of the restrictive provision. Bank failures multiplied because of excessive risk-taking by managers as a result of moral hazard behavior.

Moral Hazard

Moral hazard refers to the situation where one party benefits from the positive outcome of a risky project but the negative outcome is borne by another party. In the case of a bank, if the deposits are insured and the depositor does not bother to monitor the bank, managers have incentives to take on risky projects. If the project is unsuccessful, the FDIC will reimburse the depositors. If the project is successful, the manager (and shareholders) will reap the benefits. Most bank failures have been attributed to investments in loans that are riskier than average. The recent financial crisis is an example of banks foraying into high risk assets such as collateralized debt obligations (CDOs) and credit default swaps (CDS). Banks did not adequately price these instruments to compensate for their risk.

In theory, regulators have replaced the depositors in the monitoring the banks. Where were the regulators during the recent financial crisis? Unfortunately, bank regulation in the U.S. has been inconsistent since the 1980s. The constant tension between regulators and bankers (backed by politicians and lobbyists) resulted in regulatory forbearance during this period. In general, it is very difficult to design an optimal set of regulations for the financial services industry. In the case of deposit insurance, it appears to have worked well for nearly 40 years. Thereafter, regulators were unable to keep pace with technological and product innovation in banking and as a result allowed excessive risk-taking by banks.

Pricing

Another feature of deposit insurance that encouraged moral hazard behavior in banking is the fixed-rate deposit insurance pricing. In 1934, the price of deposit insurance was set at 8.3 cents per $100 of deposits. The price was determined by estimating the total losses in the banking industry between 1865 and 1934, excluding periods of financial crises. The 8.3 cent was estimated as the rate that would have covered all losses during that period. Since there were very few failures for the first 15 years after the introduction of deposit insurance, Congress feared the deposit fund would get too large. It passed the Federal Deposit Insurance Act in 1950 to provide rebates to banks whenever the assessment incomes were found to be greater than the expenses. It proved to be a mistake as the failures in the 1980s easily overwhelmed the deposit fund.

There are two problems with fixed-rate deposit insurance pricing:

1. As discussed above, it provides incentives for managers to engage in risky activities.
2. Institutions that take on less risk and hold more capital are subsidizing banks that take on more risk and hold less capital.

The massive bank failures in the mid-1980s and early 1990s led to the passage of the Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991. It required the FDIC to implement a risk-based

insurance pricing for deposits beginning January 1, 1994. The FDIC began to apply risk-based pricing as early as January 1, 1993 using two metrics, CAMELS ratings and capital ratios.

CAMELS

CAMELS are ratings assessed by bank regulators after on-site examinations. The acronym stands for the strength of the bank in the following areas:

C = Capital adequacy
A = Asset quality
M = Management
E = Earnings
L = Liquidity
S = Sensitivity

After the examination, a composite ranking based on the above factors is generated. Ratings of 1 and 2 indicate banks are in a strong position while 3, 4 and 5 are considered weak by supervisors. CAMELS ratings are not released to the public but only to the senior management of the bank.

The initial risk-based pricing per $100 in deposits were set as follows on January 1, 1993:

Table 4.8

	Supervisory Group		
Category	A (Camels Rating 1 and 2)	B (Camels Rating 3)	C (Camels Rating 4 and 5)
Well Capitalized	23 cents	26 cents	29 cents
Adequate Capitalized	26 cents	29 cents	30 cents
Under Capitalized	29 cents	30 cents	31 cents

Since the economy continued to do well between 1993 and 1997, the FDIC fund reached its target of 1.25% of insured deposits. Thereafter, premiums were decreased to the following on January 1, 1997.

The risk-based pricing per $100 in deposits was reduced as follows on January 1, 1997:

Table 4.9

	Supervisory Group		
Category	A (Camel Rating 1 and 2)	B (Camel Rating 3)	C (Camel Rating 4 and 5)
Well Capitalized	0 cents	23cents	17 cents
Adequate Capitalized	3 cents	10 cents	24 cents
Under Capitalized	10 cents	24 cents	27 cents

Needless to say, ten years later, the recession forced many banks into bankruptcy and depleted the FDIC fund. The FDIC however managed to avoid borrowing money from the Treasury by charging up-front premiums to the surviving banks to fill the deposit fund again. They also introduced a new set of higher rates by including brokered deposits and unsecured liabilities.

The new risk-based pricing modified in 2009 is as follows:

Table 4.10

	Risk Category I	**Risk Category II**	**Risk Category III**	**Risk Category IV**
Initial Base Assessment Rate	12 – 16	22	32	45
Unsecured Debt Adjustment (added)	-5 to 0	-5 to 0	-5 to 0	-5 to 0
Secured Liability Adjustment (added)	0 to 8	0 to 11	0 to 16	0 to 22.5
Brokered Deposit Adjustment (added)	N/A	0 to 10	0 to 10	0 to 10
Total Base Assessment Rate	7 to 24.0	17 to 43.0	27 to 58.0	40 to 77.5
Risk Category I	Well Capitalized with generally a CAMELS composite of 1 or 2			
Risk Category II	Well Capitalized with generally a CAMELS composite of 3; or Adequately Capitalized with generally a CAMELS composite of 1, 2, or 3			
Risk Category III	Well or Adequately Capitalized with generally a CAMELS composite of 4 or 5; or Under Capitalized with generally a CAMELS composite of 1, 2, or 3			
Risk Category IV	Under Capitalized with generally a CAMELS composite of 4 or 5			

In sum, deposit insurance plays an integral part in the U.S. banking system. It is an insurance program run by the government, and administered by the central bank, on behalf of the average saver who holds deposits in commercial and savings banks. Unfortunately, depositor indifference generates a moral hazard problem that encourages banks to engage in risky activities that has often resulted in major bank failures. Regulators have responded by requiring risk-based pricing to ensure that banks are discouraged from excessive risky lending. Unfortunately, even with active monitoring and risk-based premiums, regulators were unable to stop some of the large banks from taking excessive risks during the 2008 financial crisis.

Summary of the Chapter

This chapter covers the role of central banks in managing the financial system of an economy. The primary responsibility of a central bank is to issue national currency, manage monetary policy and maintain financial stability. Monetary policy is implemented by using three tools, open market operations, reserve requirements and the discount rate. In the U.S. and Europe, central banks use discount rates as their primary monetary policy tool while reserve requirements are used more in India and China.

Banks set aside reserves to protect themselves against unanticipated withdrawals. In the U.S., the Fed requires banks to maintain reserves as per Regulation D and provides a two-week computation and a two-week maintenance period. In most countries central banks do not pay interest on cash balances held at the central bank but there are exceptions. The Fed, for example, has paid interest rates on both required and excess reserves since 2008. In contrast, the Swiss National Bank has charged banks since 2014 for holding balances with them.

The chapter also covers the term structure of interest rates. The minimum interest rates are defined by the Fisher Effect which states that the nominal rate of a risk-free security is equal to the expected inflation rate plus the real rate. The upper bound is unlimited and will depend on factors specific to the borrower and the economic environment. The interest rates of different maturities can be explained by the Pure Expectations Hypothesis and the Modified Expectations Theory.

Finally, central banks around the world offer deposit insurance to protect small savers from the unlikely event of a bank failure. Federal deposit insurance began in the U.S. in 1934 after the Great Depression. It is now offered in more than 100 countries with China being the latest to adopt in 2015. Deposit insurance has been blamed for moral hazard problems in the banking industry where the lack of depositor discipline provides banks with incentives to take on added risk. Deposit insurance pricing has been modified in recent years from fixed-rate pricing to risk-based pricing. In the U.S., the pricing of deposit insurance depends on the CAMEL ratings, capital levels, brokered deposits and secured and unsecured liabilities.

End of Chapter Questions

1. Explain the four major goals of monetary policy of central banks using the Fed as an example.

2. How does reserve requirements protect a bank? Explain why the Fed requires reserves on demand deposits but not on time deposits or savings accounts.

3. A bank receives $350 million in deposits. At the same time, the central bank increases the reserve requirements for demand deposits from 10% to 16%. Estimate the impact on the total loans distributed into the economy before and after the change in reserve requirements.

4. The central bank decreases the reserve requirements for demand deposits from 15% to 12% when a bank receives $600 million in deposits. Estimate the impact on the total loans distributed into the economy before and after the change in reserve requirements.

5. First Bank Inc. has estimated that its average daily demand deposits during its recent reserve computation period was $580 million.

    a. What is the average daily required reserves to be held by the bank during the maintenance period? Under current regulations, the reserve requirement is 0% for the first $15.2m, 3% between $15.2m - $110.2 million and 10% thereafter.
    b. The bank has maintained an average of $5.77m per day as cash in vault and $52.4m per day as reserves at the Fed during the maintenance period. Is the bank in compliance with the requirements for the current period? Explain.
    c. How much fed funds should they have purchased or sold during the maintenance period in order to maintain the exact reserve requirements?

6. Apple Bank Inc. has estimated that its average daily demand deposits during its recent reserve computation period was $990 million.
    a. What is the average daily required reserves to be held by the bank during the maintenance period? Under new regulations, the reserve requirement is 0% for the first $15.2m, 3% between $15.2m - $110.2 million and 10% thereafter.
    b. The bank has maintained an average of $6.87m per day as cash in vault and $82.4m per day as reserves at the Fed during the maintenance period. Is the bank in compliance with the requirements for the new period? Explain.
    c. How much fed funds should they have purchased or sold during the maintenance period in order to maintain the exact reserve requirements?

7. Explain the Fisher Effect. If the nominal rate on a one-year risk-free bond is 12% and the expected inflation is 8%, what is the real rate demanded by lenders?

8. If the nominal rate on a one-year risk-free bond is 14.5% and the expected inflation is 6%, what is the real rate demanded by lenders?

9. If a one-year AAA-rated bond is yielding 4.5% and a four-year AAA-rated bond is yielding 8.2% , what should be the three-year forward rate from period one to four be yielding?

10. The discount rate for a two-year AAA-rated bond is 6.5% and a six-year AAA-rated bond is yielding 9.5%, what should be the four-year forward rate from period one to six be yielding?

11. Explain the difference between the Pure Expectations Hypothesis and the Modified Expectations Hypothesis versions of the term structure of interest rates.

12. Explain how it is possible to have negative interest rates. Provide examples.

13. How does deposit insurance encourage moral hazard in banking? How does risk-based pricing alleviate the moral hazard problem?

14. Define brokered deposits and its relationship to the moral hazard problem in banking. How does brokered deposits affect the new rules on deposit insurance pricing?

ProBanker Assignment 2

This assignment will demonstrate the sensitivity of loans and deposits to changes in interest rates (price elasticity of demand) and its impact on discount window advances. The basic bank in ProBanker has the following features.

a. Demand for loans will increase if interest rates are reduced (some customers will remain loyal but others will take the opportunity of the lower rates).
.

b. Supply of deposits will increase if interest rates are increased (some customers will remain loyal but others will take the opportunity of the higher rates).

c. If loan demand exceeds available funds (from deposits, CDs and equity), the program will force banks to borrow from the central bank through the discount window advances at a penalty rate.

d. Federal funds are short term loans between banks that can be used to cover shortfalls in funding and prevent a bank from accessing the discount window.

Please note that in Autosim you are playing solo against the computer. If you are in a competitive game, the results can be different because demand and supply are affected by the decisions of your competitors.

Assignment 1:

1. Create a personal **Autosim**.

    a. Click on *Games*.
    b. Click on *New Autosim game*.
    c. Select ***Assignments Regional Bank*** **template** in *using template.*
    Note: *Make sure* ***NOT*** *to choose* ***Sample Regional Bank*** *template.*
    d. Type a name for the new Autosim in *New game's name*
    e. Example "John Roger Assignment 2"
    f. Click on *Create Game*
    g. You can create as many Autosims as you wish

2. Input decisions to your new Autosim. There are four categories of decisions – '**Account *Quantities, Account Interest Rates, Advertising*** and ***Other Decisions.***

    Click on ProBanker icon on the top left to go to the home page.
    a. Click on *View Games.*
    b. Select your newly created Autosim.
    c. Click on *Play bank.*

3. **Account Quantities** – change the following:
    a. Target Reserves for Deposits = $25,000
    b. Federal Funds Purchased (not Sold) = $50,000
    c. 360 Days CDs to Issue = $50,000
    d. New Bonds to Purchase = $15,000
    e. The remaining boxes should all be zeroes.

4. **Account Interest Rates** - Reduce loan rates by 0.3 percent and increase deposit rates by 1%
    a. Reduce Fixed Rate Corporate Loan Rate = 9.00 percent
    b. Reduce Floating Rate Loan Spread = 3.70 percent
    c. Reduce Installment Loan Rate =10.70 percent
    d. Reduce Mortgage Loan Rate = 8.70 percent
    e. Increase Retail CDs Rate = 7.00 percent
    f. Increase Passbook Savings Rate = 6.00 percent
    g. Increase Long-Term Retail Deposits Rate = 8.50 percent
    h. The remaining boxes should all be zeroes.

5. **Advertising** – Leave as is (150, 80,410,580,290,140, 60)

6. **Other decisions** – Leave as is (0, 1, 0, 0, 100, 100)

7. *Simulate next period* (on left side of the screen). After a few seconds, you will notice a flicker and it should say **End of Period 1.** You are ready to review the results.

8. Record the results of quarter 1 in the shaded cells of table below by clicking on Reports. Alternatively, you can copy and paste from the Excel file '*Download full reports'* in Excel. Estimate the percent change from Q0 to Q1 in the shaded boxes and answer the questions below. Consult the manual for additional explanations on the variables.

    a. Were the reserve requirements sufficient? Explain the numbers under "excess reserves" and "discount window advances."

    b. Rates on Fixed, Floating, Installment and Mortgage loans were reduced by 0.3 percent (from 9.3% to 9.0% etc.). Which loans were impacted the most and which the least?

    c. Rates on Passbook Deposits, Retail CDs and Long-term Retail Deposits were increased by 1%. Which deposits were impacted the most and which the least?

    d. There are no interest rates for retail and corporate demand deposits. What likely factors can explain the change in volume of deposits?

<u>Assignment 2 continued</u>

9. Input decisions for quarter 2 as given below:

10. **Account Quantities** – change the following
    a. Target Reserves for Deposits = $25,000
    b. Federal Funds Purchased = $50,000
    c. 90-day CDs to issue = $25,000
    d. 180-day CDs to issue = $25,000
    e. 360 Days CDs to Issue = $50,000
    f. New Bonds to Purchase = $15,000
    g. The remaining boxes should all be zeroes

11. **Account Interest Rates** - Reduce loan rates by an additional 0.3 percent and increase deposit rates by an additional 1%

    a. Reduce Fixed Rate Corporate Loan Rate = 8.70 percent
    b. Reduce Floating Rate Loan Spread = 3.40 percent
    c. Reduce Installment Loan Rate =10.40 percent
    d. Reduce Mortgage Loan Rate = 8.40 percent
    e. Increase Retail CDs Rate = 8.00 percent
    f. Increase Passbook Savings Rate = 7.00 percent
    g. Increase Long-Term Retail Deposits Rate = 9.50 percent

12. Simulate next quarter and record the results of quarter 2 under Quarter 2 in the table and estimate the percent change from Q1 to Q2.

    a. Were the reserve requirements sufficient? Explain.

    b. Rates on Fixed, Floating, Installment and Mortgage loans were reduced further by 0.3 percent. Which loans were impacted the most and which the least?

    c. Rates on Retail CDs, Passbook Savings and LTRDs were increased by 1%. Which deposits were impacted the most and which the least?

ASSETS	Q0	Q1	Q2	Percent Change Q0 to Q1	Percent change Q1 to Q2
Required Reserves (at the Federal Reserve)					
Excess Reserve Balances (at other commercial banks)				.	
Federal Funds Sold					
Fixed Rate Corporate Loans					
Floating Rate Corporate Loans					
Installment Loans					
Mortgages					
Bonds					
Fixed Assets					
Loan Loss Allowance					
Total Assets					
LIABILITIES					
Federal Funds Purchased					
Retail Demand Deposits					
Corporate Demand Deposits					
Negotiable CDs					
Passbook Deposits					
Retail CDs					
LTRDs					
Discount Window Advances					
Net Worth and Retained Earnings					
TOTAL LIABILITIES AND NET WORTH					

ProBanker Assignment 3

This assignment will demonstrate the importance of calculating the all-in-cost of borrowed funds (liabilities such as deposits and CDs) and net return of earning assets (loans and bonds).

The all-in costs include costs associated with the procurement of deposits. In the case of passbook savings, it will include interest expense and operating costs related to advertising, originating and maintaining the account. In the case of demand deposits, only operating costs are relevant since demand deposits pay no interest. Thus, all-in-cost includes both direct and indirect costs.

Net returns on loans are the net interest income earned on loans less costs associated with advertising, originating and maintaining loans.

The goal of a bank is to maximize the difference between average net return of earning assets and the average all-in cost of borrowed funds.

All-in-Cost of Liabilities (Borrowed funds)

Fill in the worksheet below to estimate the all-in-cost of the liabilities using the same results of **Quarter 2 of Assignment 2** of your Autosim that was created using the *Assignments Regional Bank Template*.

1. The contract rate is the rate quoted to the client, expressed as an annual percentage rate (enter twelve percent as 12.00).
2. Express operating and advertising costs and FDIC premium as an annualized percentage of the associated account balance. For example, a cost of $2 per quarter associated with a $100 account balance should be entered here as 8.00 percent per year.
3. Assume operating costs for many loan and deposit types reflect both the account balances and recent changes in those balances. As long as your bank's account balances are not swinging wildly, you can safely ignore the "change" component of operating costs, and assume that all costs are proportional to outstanding account balances.
4. Be careful to annualize all expense and loss ratios. That is, the quarterly operating cost ratio must be multiplied by four to compare an annual operating cost ratio with an annual contract rate of interest.
5. It will save you some computations to know that the transaction cost per dollar bought is the same for FFP, FFS, and negotiable CDs.
6. Fee income is for demand deposits only.

Important:
Please see sections 4.4 and 6.1 of your student manual for additional details.

Worksheet 1: Liability Costs									
For each of the following liabilities, compute the "all-in" cost of new loanable funds.									
	Federal Funds Purchased	Demand Deposits Retail	Demand Deposits Corporate	Passbook Savings	Negotiable Certificates of Deposit			Retail Certificate of Deposits	Long-term Retail Time Deposits
	FFP	DDR	DDC	PASS	1-period	2-period	4-period	RCD	LTRD
1. Contract Rate									
2. Operating Costs									
3. Advertising									
4. Fee Income									
5. FDIC Premium									
6. All-in Cost of These Deposits									
7. Reserve Requirement (%)									
8. Average Cost of Loanable Funds									

All-in-all Cost of Assets

Fill in the worksheet below to estimate the all-in-cost of the liabilities using the same results of **Quarter 2 of Assignment 2** of your Autosim that was created using the Assignments Regional Bank Template.

1. The contract rate is the rate quoted to the client, expressed as an annual percentage rate (enter ten percent as 10.00).
2. Express operating and advertising costs as an annualized percentage of the associated account balance. For example, a cost of $2 per quarter associated with a $100 account balance should be entered here as 8.00 percent per year.
3. Be careful to annualize all expense and loss ratios. That is, the quarterly operating cost ratio must be multiplied by four to compare an annual operating cost ratio with an annual contract rate of interest.

Worksheet 2: Net Return of Assets						
Compute the net return for each of the following assets.						
	Federal Funds Sold	**Fixed-Rate Loan**	**Floating-Rate Loan**	**Installment Loan**	**Mortgage Loan**	**Government Bonds**
	FFS	FR	FL	INST	MORT	BONDS
1. Contract Rate						
2. Operating Costs						
3. Advertising						
4. Default Rate						
Net Return on Individual Assets						

Important:
Please see sections 4.4 and 6.1 of your student manual for additional details.

5

Chapter 5 - INTEREST RATE RISK

Introduction

As discussed in Chapter 1, commercial banks are part of a group of financial institutions that serve as financial intermediaries to channel money from savers to users. They face two major risks in the financial intermediation process.

1. **Interest Rate Risk** is defined as the risk associated with unanticipated changes to interest rate changes, affecting the profitability and market value of existing loans.
2. **Credit Risk** is defined as the risk of default to loans once they have been disbursed. It includes partial and delayed payments of principal and interest that usually occurs prior to a default.

This chapter covers interest rate risk management and the next chapter covers credit risk management.

Maturity Intermediation

As discussed in chapter 1, commercial banks are considered asset transformers because they convert one form of assets, short-term deposits, to another form of assets, long-term loans. This differences in maturity enable them to earn a spread between the borrowing and lending rates because short-term rates are lower than long-term rates when the yield curve is upward sloping. In other words, they engage in ***maturity intermediation***. Maturity intermediation, however, exposes banks to interest rate risk.

Interest Rate Risk

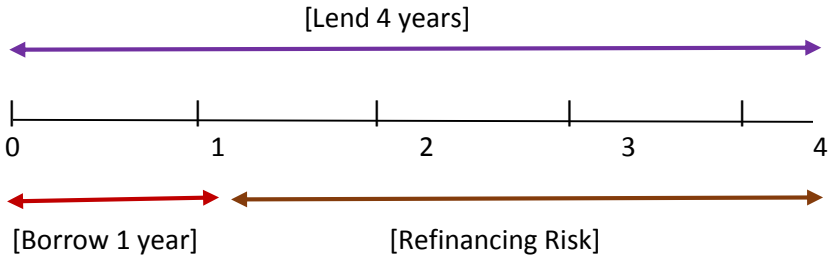
Financial intermediaries incur two forms of interest rate risk, **refinancing risk** and **reinvestment risk**.

Refinancing Risk

Refinancing risk refers to the likelihood that a bank may have to refinance its borrowings at a higher rate at maturity. This can happen if it borrows short-term and lends long-term. Assume a bank issues a $100 1-year certificate of deposit (CD) at 3% as shown in the box below. It has the option of investing the $100 in the following manner:

Deposit	Loan (Low Risk)	Loan (High Risk)
1 year at 3.0%	1-year at 3.25%	1-year at 4.00%
	2-year at 3.75%	2-year at 4.25%
	3-year at 4.25%	3-year at 4.50%
	4-year at 4.75%	4-year at 5.00%

The bank can earn a spread of 1.75% by lending to low-risk customers for 4-years at 4.75%. If it is willing to take on additional risk, it could lend to high-risk clients at 5% and earn a spread of 2%. Irrespective of which client it lends, borrowing short-term and lending long-term is an inherently a risky strategy because a depositor may not renew the deposit at maturity, forcing the bank to seek alternate sources of funding that may cost more than its earning assets. This risk is termed **refinancing risk**, as shown below**.**



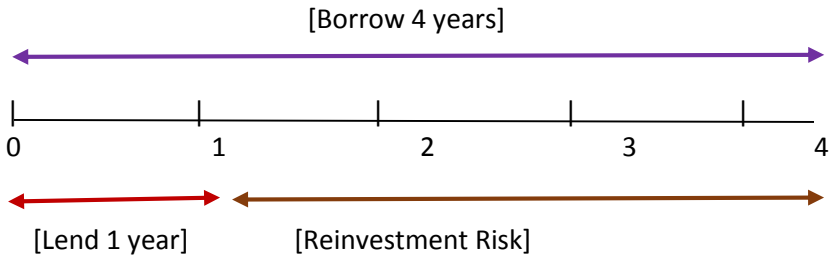
A depositor may choose not to renew because market interest rates may have risen in the interim period or other banks may be offering higher rates. If the bank is forced to offer higher interest rates in order to attract $100 to repay the depositor, it will earn a lower spread. At the extreme, if the bank pays more than 5.00%, it will earn a negative spread since it only earns 5.00% on its 4-year loan.

Reinvestment Risk

Reinvestment risk is the opposite of refinancing risk and occurs when a bank borrows long-term and lends short-term. Assume a bank is expecting interest rates to rise and would like to lock on the current low interest rates. It issues a 3-year $100 certificate of deposit (CD) at 3%. The bank has the option of lending the $100 as shown in the text box.

The bank will earn a positive spread if it lends for 3 years at 3.50% to low-risk clients and 3.75% to high-risk clients. If it expects interest rates to increase, it could lend at 3.00% for one year and hope for the interest rates to increase the following year. If it does not wish to take a loss, it can lend to riskier clients at 3.25% for one year. This is an inherently risky strategy because if interest rates decrease instead of increase, it will earn a negative spread. This exposure is termed reinvestment risk.

Deposit	Loan (safe client)	Loan (risky client)
3-year at 3.0%	3-year at 3.50%	3-year at 3.75%
	2-year at 3.25%	2-year at 3.50%
	1-year at 3.00%	1-year at 3.25%



In sum, the impact of interest rate changes on banks facing reinvestment and refinancing risk is as follows:

Refinancing Risk	- banks lose if interest rates increase - banks gain if interest rates decrease
Reinvestment Risk	- banks gain if interest rates increase - banks lose if interest rates decrease

Refinancing Risk

The Savings and Loan Crisis

One of the best examples to illustrate the impact of refinancing risk is the Savings and Loans (S&Ls) crisis in the United States during the 1980s. S&Ls were primarily small banks, mostly in the Northeastern United States, that relied on savings deposits for funds to finance their primary assets, mortgages. The S&L loan crisis also included savings banks. Savings banks were similar to S&Ls except they offered individual and business loans in addition to mortgages.[29] The term S&Ls in this chapter will refer to both groups of banks.

Prior to the 1980 crisis, S&Ls followed the very traditional business of accepting deposits from small savers in their local vicinity and disbursing them in the form of long term 30-year mortgages. The business was never considered risky because the interest rate environment in the United States remained low for many decades during the first three decades after World War II. It was so sedate that it was termed the 3-6-3 business; managers accepted deposits at 3%, made mortgages at 6%, and were at the golf course by 3:00 PM. Studies have shown that the non-competitive behavior of S&Ls can be traced to the strict restrictions placed on deposit and loan interest rates by regulators.

In the 1970s, interest rates began to rise as a result of global events. In 1973, the OPEC cartel (Organization for Petroleum Exporting Countries) raised the price of oil drastically. The expected increase in inflation rates led to an increase in interest rates. OPEC raised oil prices again in 1979 leading to further increases in interest rates. As Table 51 shows, the monthly prime rate, charged by banks for their most favored clients, exceeded 18% in 1.981.

[29] They were also supervised and insured by different regulators. Savings and Loans institutions were supervised by the Federal Home Loan Board and insured by the Federal Savings and Loans Insurance Corporation (FSLIC), while mutual savings banks were supervised and insured by the Federal Deposit Insurance Corporation.

Table 5.1

Historical Average Monthly Prime Rates (charged by banks to their best customers for short-term loans) Source: Federal Reserve (H.15), April 2016												
1956	1966	1971	1973	1974	1979	1980	1981	1990	2000	2007	2014	2016
3.77	5.63	5.73	8.03	10.81	12.67	15.26	18.87	10.01	9.23	8.05	3.25	3.50

As market interest rates began to rise, S&Ls began to face stiff competition from non-banks offering money market mutual funds at high interest rates. S&Ls had to reciprocate by offering higher interest rates to prevent withdrawals. Unfortunately, market interest rates continued to increase and exceeded the rates earned on their mortgages.

For illustration, assume a bank makes a 30-year, $100 mortgage at 6% funded by a one-year deposit at 3%. The balance sheet is shown below.

Mortgage (6%, 30-years)	= $100	Deposits (3%, 1-year)	=$100
Total Assets	= $100	Total Liabilities	= $100

Assume interest rates rise and depositors request withdrawal of the $100 because they have been offered higher rates at other financial institutions.

The bank is faced with two options:

1. Close the bank and let the government (FSLIC or FDIC) pay the depositors $100. The government will attempt to salvage the $100 loan, most likely by selling it to another bank.
2. Offer higher interest rates to attract additional deposits and make new loans at a higher rate to compensate for the low rates of current loans.

Note that option 2 requires banks to attract sufficient deposits to compensate for the old loans that were disbursed with lower rates. For the above example, assume the bank is able to offer 8% and attract as much deposits as possible. How much deposits should it attract to stay solvent if it can make new loans at 14%? The bank should attract at least $133.33 of deposits at 8% and be able to make $33.33 of new loans at 14% to compensate for the low rates of their prior loans.

Check

Mortgage new (14%)	= $ 33.33	Deposits (8%, 1-year)	= $133.33
Mortgage old (6%, 30-year)	= $100.00		
Total Assets	= $133.33	Total Liabilities	= $133.33

Interest expense: 133.33 x .08 = $10.67
Interest Income: 100 x .06 + 33.33 x .14 = 6 + 4.67 = 10.67

Instead of allowing the S&Ls to fail, the government opted to encourage banks to take the second choice as they were unwilling to bear the political consequences of closing down S&Ls across the nation. Congress

passed a number of bills to ease the restrictions on the lending practices of S&Ls. The laws initially spurred a growth in the assets of S&Ls. Unfortunately, several of them also took on too many risky investments, primarily in real estate and high-yielding (junk) corporate bonds, and the rapid growth eventually forced many of them into bankruptcy. Over 700 thrifts were closed and the final costs to the taxpayer has been estimated at approximately $48.90 billion.

The S&L crisis provides a perfect example of the risks involved when banks borrow short-term and lend long-term. Active management of interest rate risk is critical if a bank is to avoid refinancing or reinvestment risk. One of the tools available for managing interest rate risk is GAP analysis, discussed next.

Managing Interest Rate Risk

Asset Liability Management

Interest rate risk is the measure of exposure of a bank's financial health against potential adverse movements in interest rates. As mentioned earlier, most banks borrow short-term and lend long-term to earn a positive spread on their loans. They are constantly exposed to refinancing risk and spend considerable time ensuring that they have sufficient liquidity and access to short-term funding to protect against unanticipated withdrawals. Interest rate risk should be considered as part of the normal risk for financial institutions because they provide the revenues and profitability if it is managed well. However, excessive risk exposure could potentially lead a bank into default; hence the need for an effective interest rate risk management process.

The management of interest rate risk exposures falls under the rubric of asset-liability management or ALM. Banks have always been concerned about ALM because of the mismatch in maturities between loans and deposits. It is very important for banks to have sound ALM practices because it not only prevents a liquidity shortfall but also can enhance the long-run performance such as net interest margin, return on equity and return on assets.

Managing ALM requires an understanding of the following:

1. Sources of interest rate risk
2. Financial impact of interest rate risk

Once the sources and impact of interest rate risks are identified and understand, we can evaluate the various measures available to managers to manage them.

Sources of Interest rate risk

There are four sources of interest rate risk.

1. Repricing risk
2. Yield curve risk
3. Basis points risk
4. Embedded options risk

Repricing risk

Repricing risk occurs when there are timing differences in the:

a. maturity of fixed-rate assets, liabilities and off-balance sheet (OBS) contracts
b. repricing of floating-rate assets and liabilities and off-balance sheet contracts

An example of maturity mismatch was provided earlier, but we present one below where the timing of the repricing differs between assets and liabilities. Consider a bank that borrows $100 million in deposits at a floating rate of T-Bill plus 2% and lends at T-Bill plus 4%, earning a spread of 2%, as shown below.

Bank A				
Loans			Deposits	
T-Bill + 4%	$100		T-Bill + 2%	$100
Reset semi-annually			Reset quarterly	
Total	$100		Total	$100

The deposits are reset quarterly, i.e. interest rates will change every quarter based on the T-Bill rate. In contrast, the loans are reset semi-annually, i.e. interest rates will change every six months based on the T-Bill rate. If interest rates increase in the first quarter, the bank will incur higher costs for deposits and reduce their spread for the quarter.

For example, assume the T-Bill rate was 3% when the loan was disbursed. The spread is given as follows:

Return on Loan	= 7%	(3% + 4%)
Cost of deposit	= 5%	(3% + 2%)
Spread	= 2%	

Assume by the first quarter, the T-Bill rate increases to 4%. The spread for the second quarter is now lower:

Return on Loan	= 7%	(3% + 4%)
Cost of deposit	= 6%	(4% + 2%)
Spread	= 1%	

Alternatively, if interest rates fall by the first quarter, the bank will increase its spread for that quarter.

Yield curve risk

Yield curve risk occurs when the term structure of interest rates (yield curve) shifts and impact net earnings even if the maturities and the timings of the repricing are similar. Consider a bank that borrows $100 million in deposits at a floating rate of T-Bill plus 2% and lends at T-Bill plus 4%, earning a spread of 2%, as shown below. Both rates are reset semi-annually. However, the benchmark T-Bill for deposits is the 6-month T-Bill while that for loans is the 3-month T-Bill, as shown below.

Bank A				
Loans			Deposits	
3-month T-Bill + 4%	$100		6-month T-Bill + 2%	$100
Reset semi-annually			Reset semi-annually	
Total	$100		Total	$100

Assume the 3-month T-Bill rate was 3.0% and the 6-month T-Bill rate was 3.25% when the loan was disbursed. The spread is given as follows:

Return on Loan	= 7.00%
Cost of deposit	= 5.25%
Spread	= 1.75%

Assume six months later, average interest rates increase by about 1%. If there is parallel shift in the term structure, the spread will remain the same. However, if the 6-month rate increases to 4.50% while 3-month rates increase to 4.0%, the spread drops from 1.75% to 1.5%.

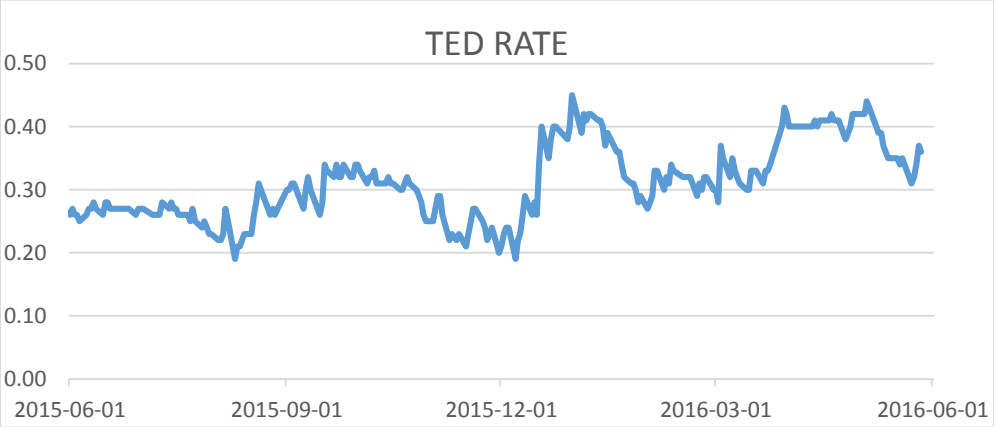
Return on Loan	= 8.00%
Cost of deposit	= 6.50%
Spread	= 1.50%

As the slope of the yield curve increases, the higher interest rates reduces the spread on the loan.

Basis points risk

Basis points risk occurs when the benchmark rates for pricing the loans and deposits are different. The two most popular benchmark rates used for financial instruments are the LIBOR and Treasury Bill rates. Most of the time the rates move together. The difference is called the TED spread; the difference between the three-month Treasury Bills (**T**) and the three-month Eurodollar (ED) certificates of deposit. An increase in the TED spread indicates that credit conditions have deteriorated in the market, as investors choose risk-free Treasury bills over Eurodollar deposits.

Figure 1



Source: Federal Reserve Bank of St. Louis, TED Spread. https://research.stlouisfed.org/fred2/series/TEDRATE/, June 03, 2016.

Figure 1 shows the TED rate, defined as the difference between the daily LIBOR and 3-month T-Bill rates, for the period June 2015 to May 2016. As the graph showed, the difference fluctuates between 20-50 basis points.

Consider a bank that borrows $100 million in deposits at a floating rate of T-Bill plus 2% and lends at LIBOR plus 4%. Both rates are reset semi-annually. Normally, both rates move together. Assume the 3-month LIBOR rate was 3.20% and the 3-month T-Bill rate was 3.0% when the loan was disbursed. The spread is given as follows:

Bank A				
Loans			Deposits	
3-month LIBOR + 4%	$100		3-month T-Bill + 2%	$100
Reset semi-annually			Reset semi-annually	
Total	$100		Total	$100

Return on Loan = 7.20%
Cost of deposit = 5.00%
Spread = 2.20%

Assume six months later, average interest rates increase by about 1%. If both LIBOR and T-Bill rates increase by 1%, the spread will remain the same. However, if the 3-month LIBOR rate increases to 4.20% while 3-month T-Bill rates increase to 4.10%, the spread changes as follows:

Return on Loan = 8.20%
Cost of deposit = 6.10%
Spread = 2.70%

The change in the basis between LIBOR and the T-Bill reduces the spread from 2.20% to 2.10%.

Embedded options risk

Embedded options risks occur when there are payment options embedded in the loans and deposits that can affect final interest payments. There are many types of options imbedded in deposits and loans. One example is the prepayment feature in mortgage loans where borrowers can prepay their loans without incurring penalties. Prepayments can occur for many reasons but one important determinant is interest rate. As interest rates decline, the percentage of prepayments increase because borrowers will opt to refinance their loans. This will force banks to reinvest the repaid principal at lower rates. In the case of deposits, an increase in interest rates can result in withdrawals from demand deposits and savings accounts, requiring banks to acquire higher costs funds.

Financial Impact of interest rate risk

The financial impact of interest rate risk on financial institutions can be separated into two main categories:

- impact on current earnings
- impact on the economic value of the firm

IMPACT ON CURRENT EARNINGS

As shown above, when interest rate changes, the impact on a bank's earnings depends on the maturity mismatch and the differences in the timing of repricing of assets or liabilities. Banks monitor their assets and liabilities continuously and keep track on maturing assets and liabilities to assess potential loss in the event of an unanticipated change in interest rates. The earlier examples used only one asset and one liability. The example below shows a bank with two kinds of fixed-rate loans and deposits. The interest

rate and maturity are reported in parentheses. We will ignore equity for the moment. All interest rates are quoted p.a. or per annum.

Bank A			
Loan A (6%, 1 year)	= $100	Deposit A (3%, 3 months)	= $250
Loan B (9%, 2 years)	= $200	Deposit B (5%, 1 year)	= $ 50
Total Assets	= $300	Total Liabilities	= $300

The average maturity of the assets is larger than that of the deposits, as is typical of most banks.

The annual interest income on its loans is as follows -
(.06 x $100) + (.09 x $200) = $24 or $24/300 = .08 or 8.0%

The annual interest expense on its deposits is as follows -
(.03 x $250) + (.05x$50) = $10.50 or $10.0/$300 = .033 or 3.3%.

The net interest margin or spread is 8% - 3.3% = 4.7&

In other words, the bank is paying 3.3% on its deposits % to earn a 4.7% spread on its loans.

The risk to the bank is the mismatch of maturities among the loans and deposits. Deposit A matures every three months. If interest rates increase during this period, the spread on the overall portfolio will be reduced. For example, assume that the deposit rates in three months increase from 3% to 4.5%. The interest expense will now be (.045 x $250) + (.05x$50) = $13.75
or $13.75/$300 = .0458 or 4.58%. The spread will be reduced to 3.42% (8% - 4.58%).

If market interest rates increase dramatically, it is possible for the spread of the portfolio to become negative. What interest rates will drive the spread to zero?

To solve the problem, we need to note that Deposit A and B cannot pay more than the earnings of the two loans, A and B. Loans A and B earned a combined total of $24. Deposit B incurs interest expense of $2.50. Hence the maximum that can be paid on Deposit A is

Interest expense (Deposit A) = $24-$2.50=$21.50/$250 or 8.6%.

If the bank is forced to borrow at 8.6% or higher (which could happen during periods of economic uncertainty), the bank would incur a loss. This kind of analysis forms the basic model for interest rate risk management, termed GAP analysis and Earnings at Risk (EAR).

GAP Analysis and Earnings at Risk

In managing interest rate risk, the first step is the estimation of GAP followed by the estimation of earnings at risk (EAR).

Measurement of GAP

GAP refers to the difference in the average maturities between assets and liabilities that are subject to interest rate changes in a specified time frame.

Measurement of Earning at Risk (EAR)

EAR refers to changes to net interest income (ΔNII) as result of the GAP.

Measurement of Gap

GAP is defined as the difference between risk sensitive assets and risk sensitive liabilities, (RSA – RSL). It is measured in time buckets that can vary from overnight (one-day bucket) to longer periods, such as 30-days, 6-months or 1-year.

The first stage in estimating GAP is to identify the various loans and deposits that are subject to refinancing or reinvestment during a specified period. It requires listing the various loans and deposits by maturity. Table 5.2 shows an example of Applebank Inc. with the loans, deposits and short-term borrowings listed in order of maturity.

Table 5.2. Applebank Inc. Balance sheet (in millions)

Assets	Potential rate change	Amount			Liabilities	Potential rate change	Amount
Reserves at the Fed	n.a	$200			60-day CDs	2.0%	$175
Cash at Vault	n.a	$ 50			180-day CDs	2.0%	$100
3-month (90-day) G-bonds	2.0%	$100			Passbook Savings	2.0%	$ 75
6-month (180-day) G-bonds	2.0%	$ 75			Time Deposits 1-year	2.0%	$175
1-year installment loans	2.0%	$200			Time Deposits 2-year	2.0%	$225
3-year fixed-rate loan	2.0%	$175			Subordinated Debt	n.a	$150
5-year fixed rate loans	2.0%	$200			Stockholder's equity	n.a	$100
Total		$1,000			Total		$1,000

Which assets and liabilities are impacted if interest rates change during the year? Obviously, Cash at Vault and Reserves at the Fed are not affected by interest rate changes. Three of the five investments assets are affected: three- and six- month government bonds and the one-year installment loans. These assets are termed as risk-sensitive assets (RSAs), since they are subject to repricing within a year. If interest rates increase, the impact is positive for RSAs since they will earn an additional two percent. However, the gain is offset by the three rate-sensitive liabilities (RSLs), 60-day and 180-day CDs and the one-year time deposits. They will have to be refinanced at the higher rate, increasing the cost of funding. Passbook savings account may or may not be affected because there is no maturity. Since savers can withdraw their money at their discretion, there is a positive probability that some clients may withdraw their funds.

Whether the impact on earnings will be positive or negative will depend on the volume of the risk-sensitive assets and liabilities.

What is the GAP if we use a one-year time bucket?

Since the GAP is negative (ignoring passbook savings), an increase in interest rates will result in a negative impact on earnings

The one-year GAP is measured as follows:

$GAP_{1\text{-year}} = (RSA_{1\text{-year}} – RSL_{1\text{-year}}) = 375m - \$450m = -\$75$ million

What is the GAP if we use the shortest bucket among the assets and liabilities, 60-days? If interest rates increase during the 60-day period, the 60-day CD will have to be refinanced at rates higher than the existing 2%. There will be no impact on any of the assets because the earliest asset to be reinvested is the 90-day G-bond.

Since the GAP is negative, in increase in interest rates will result in a negative impact on earnings.

The 60-day GAP is given as follows:

$GAP_{60\text{-day}} = (RSA_{60\text{-day}} – RSL_{60\text{-day}}) = 0 - \$175m = -\$175$ million

Finally, what will the GAP if a six-month time frame is used?

$GAP_{6\ month} = (RSA_{6\text{-month}} – RSL_{6\text{-month}})$

$RSA_{6\text{-month}} = \$100$ (90-day G-Bond) + \$75 (90-day G-Bond)	= \$175million
$RSL_{6\text{-month}} = \$175$ (60-day CDs) + \$100 (180-day CDs)	= \$275 million
$GAP_{6\ month} = 175m - \$275m$	= -\$100 million

For all three time buckets, the GAP has been negative indicating that this bank is exposed to interest rate increases.

EAR or Earnings at risk (parallel shift in yield curve)

The next step after the estimation of the GAP is the determination of the earnings at risk (EAR). This is measured by assuming different scenarios of interest rate changes and estimating the changes to net interest income, ΔNII. We begin with the assumption that increases in interest rates are uniform across all assets and liabilities. In other words, we assume a parallel shift in interest rates.

1. **What is the impact on net interest income (NII) if interest rates increase 2% in 60-days?**

   The answer is shown below.

$\Delta NII = (RSA_{60\text{-day}} - RSL_{60\text{-day}})* (.02)$ or $(GAP_{60\text{-day}} * .02)$
$= (0 - 175) * (.02) = -\$3.5$ million

For the sixty-day period, the GAP is -$175 million and the bank will pay an additional $3.5 million in interest payments.

2. **What is the impact of the interest rate increase of 2% on NII over a six-month period?** :

Rate-sensitive Assets: $175 x .02 = + $3.5 million
Rate sensitive Liabilities: $275 x .02 = - $5.5 million
$\Delta NII = (RSA_{6\text{-month}} - RSL_{6\text{-month}})* (.02)$
$= (175 - 275) * (.02) = -\$2$ million annually

For the six-month period, the GAP is -$100 million and the bank will pay an additional $2 million in interest payments.

What will be the impact on net interest income (NII) if interest rates increase 2% across the board for a one-year time bucket?

$\Delta NII = (RSA_{1\text{-year}} - RSL_{1\text{-year}})* (.02)$
$= (375 - 450) * (.02) = -\$1.5$ million

For the one-year period, the GAP is -$75 million and the bank will pay an additional $1.5 million in interest payments

GAP analysis provides a timely mechanism for managers to determine the potential impact on a bank's earnings by running scenarios of potential changes to interest rates, especially in the short run. It has been one of the early tools used by banks in managing interest rate risk and continues to be used by banks worldwide.

Estimating Earnings at risk (non-parallel shift in yield curve)

Most banks assume both parallel and non-parallel increases and decreases in interest rates for assessing exposure to changes in interest rates. Regulators also expect banks to assume parallel and non-parallel shift in interest rates.

Table 5.3 provides an example of estimating EAR using non-parallel shifts in the yield curve. We will make the following assumptions to estimate the impact of a non-parallel shift of interest rates on net interest income.

1. Repricing risk will be estimated for a one-year time horizon.
2. Yield curve risk is included by assuming changes in long-term rates will be subject to larger changes than short term rates.
3. Basis risk is incorporated by assuming changes to interest rates will be larger for assets than for liabilities.
4. Embedded options risk is incorporated by assuming different percent of prepayments and potential withdrawals for loans, bonds and deposits.

Table 5.3. AppleBank Inc. (Potential rate change in one-year)

Assets	Potential rate change	Potential withdrawal in 1-year	Amount		Liabilities	Potential withdrawal in 1-year	Potential rate change	Amount
Reserves at the Fed	na		$200		60-day CDs		1.00%	$175
Cash at Vault	n.a		$50		180-day CDs		1.25%	$100
3-month (90-day) G-bonds	1.00%		$100		Passbook Savings	20%	1.50%	$75
6-month (180-day) G-bonds	1.25%		$75		Time Deposits 1-year	60%	1.75%	$175
1-year installment loans	1.50%	25%	$200		Time Deposits 2-year	60%	2.00%	$225
3-year fixed rate Loans	2.00%	25%	$175		Subordinated Debt		n.a	$150
5-year fixed rate loans	2.25%	25%	$200		Stockholder's equity		n.a	$100
Total			$1,000		Total			$1,000

Table 5.4 lists the various assets and liabilities with different potential rate changes as well as early redemptions or withdrawals. The estimate of GAP has to be performed on the individual asset and liability and is shown in Table 5.4. Risk sensitive assets (RSAs) are $468.75 million while risk-sensitive liabilities (RSLs) are $600 million. An increase in the interest rates over the year will result in an increase in net interest income (NII) on its risk-sensitive assets by $6.94 million. However, the increase in expenses on its risk-sensitive liabilities (RSLs) is greater at $8.99 million for a net loss of $-2.05 million.

Table 5.4. Example - GAP (non-parallel)

Bank A	Amount Impacted		Expected Change in rate	Change in earnings
Rate-sensitive assets				
3-month (90-day) G-bonds	$100.00		1.00%	$1.00
6-month (180-day) G-bonds	$75.00		1.25%	$0.94
1-year installment loans	$200.00		1.50%	$3.00
3-year fixed rate Loans	$43.75		2.00%	$0.88
5-year fixed rate loans	$50.00		2.25%	$1.13
Total RSA	$468.75		Δ interest income	$6.94
Rate-sensitive liabilities				
60-day CDs	$175		1.00%	-$1.75
180-day CDs	$100		1.25%	-$1.25
Passbook Savings	$15		1.50%	-$0.23
Time Deposits 1-year	$175		1.75%	-$3.06
Time Deposits 2-year	$135		2.00%	-$2.70
Total RSL	$600		Δ interest expense	-$8.99
GAP	-$131.25		ΔNII	-$2.05

Strengths of GAP and Earnings at Risk Analysis

Easy to construct

- GAP analysis is straightforward to construct even if the bank has different types of assets and liabilities.
- It provides a clear picture of the impact on net interest income in the short-run.
- By developing various scenarios of likely changes, management can take steps to mitigate the fallout by readjusting their portfolios.

Weaknesses of GAP and Earnings a Risk Analysis

GAP has also many weaknesses, although they can all be mitigated by making adjustments to the overall portfolio.

- Ignores changes in market value of assets and liabilities.
- Difficult to estimate withdrawals on some RSLs such as demand deposit and passbook savings.[30]
- Difficult to determine prepayments of some RSAs.
- Formula for estimating NII is simplified and may not predict exact loss or gain.
- Failure to capture impact on non-interest revenue, including those generated by off-balance sheet activities.
- Ignores time value of money.
- Requires time buckets to be specified. Buckets may be too large. Given today's computing sped, it is possible to breakdown repricing risk on a daily basis.

In spite of these weaknesses, GAP analysis serves as a very important and necessary tool for all banks managers. GAP analysis is somewhat similar to the cash management activities of non-financial institutions. It provides the necessary information to warn a bank of a potential shortages of funds. It ensures that a bank is not caught off-guard with less than the minimum required funds when there is an unanticipated change in interest rate. Nearly all banks pursue some form of GAP analysis with one-year being the most common time bucket.

IMPACT ON ECONOMIC VALUE OF EQUITY (EVE)

One of the problems of GAP and EAR analyses is that it ignores the market value of the assets and liabilities. It is possible that interest payments on a loan is being paid on time but that the actual condition of the borrower may be deteriorating. Assume a loan to real estate developer is currently in good standing but the real estate market is currently in a bubble. At some time in the near future, the real estate market is likely to experience a downturn resulting in delinquent loans. As long as the interest payments are being made on time, banks will not classify loans as non-performing. This weakness in GAP analysis requires an alternative or additional method to forecast deterioration in the market value of loans and deposits. Most banks estimate the economic value of equity (EVE) to assess such a change. It is a separate analysis that is done in conjunction with GAP analysis.

Regulators have long recognized that assessing the impact on current earnings via GAP analysis is insufficient.[31] When interest rates change, not only is there an impact on earnings as a result of repricing but it also affects the market value of the assets and liabilities. When interest rates increase, the market value of both loans and deposits decrease in value and the reverse takes place when interest rates fall.

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[30] Formally, it fails to include the costs of embedded options in the liabilities.

[31] Regulators have required banks to examine the impact on both current earnings and economic value of the firm since 1997 when Basel released a set of principles to govern the management of interest rate risk. The document is titled "Principles for the Management of Interest Rate Risk." Available at http://www.bis.org/publ/bcbs29a.pdf

The example below highlights the impact of interest rate changes on the market value of loans and deposits when the maturities are different. Assume a bank borrows $300 million for one-year in the wholesale deposit market at 5% and lends it at 9% for five years.

Loan A (9%, 5 years)	**= $300**	**Deposit A (5%, 1 year)**	**=$300**
Total Assets	= $300	Total Liabilities	= $300

The cash flows of Loan A are shown in the box below:

	0	1	2	3	4	5
Interest	-300	$27	$27	$27	$27	$27
Principal						$300
Cash Flows		$27	$27	$27	$27	$327

PV = $300

$PV_{@9\%}$ =$300 (I/YR=9, PMT=27, N=5, FV=300, CPT PV)

The present value of the loan discounted at 9%, the nominal interest rate of the loan, will equal to the par value, or $300 million.

What happens when the market interest rates increase as a result of higher inflation? The market value of the loan portfolio will decline. For example, if the yields for similar loans increase to 12%, the present value of the loans will decline to $267.56 (I/YR=12, PMT=27, N=5, FV=300, CPT PV).

Interpreting Declines in the Market Value of Loans

What is the impact on a bank if the market value of the loan declines as a result of changes in interest rates? It depends on whether the market value declined as a result of an increase in general interest rates or as a result of the deteriorating quality of the borrower.

If interest rates increase as a result of inflationary expectations, banks may end up losing at the expense of the borrower. During inflationary periods, a company may be able to increase its prices and profits. The following example highlights the case of a hypothetical increase in inflation of 50%. Assume the firm's revenue and costs increase by 50% in tandem with inflation (we ignore taxes).

Before Inflation	After Inflation (50%)
Sale = $100	Sale = $150
Costs = $ 50	Costs = $ 75
Profits =$ 50	Profits = $ 75

If there are no fixed costs, the firm's profits also increase by 50%, and the company does not experience any change. The $75 profit will purchase the same amount of goods as before inflation.

However, if there are fixed costs such as interest payments, there will be difference. Assume the firm makes a fixed interest payment of $20 per year.[32] The new profits before and after inflation are shown below.

Before Inflation		After Inflation (50%)	
Sale	= $100	Sale	= $150
Costs	= $ 50	Costs	= $ 75
Interest	= $ 20	Costs	= $ 20
Profits	=$ 30	Profits	= $ 55
In this case, the increase in profits is greater than 50%			
Times Interest Earned or TIE			
	=50/20=2.5		=75/20=3.75

The above example shows that inflation can benefit the borrower if revenues and costs increase in tandem with inflation. The interest payment is fixed at $20 increasing the Times interest Earned (TIE) which is measured by gross profit (Revenue –Cost) over interest payment. After inflation, it will be 3.75 ($75/$20) compared to 2.5 ($50/$20) before inflation. For banks, the interest payments received after inflation will be lower in real terms.

On the other hand, if market interest rates increase as a result of uncertainty in the market, it may increase the likelihood of defaults. Banks should be concerned about the quality of the loans because defaults will impact the bank's earnings much more than the loss of purchasing power. If loans are only reported in book values, then lenders and investors may not be able to assess the risks of the loans and manage interest rate risk.

The Fed expects all banks to manage interest rate risk using a combination of both Earnings at Risk (EAR) and Economic Value of Equity (EVE).

Measuring EVE

EVE is defined as the present value of assets minus the present value of liabilities. In the case of banks, the assets are made up of loans and bonds and the liabilities are deposits and short-term borrowings. An example will highlight the EVE method. The balance sheet below assumes that the market and the book values are the same and interest rates are paid annually. For example, the market value of Loan B is $200 which indicates that the loan rate charged by the bank is the same as the required rate of the bank (9%). In other words, the yield to maturity is the same as the coupon rate.

BANK A			
Bonds (8%, 5 years)	=$ 50	Deposit A(3%, 3 months)	= $ 50
Loan A (6%, 1 year)	= $100	Deposit B(5%, 2 year)	= $250
Loan B (9%, 2 years)	= $200	Equity	= $ 50
Total Assets	= $350	Total Liabilities and Equity	= $ 350

[32] We are ignoring fixed operating and financial costs which can increase the volatility of cash flows.

Change in Economic Value of Equity (parallel shift)

The Fed recommends banks to assume a minimum of +/- 300 basis (and recommends +/- 400 basis) points to determine the impact of unexpected changes in interest rates on the market value of assets and liabilities. In this example, we will assume that interest rates are likely to change +/- 200 basis points for the three assets, bonds, Loan A and Loan B, and both deposits, A and B.

Bonds

For our example above, what will be market value of the bonds, if interest rates increase to 10% and decrease to 6%?

Increase to 10%	
Market value of bonds = $ 46.21	**(I/YR=10, PMT=4, N=5, FV=50, CPT PV).**
Decrease to 6%	
Market value of bonds = $ 54.21	**(I/YR=6, PMT=4, N=5, FV=50, CPT PV).**

Loan A

What will be market value of Loan A, if interest rates increase to 8% and decrease to 4%?

Increase to 8%	
Market value of Loan = $ 98.15	**(I/YR=8, PMT=6, N=1, FV=250, CPT PV).**
Decrease to 4%	
Market value of Loan A = $ 101.92	**(I/YR=4, PMT=6, N=1, FV=100, CPT PV).**

Loan B

What will be market value of Loan B, if interest rates increase to 11% and decrease to 7%?

Increase to 11%	
Market value of Loan = $ 193.15	**(I/YR=11, PMT=18, N=2, FV=200, CPT PV).**
Decrease to 7%	
Market value of Loan A = $ 207.23	**(I/YR=7, PMT=18, N=2, FV=200, CPT PV).**

Deposit A

What will be market value of Deposit A, if interest rates increase to 5% and decrease to 1%?

Increase to 5%	
Market value of Loan = $49.75	**(I/YR=1.25, PMT=0.375, N=1, FV=50, CPT PV).**
Decrease to 1%	
Market value of Loan A = $50.25	**(I/YR=0.25, PMT=0.375, N=1, FV=50, CPT PV).**

Deposit B

What will be market value of Deposit B, if interest rates increase to 7% and decrease to 3%?

Increase to 7%	
Market value of Loan = $ 240.60	**(I/YR=7, PMT=12.50, N=2, FV=250, CPT PV).**
Decrease to 3%	
Market value of Loan A = $ 259.57	**(I/YR=3, PMT=12.50, N=2, FV=250, CPT PV).**

Summing up the results

Change in the market value of equity due to a 200% basis points increase =

Market value of Asset	= 46.21 + 98.15 + 193.15	= 337.51
Market value of Deposit	= 49.75 + 240.60	= 290.35
Equity		= 47.16

EVE or the economic value of equity has declined from $50 to $47.16, a loss of $2.84.
The new balance sheet is shown in Table 5.5.

Table 5.5.

BANK A			
Bonds (8%, 5 years)	**=$ 46.21**	**Deposit A (3%, 3 months)**	**= $ 49.75**
Loan A (6%, 1 year)	**= $ 98.15**	**Deposit B (5%, 2 year)**	**= $240.60**
Loan B (9%, 2 years)	**= $193.15**	**Equity**	**= $ 47.16**
Total Assets	**= $337.51**	**Total Liabilities**	**= $337.51**

In the case of an increase of a decline of 200bp in interest rates, the balance sheet is shown in Table 5.6 with EVE showing an increase of $3.54 million.

Table 5.6.

BANK A			
Bonds (8%, 5 years)	**=$ 54.21**	**Deposit A (3%, 3 months)**	**= $ 50.25**
Loan A (6%, 1 year)	**= $101.92**	**Deposit B (5%, 2 year)**	**= $259.57**
Loan B (9%, 2 years)	**= $207.23**	**Equity**	**= $ 53.54**
Total Assets	**= $363.36**	**Total Liabilities**	**= $363.36**

Change in EVE (non-parallel shift)

The analysis to perform EVE using non-parallel shift in interest rates is similar in structure as above except that increases and decreases in interest rate will vary for each of the assets and liabilities. Most software programs that estimate IRR exposure provide results for both parallel and non-parallel shifts in interest rates.

The challenging component of performing non-parallel tests in EVE is determining the boundaries for the unexpected changes. The majority of firms use historical data to determine the possible expected changes

or the forward rates on existing loans, if available. For example, the unexpected changes in interest rates can be assumed to be +400/-100 bp for loans and +200/-200 bp for deposits.

Example

Assume the following rates were observed over the last ten years for different values of the fed fund rates? The current fed funds rate is assumed to be 4%.

Table 5.7

	Market interest rates							
Fed Funds	1%	2%	3%	4%	5%	6%	7%	8%
Loans (AA-rated)	5%	6.0%	7.0%	8.0%	10.0%	12.0%	14.0%	15.50%
Deposits	2%	2.25%	2.50%	2.75%	3.25%	3.75%	4.25%	4.75%

Based on the above data if the bank chooses to estimate the unexpected changes to loan and deposit rates when fed funds rates are expected to increase or decrease by 200%, the following non-parallel shifts can be assumed.

Loans: +400/-200 bp

Reason: As shown above, for every 1% increase in the fed funds rate above 4%, the increase in AA-rated loans is 2%. For every 1% decrease in the fed funds rate below 4%, the decrease in AA-rated loans is 1%. Hence, for a +/- 200 bp change in general interest rates, loan rates should be assumed to change +400/-200 bp for non-parallel estimations.

Deposits +100/-50 bp

Reason: For every 1% increase in the fed funds rates above 4%, the increase in deposit rates is 2%. For every 1% decrease in fed fund rates, the decrease in deposit rates is 0.5%. Hence, for a +/- 200 bp change in rates, deposit rates should be assumed to change by +100/-50 bp for non-parallel estimations.

Managing Interest rate risk

EAR and EVE only provide the information about the likely impacts on a bank's earnings in the event of an unexpected interest rate shock. If the losses are too high, the bank is better off adjusting its portfolio to keep its losses at tolerable levels. The decision on the maximum tolerable losses is usually determined by the Asset and Liability Committee (ALCO) comprising of senior executives. If the maximum potential losses exceed the set limits, management has to reduce the exposure by adjusting the relevant portfolios to meet its compliance requirements. In our example from Tables 5.5 and 5.6, let us assume the ALCO limits are set at losses that exceed 10% of equity (>-10%).

Table 5.8

FV of Equity (unchanged)	**FV of equity (+200 bp)**	**Percent Change**	**ALCO Limit**
$50 million	$47.16	-5.68%	> -10%
FV of Equity (unchanged)	FV of equity (-200 bp)	Percent Change	ALCO Limit
$50 million	$53.54	+7.08%	> -10%

For both scenarios, the bank's exposure is within range of the ALCO limits and the bank does not have to adjust any of its loan or deposit portfolios.

The ALCO limit is very low in the above example. A typical limit for most banks will be as follows:

Table 5.9

Rate Shock	ALCO limits
+/- 300 bp	> - 40%
+/- 200 bp	> - 30%
+/- 100 bp	> - 20%

Regulation

The Fed together with the FDIC has been concerned about the adequacy of interest rate risk management practices of commercial banks. They have issued several guidelines to ensure that banks have established a rigorous process in place for managing their risks. Among the regulatory tips provided by the FDIC are:[33]

1. Identify the bank's appetite for IRR in comparison to credit risk and other risk types.
2. Ensure that IRR measurement guideline exposure limits are consistent with the bank's IRR appetite.
3. Consider a "risk management" rather than a "budget" perspective for IRR measurement.
4. In addition to GAP analysis, use ALM models that capture long-term IRR exposure such as EVE and extended simulation models.
5. Ensure that management understands and supports the bank's most critical ALM modeling assumptions.
6. Consider at least a +/- 300 basis points rate change over one year (or more spontaneous) in the worst case scenario. Not required but recommended to also consider +/- 400 basis points.
7. Consider non-parallel rate scenarios.

[33] The ALCO Process: A View from the Regulatory Arena. FDIC 2010. Available at https://www.google.com/search?q=The+ALCO+Process%3A+%0BA+View+From+the+Regulatory+Arena&ie=utf-8&oe=utf-8

Summary of the Chapter

The chapter provides an overview of the interest rate risks faced by commercial banks as a result of the differences in maturities between assets and liabilities. Financial institutions face two forms of risk, refinancing and reinvestment risks, and both have to be managed carefully. An example of mismanaged interest rate risk is the Savings and Loan crisis of the 1980s when hundreds of banks failed because banks were caught off guard to the rapid increase in interest rates in the 1970s. Banks that were hurt the most was those that did not respond aggressively to address the issue.

The primary source of interest rate risk is the difference in maturities of loans and deposits, resulting in repricing risk. In addition to repricing risk, commercial banks face three additional risks, yield curve risk, basis points risk and embedded options risk. The management of interest rate risk requires the estimation of Earnings at Risk (EAR) and the Economic Value of Equity (EVE).

The first step in EAR analysis is the estimation of GAP followed by an estimation on the change to net interest income (NII). Regulators expect banks to assume potential adverse changes to interest rates as high as +/- 300 basis points. In addition, they expect banks to include both parallel and non-parallel shifts in interest rates.

Regulators also expect bank to consider the impact of interest rate changes on the market value of banks by estimating EVE. It is measured as the present value of assets less the present value of liabilities for different interest rate scenarios.

End of Chapter Questions

1. Distinguish refinancing and reinvestment risks.

2. What are four sources of interest rate risk? Explain each of them briefly.

3. In the following balance sheet, estimate the impact on net earnings.
   a. if all interest rates increase by 2%
   b. If interest rates of assets fall by 1% and deposit rates increase by 1%.

Loan A (8%, 3 year)	= $100	Deposit A (5%, 2 years)	=$250
Loan B (11%, 4 years)	= $200	Deposit B (7%, 3 year)	= $ 50
Total Assets	= $300	Total Liabilities	= $300

4. In the following balance sheet, estimate the impact on net earnings.
   a. if all interest rates decrease by 3%
   b. If interest rates of assets increase by 1% and deposit rates decrease by 2%.

Loan A (7.5%, 5 year)	= $300	Deposit A (6%, 1 years)	=$350
Loan B (15%, 10 years)	= $200	Deposit B (5%, 2 year)	= $150
Total Assets	= $500	Total Liabilities	= $500

5. Assume a bank has the following balance sheet

Assets	Potential rate change	Amount		Liabilities	Potential rate change	Amount
Cash	n.a	$100		**90-day CDs**	0.75%	$100
6-month G-bonds	2.00%	$300		**360-day CDs**	1.00%	$200
2-year commercial loans	3.00%	$400		**Time Deposits 2-year**	1.50%	$900
5-year fixed rate loans	2.00%	$500		**Stockholder's equity**	n.a	$100
Total		$1,300		**Total**		$1,300

a. Determine the 1-year and 2-year GAP (GAP).
b. What is the net impact on net interest income (NII), if interest rates are expected to change as specified in the Potential rate change, for the 1- and 2-year GAP?

6. Assume a bank has the following balance sheet

Assets	Potential rate change	Amount		Liabilities	Potential rate change	Amount
Reserves at the Fed	n.a	$200		**90-day CDs**	0.75%	$200
6-month T-Bills	2.00%	$400		**360-day CDs**	1.00%	$300
3-year Consumer loans	3.00%	$600		**Time Deposits 2-year**	1.50%	$1200
10-year mortgages	2.00%	$800		**Stockholder's equity**	n.a	$200
Total		$2,000		**Total**		$2,000

a. Determine the 1-year and 3-year cumulative GAP (CGAP).
b. What is the net impact on net interest income (NII), if interest rates are expected to change as specified in the Potential rate change, for the 1- and 3-year CGAP?

7. Explain the difference between EAR and EVE.

8. What are some of the minimum requirements specified by the FDIC in managing interest rate risk?

ProBanker Assignment 4

Using the same quarter 2 data of Assignment 2, please fill in the numbers in the table below and estimate the GAP or rate-sensitive assets minus rate-sensitive liabilities (RSA – RSL) using T+2 and T+4 time frames.

GAP Analysis				
Floating Rate Corporate Loans, maturing start of:			**Demand Deposits**	
T+1			Retail	0.00
T+2			Corporate	0.00
Retail Installment Loans, maturing start of:			**Negotiable CDs, maturing start of:**	
T+1			T+1	
T+2			T+2	
T+3			T+3	
T+4			T+4	
Retail Mortgage Loans, maturing start of:			**Passbook Savings Deposits**	0.00
T+1				
T+2			**Retail CDs, maturing start of:**	
T+3			T+1	
T+4			T+2	
T+5			**IRAs, maturing start of:**	
T+6			T+1	
T+7			T+2	
T+8			T+3	
Bonds, maturing start of:			T+4	
T+1			T+5	
T+2			T+6	
T+3			T+7	
T+4			T+8	
T+5				
T+6				
T+7				
T+8				
Total Risk-Sensitive Assets (RSAs) T+2			Total Risk-Sensitive Assets (RSAs) T+4	
Total Risk-Sensitive Liabilities (RSLs) T+2			Total Risk-Sensitive Liabilities (RSLs) T+4	
Cumulative Gap (CGAP) T+2			Cumulative Gap (CGAP) T+4	

Appendix – Duration Analysis

Duration Analysis

An alternate approach to measuring change in the economic value of equity (EVE) is using the duration of assets and liabilities. As will be shown later, duration analysis provides a simpler way to revalue assets and liabilities in a portfolio. We begin with a definition of duration.

Duration is referred to as the weighted average maturity of an asset with periodic cash flows. The weighted average maturity of a one-year 10% loan can vary significantly, based on the repayment terms demanded by a borrower, as shown in three examples described below.

Loan 1: Payment terms require principal and interest payments at the end of the year.

Loan: 0----------1

Interest	$10
Principal	$100
Cash Flows	$110

Loan 2: Payment terms require principal and interest payments in two installments, first in six months and the second at the end of the year.

Loan: 0----------1/2----------1

Interest	5.00	$2.50	Interest payments
Principal	50.00	$50.00	Principal
Cash Flows	55.00	$52.50	

Loan 3: Payment terms require equal principal payments in four installments, paid quarterly.

Loan: 0----------1/4----------1/2----------3/4----------1

Interest	2.50	1.875	1.25	$0.625	Interest payments
Principal	25.00	25.00	25.00	$25.00	Principal
Cash Flows	$27.50	$26.875	$26.25	$25.625	

Question: Given the above different terms of payments, is the effective rate paid by the borrower different? If so, what are the rates?

To estimate the effective rate, find the IRR of each loan.

Table 5.1A

IRR	Formula using Calculator
Loan 1 = 10%	(equivalent to a zero coupon bond. -100=PV, 1=N, 110 = FV, 0=PMT, CPT I/YR)
Loan 2 = 10%	(CF_0 = -100, CF_1 =55, CF_2 = 52.50, CPT IRR = 5% x 2 =10%)
Loan 3 = 10%	(CF_0 = -100, CF_1 =27.50, CF_2 = 26.875, CF_3 = 26.25, CF_4 = 25.625, CPT IRR = .5% x 4 = 10%)

Although the effective interest rates are the same for all loans, it cannot be said for the effective maturity of the loans. The nominal maturity is one year for all three loans. However, the lender of all three loans receives different amounts of principal and interest during the year. If the timing of the payments is to be considered, then the maturity of the loans is different for all three loans and the appropriate measurement is duration. Duration provides a measure of the maturity of a loan (of any fixed-rate asset or liability) after considering the timing of the payments.

For a better understanding of duration, assume a one-year loan of $100 with no interest payments. The principal is repaid as follows:

Loan 1; |----------|

$99 $1

Loan 1; |----------|

$1 $99

Although both loans are fully repaid at the end of the year, Loan 1 is practically a one-day loan since $99 out of the $100 is paid the next day. In contrast, Loan 2 is a (near) one-year loan because $99 of the $100 loan is paid at the end of the year. Loan 1 has a lower duration because the formula takes into account the timing of the cash flow.

The formula to estimate duration is shown below. It was developed by Frederic Macaulay in 1938 and applies to assets that have fixed cash flows and maturity.

$$D = \sum_{t=1}^{n} \frac{CF_t * PV_t * t}{CF_t * PV_t}$$

Where

CF = Fixed cash flows
PV = Present value factors

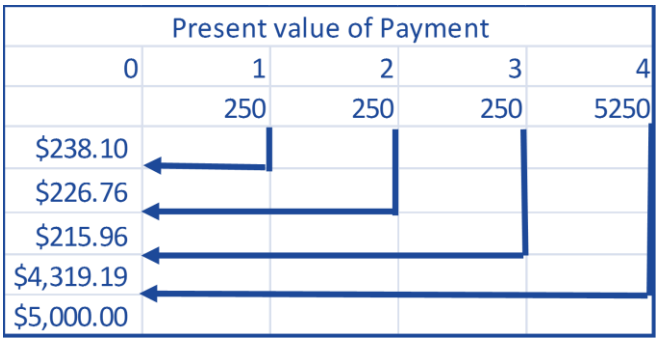
A couple of examples will highlight the estimation of duration. Assume a 4-year loan with a principal of $5,000 that pays 5% interest. The current market yield on the loan is also 5%. Using the above formula, the estimation of the duration is shown in Table 5.2A.

Table 5.2A

Period	CF	PV Factor	CF * PV	CF*PV*t
1	250	0.95	238.10	238.10
2	250	0.91	226.76	453.51
3	250	0.86	215.96	647.88
4	5250	0.82	4319.19	17276.75
Total			5000.00	18616.24
Duration = 18616.24/5000 = 3.723				

The duration is 3.72 years. It is lower than the stated maturity of four years because some of the cash flows are paid earlier than four years. A breakdown of the four payments to time period 0 will highlight the present value of the payments per year.

Table 5.3A



The bulk of the interest and principal payments is received in year 4, whose present value is $4,319.19. The interest payment in year 3 accounts for $215.96 of the total $5,000 disbursed in year 0. Thus, the weighted average of the payments can be estimated as follows:

Weighted average maturity

= 1*(238.10/5000) + 2*(226.76/5000) + 3*(215.96/5000) + 4*(4,319.19/5000)

= 3.723 or the duration of the loan.

Another Example

The following example assumes a one-year loan with three different payments. Loan 1 repays the principal at the end of the year. Loan 2 repays the principal back in two installments, half in six months and the rest at the end of the year. Loan 2 repays the principal back in four installments, 25 percent every quarter.

Table 5.4A. Loan 1: Duration

Duration - Loan 1				
Year				1
CF				110
$100.00	←			
$100.00	Duration =		1	

Table 5.5A. Loan 2: Duration (non-fixed cash flows)

Duration - Loan 2				
Year		0.5		1
CF		55		52.5
$53.67	←			
$50.00	←			
$103.67	Duration =	0.74		

Table 5.6A. Loan 3: Duration (non-fixed cash flows)

Duration: Loan 3				
0	0.25	0.5	0.75	1
	$27.50	$26.88	$26.25	$26.63
$27.33	←			
$26.55	←			
$25.77	←			
$25.61	←			
$105.25	Duration =	0.62		

The duration of the loans continues to decrease as the payments of the loan are made earlier.

Duration and Market Value

One of the advantages of duration is that it can be used to estimate the change in the value of market of a fixed-income asset or liability, such as loan or deposit. The relationship between duration and change in market value of an asset (MV) is given by:

$\Delta\%(MV) = -MD^* \Delta r^*$

Where
Δr = Change in interest rate (or interest rate shock)

MD or Modified Duraton= $\frac{Macaulay\ Duration}{1+\frac{Yield\ to\ maturity}{Payments\ per\ year}}$

For small changes in interest rates, the market value of a loan will decrease by the modified duration.

We will use the 4-year $5,000 loan estimated earlier as an example. The duration was estimated at 3.723 and the modified duration = 3.723248/1.05 = 3.546 (note that payments per year is 1)

Let us find the market value of the loan if the yield to maturity increases from 5.00 percent to 5.05%. Using a calculator or Excel, the market value is shown to decrease to $4,991.15 (-5000=FV, 250=PMTs, 4=N, 5.05 = I/YR, CPT PV).

Using Modified duration, the change in the value of a loan is given by:

Δ%(Market Value, MV) = -MD*Δr
= -3.546*(.0005) = -0.001773

The market value of the loan will decline by .001773%

Δ%(MV) = (New MV– Old MV)/Old MV

New MV = Old MV + (-0.001773 * Old MV)
= $5,000 - $8.865=$4,911.14 (same as above).

Advantages of Duration

There are several advantages to have the information of duration available on most loans and bonds.

1. It is easy to compare loans and bonds that have different coupon and interest payments, maturities, and market yields. Once the duration of an asset is known, the change in its market value can be configured easily by estimating the modified duration,

2. It is easy to distinguish bonds that are interest sensitive versus those that are not sensitive.

3. It is easy to construct mix and match portfolio of loan to a specific duration and help to hedge exposures of the overall portfolio.

Weighted average duration

One of the important properties of duration is that one can mix the different assets to obtain an average duration of a portfolio. That is.

$D_{avg} = w_1(D_1) + w_2(D_2) + \ldots + w_nD_n$

We will use the following example to demonstrate the property. Assume there are two loans of $5000 each, one with a maturity of one for 8 years. The interest rate is 5% for both loans. The duration of the 4-year loan is 3.7232, as shown in Table 5.7A.

Table 5.7A

Period	CF	PV Factor	CF * PV	CF*PV*t
1	250	0.95	238.10	238.10
2	250	0.91	226.76	453.51
3	250	0.86	215.96	647.88
4	5250	0.82	4319.19	17276.75
Total			5000.00	18616.24
Duration = 18616.24/5000 = 3.7232				

The duration of the 8-year loan is 6.7864, as shown in Table 5.8A.

Table 5.8A

Period	CF	PV Factor	CF * PV	CF*PV*t
1	250	0.9524	238.10	238.10
2	250	0.9070	226.76	453.51
3	250	0.8638	215.96	647.88
4	250	0.8227	205.68	822.70
5	250	0.7835	195.88	979.41
6	250	0.7462	186.55	1119.32
7	250	0.7107	177.67	1243.69
8	5250	0.6768	3553.41	28427.25
Total			5000.00	33931.87
	Duration	=	6.7864	

The cash flows of combined loans are shown in Table 5.9A with a duration of 5.254.

Table 5.9A

Period	CF	PV Factor	CF * PV	CF*PV*t
1	500	0.9524	476.19	476.19
2	500	0.9070	453.51	907.03
3	500	0.8638	431.92	1295.76
4	5500	0.8227	4524.86	18099.45
5	250	0.7835	195.88	979.41
6	250	0.7462	186.55	1119.32
7	250	0.7107	177.67	1243.69
8	5250	0.6768	3553.41	28427.25
Total			10000.00	52548.11
	Duration	=	5.254811	

We can obtain the same results if we take a weighted average of the individual loans in Table 5.7A and 5.8A.

Weighted average duration = (5000/10000)*3.7232 + (5000/10000)*6.7864

= 5.254

However, one has to be cautious about obtaining weighted averages of durations. If the intermediate cash flows are not perfectly fixed (and synchronous), there will be slight variations in the derived average. This is show by combining Loan 2 of Table 5.5A and Loan 3 of Table 5.6A estimated earlier. The combined duration is shown in Table 12 below.

Table 5.10A.

Duration: Loan 4 (2 + 3)					
0	0.25	0.5	0.75	1	
	$27.50	$81.88	$26.25	$79.13	
$27.33					
$80.87					
$25.77					
$77.20					
$211.16	Duration =	0.6809			

The duration for the combined cash flows is estimated at 0.6809.

The weighted average duration of the two individual loans is given by

= (103.67/211.16)*0.7411 + (105.25/211.16)*0.6179 = 0.6791.

The difference is due to discounting of the combined cash flows using quarterly estimates while the cash flows of Table 5.5A used semi-annual discount rates.

Using duration to measure change in EVE

In our previous example, we estimated the change in EVE by computing the present value of the loans and deposits assuming +/- 200 basis points. In the example below, we will use the duration formula to estimate the same change in EVE for +/- 200 basis points. We first estimate the durations of the bonds, loans and deposits, as shown below in parentheses.

Bonds (8%, 5 years, D=4.321)	=$ 50	Deposit A (3%, 3 months, 0.25)	= $ 50
Loan A (6%, 1 year, D=1)	= $100	Deposit B (5%, 2 year, D=1.952)	= $250
Loan B (9%, 2 years, D=1.917)	= $200	Equity	= $ 50
Total Assets	= $350	Total Liabilities	= $350

We will estimate the change in the market values assuming a 200 bp increase in rates using the duration formula. Note that the formula is:

New MV = Old MV + (-MD * Old MV)

Bonds			
New market value	= Loan Amount +	(-MD*Δr *Loan Amount)	
	= 50	+	(-(4.321/1.08)*.02*50)
	= $50	+	-$4.39
	=$45.61		

Loan A			
New market value	= Loan Amount +	(-MD*Δr *Loan Amount)	
	= 100	+	(-(1/1.06)*.02*100)
	= $100	+	-$1.89
	=$98.11		

Loan B			
New market value	= Loan Amount +	(-MD*Δr *Loan Amount)	
	= 200	+	(-(1.917/1.09)*.02*200)
	= $200	+	-$7.04
	=$192.96		

Deposit A			
New market value	= Deposit Amount	+	(-MD*Δr *Loan Amount)
	= 50	+	(-(0.25/1.0075)*.02*50.375)
	= $50	+	-$0.25
	=$49.75		

Deposit B			
New market value	= Deposit Amount	+	(-MD*Δr *Loan Amount)
	= 250	+	(-(1.952/1.05)*.02*250)
	= $250	+	-$9.30
	=$240.70		

Value of EVE using duration formula			
Bonds (8%, 5 years, D=4.321)	=$ 45.61	Deposit A (3%, 3 months, 0.25)	= $ 49.75
Loan A (6%, 1 year, D=1)	= $ 98.11	Deposit B (5%, 2 year, D=1.952)	= $240.70
Loan B (9%, 2 years, D=1.917)	= $192.96	Equity	= $ 46.23
Total Assets	= $336.38	Total Liabilities	= $336.38

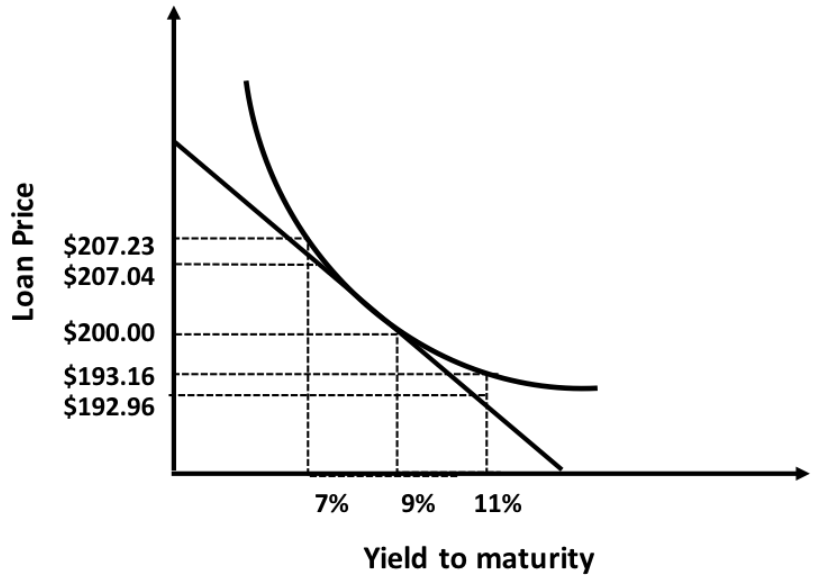
Loss in EVE is estimated at $3.72 = $50 - $46.23 and the new market value of the firm =$336.38.

In the earlier analysis, loss in EVE was $2.84 = $50 – 47.16 and the new market value of the firm was $337.51.

The difference of $0.93 is because the duration formula is an approximation. The duration formula is linear whereas the actual change in prices of fixed-rate instruments are convex. Hence, ignoring the convex nature of the price-interest rate relationship can result in deviations and duration should be used only for small changes in interest rates. For large changes in interest rates, we should correct for the approximation by including convexity in the formula.

Convexity

Convexity refers to the convex shape of the price of a fixed-rate instrument, such as a bond or a bullet loan, as shown below. For example, in the case of our 9%, 2-year $200 loan, the market value of the loan will be $200 if the yield to maturity is 9%.



If the yield to maturity decreases by 2%, the duration formula will predict that the new price will be $207.04.

%Δ(MV) = -MD*Δr = -(1.917/1.09)*(-0.02) = -0.0352

New market value = Loan Amount + (-MD*Δr *Loan Amount)
= 200 + (-(1.917/1.09)*(-0.02)*200)
= $200 + $7.04
=$207.04

However, if the price is estimated by using present value of the cash flows with 7% as the yield-to-maturity, the loan value increases to $207.23, an increase of $0.20. As shown in the figure above, the duration formula is a linear approximation and will underestimate the increase in the prices.

If the yield to maturity increases by 2%, the duration formula will predict that the new price will be $192.96.

%Δ(MV) = -MD*Δr = -(1.917/1.09)*(+0.02) = -0.0352

New market value = Loan Amount + (-MD*Δr *Loan Amount)
= 200 + (-(1.917/1.09)*(+0.02)*200)
= $200 - $7.04
=$192.96

However, if we estimate by using present value of the cash flows with 11% as the yield-to-maturity, the loan value decreases to $193.16, about $0.20 less than using the duration formula.

It is important to note that we underestimate the price increase and overestimate the price decrease when we use the duration formula.

Duration plus convexity formula

In order to adjust for the difference, we should add the convexity factor. First, we will estimate convexity.

Estimating convexity

The following formula measure the convexity of any fixed-rate instrument.

$$C = \sum_{t=1}^{n} \frac{CF_t * PV_t * t * (t+1)}{(CF_t * PV_t) * (1+R)^2}$$

For our 2-year, 9% $200 Loan, we have

Period	CF	PV Factor	CF * PV	CF*PV*t	CF*PV*t*(t+1)
1	18	0.9174	16.51	16.51	33.02752294
2	218	0.8417	183.49	366.97	1100.917431
Total			200.00	383.49	1133.94
	Duration	=	1.9174		
	Convexity	=	4.772094		

$C = \sum_{t=1}^{n} \frac{1133.94}{200*(1+09)^2}$ = 4.772

The equation to include convexity in the duration model is given as follows:

Δ%(MV) = -MD*Δr + 0.5*C*(Δr)^2

For our example:

Δ%(MV) = .0352 + [0.5 * 4.772 * (-.02)^2]
= .0352 + .0010 (precisely 0.0009544)
= .0362

New MV = Loan Amount + (.0362*Loan Amount)
= 200 + 7.24
=$207.24

This is very close to $207.23. Hence adding convexity increases the prevision of the estimates using duration.

Summary of the Appendix

Duration is another measure used in estimating changes to the market value of equity. The Macaulay duration is able to estimate the changes to market value as long as payments are fixed and periodic. However, one weakness of the use of duration is that the equation is linear while the relationship between bond prices and interest rates is convex. As a result, for large changes in interest rates, duration should be used together with convexity to determine changes in the market value of equity.

End of Chapter Questions

1. Estimate the duration of Loan M and Deposit N

Cash	= $ 50	Deposit N (3 years, 3%)	= $ 200
Loan M (5%, 6 years)	= $200	Equity	= $ 50
Total Assets	= $250	Total Liabilities	= $ 250

   a. Estimate the duration of Loan M and Deposit N.
   b. Using the duration formula estimate the change in the value of the equity if interest rates are expected to increase by 2%.
   c. Estimate the convexity of Loan M.
   d. Using the duration plus convexity formula estimate the change in the value of Loan M if interest rates are expected to increase by 2%. There is no need to estimate the convexity of deposit N.

2. Estimate the duration of Loan A and Deposit B

Cash	= $ 50	Deposit B (5%, 2 years)	= $ 520
Loan A (10%, 5 years)	= $500	Equity	= $ 30
Total Assets	= $550	Total Liabilities	= $ 550

   a. Estimate the duration of Loan A and Deposit B.
   b. Using the duration formula estimate the change in the value of the equity if interest rates are expected to decrease by 3%.
   c. Estimate the convexity of Loan A.
   d. Using the duration plus convexity formula estimate the change in the value of Loan A if interest rates are expected to decrease by 3%. There is no need to estimate the convexity of deposit B.

6

Chapter 6 - CREDIT ANALYSIS

Introduction

The general definition of credit or default risk is the nonpayment of a financial obligation on due date. In the case of debt or loans, default risk is nonpayment of scheduled interest and principal payments on the due date. It is a major risk faced by commercial banks because loans make up the bulk of their assets and interest income is the main source of revenue. A single default can potentially put a bank into insolvency because it may not have sufficient capital to absorb the loss. Table 6.1 shows a hypothetical balance sheet of a bank with $100 in deposits and ten loans of $10 each with a maturity of one year.

Table 6.1. Basic Bank

Loans	$ 10.00		**Deposits**	$ 90.00
	$ 10.00			
	$ 10.00			
	$ 10.00			
	$ 10.00			
	$ 10.00			
	$ 10.00			
	$ 10.00			
	$ 10.00		**Equity**	$ 10.00
Total Assets	$ 100.00		**Total Liab and Equity**	$ 100.00

Once a loan is disbursed, the bank faces two kinds of risk – interest rate risk and credit risk. In the previous chapter, we discussed interest rate risk and showed that earnings are sensitive to changes in interest rates and can potentially narrow the spread on the loans. In Table 6.1, if interest rates decline by 1% at the end of the year, the loss on the interest income is $10. It is offset by an increase in savings of $9 on interest expense, assuming a parallel shift in interest rates. The resulting loss of $1 will lower the value of equity to $9.

However, this loss is low compared to a default of a single $10 loan. If the loan is unrecoverable, the value of the equity can be reduced to zero. A default of two loans will result in bankruptcy. Hence, managing credit risk can be considered more imperative than interest rate risk because of the large potential losses. The potential for large losses makes credit risk management a demanding task for senior management, requiring them to continuously monitor their loan portfolio.

Since the losses of a single loan can be large, banks spend a significant amount of time and energy to develop and implement a rigorous credit policy for loan approvals. The policy includes a stringent credit analysis process to screen applicants and a risk management process to monitors loans once they have

been disbursed. Banks expect some loans to default even if all their clients have been subject to a rigorous screening process. Even the best of companies can face unexpected economic events such as a recession or competition. Banks will set interest rates to compensate both expected and unexpected defaults. A sound credit policy will attempt to ensure that a bank stays below an average sustainable default rate.

The chapter will first cover credit risk analysis and the methods employed by banks to minimize likely defaults. The regulatory component of credit risk will be covered in the next chapter on capital adequacy.

Defining Default

Types of Default

Non-repayment of interest and principal may take place for two reasons, inability to pay and unwilling to pay:

1. Inability to pay occurs when unanticipated events disrupt the expected cash flows of an individual or business. For example,
    a. macroeconomic events such as a recession may result in a business failure, leaving a company without the means to pay.
    b. an individual may lose a job leaving him or her unable to make the payments on the loan.

In both cases, there is a willingness to pay but there are insufficient resources to enable payments.

2. Unwilling to pay is usually the result of fraud.
    a. The character of the borrower may have been misjudged and the loan should not have been made in the first place.

Five Cs

Traditionally, the decision to lend focused on assessing the five Cs of lending – character, capacity, collateral, capital and conditions. The assessment is based partially on quantitative analysis and partly on qualitative factors. The five C's are explained below.

Character: refers to the integrity and honesty of the borrower and applies to both individuals and companies. Credit history usually serves as the main source for determining the character of a borrower. If a company or individual has a history of declaring defaults, opening and closing businesses, or engaging in excessive risk-taking behavior, the likelihood of non-repayment is higher and banks may refuse to extend credit. On the other hand, an individual or corporation with a strong record of timely payments may induce a bank to lend even in lean times and renegotiate loan terms when a borrower has difficulty making payments.

Capacity: refers to the level of income of the firm or individual to repay its debt. Does the company have the ability to generate sufficient cash flows to repay interest and principal over the maturity of the loan? Is the business sufficiently diversified to withstand periodic shocks? Is the product or service focused on one line of business? Is the income of an individual sufficiently large to allow for unanticipated expenses? The analysis may be both quantitative and qualitative.

Capital: refers to the savings or wealth of the borrower as an additional source of income to repay the loan. A company that is cash rich with little debt or an individual with significant wealth provides assurances to the bank that its loan will be repaid even if the primary source of income is disrupted.

Collateral: refers to assets that are pledged to the lender. In case of nonpayment, the lender can liquidate the assets to pay off the loan. Providing collateral can benefit both the lender and borrower. The bank is assured of receiving partial or full payment in the event the borrower is unable to pay the loan. The borrower in turn is likely to get a lower rate as a result of the collateral.

Conditions: refer to external factors including the state of the economy that can impact the borrower's source of income. They include macroeconomic changes to the overall economy, opportunities and threats in the industry of the borrower, and changes in government policies and regulations. For example, if a recession is anticipated, it is very likely that default and foreclosure rates will increase. In addition, the impact may be higher for those firms whose products and services are price elastic. In short, any event they can potentially impact the cash flows of a firm or the income of an individual should be considered as a relevant factor.

RATIO ANALYSIS

Banks spend considerable time to ensure that they are able to discern borrowers who are likely to default. With computers and big data, more information can be analyzed quantitatively by lenders to supplement the five Cs. The prevalent method adopted by most lenders is ratio analysis where quantitative indicators are determined based on financial information of the borrower.

In the case of a corporation, the quantitative indicators are obtained from the income statement and balance sheet of the company. A strong and consistent income statement and balance sheet will indicate a high likelihood of repayment by the borrower. Some of the key variables examined in ratio analysis include return on assets (ROA), return on equity (ROE), times interest earned (TIE), current ratio (CR) and earnings per share (EPS). An example below will highlight the use of ratio analysis.

Assume a bank is considering lending to two manufacturing firms, A and B. Selected income statement and balance sheet figures are listed in Table 6.2. The financial ratios are computed and shown below. Which firm is stronger from a credit risk perspective?

ROA_A = Net Income /Total Assets	= 176.25/2200	= 8.01%
ROA_B = Net Income /Total Assets	= 360/4450	= 8.09%
ROE_A = Net Income /Total Equity	= 176.25/950	= 18.55%
ROE_B = Net Income /Total Equity	= 360/1600	= 22.50%
TIE_A = Net Income/Interest Expense	= 176.25/56.25	= 3.13
TIE_B = Net Income/Interest Expense	= 360/150	= 2.40
CR_A = Current Assets/Current Liabilities	= 850/500	= 1.70
CR_B = Current Assets/Current Liabilities	= 2100/850	= 2.47
EPS_A = Net Income/# of shares	= 176.25/150	= $1.18
EPS_B = Net Income/# of shares	= 360/150	= $1.80

Table 6.2

Income Statement	Manufacturing Firm A	Manufacturing Firm B
Sales	$1,000.00	$1,500.00
Cost of Goods Sold	($350.00)	($475.00)
Gross Profit	$650.00	$1,025.00
Operating expense		
- Selling expenses	($125.00)	($75.00)
- General and Administrative	($175.00)	($200.00)
Interest Expense	($56.25)	($150.00)
Earnings before taxes	$293.75	$600.00
Provisions for taxes (40%)	$117.50	$240.00
Net income	$176.25	$360.00
# of shares	$150.00	$200.00
Earnings per share	$1.18	$1.80
Balance Sheet		
Current Assets	$850.00	$2,100.00
Fixed Assets	$1,350.00	$2,350.00
Total Assets	$2,200.00	$4,450.00
Current Liabilities	$500.00	$850.00
Long-term Debt	$750.00	$2,000.00
Equity	$950.00	$1,600.00
T. Liabilities and Net Worth	$2,200.00	$4,450.00

A review of the ratios indicates that Firm B is in a stronger financial position than Firm A. The ROA, ROE, CR and EPS ratios for firm B are stronger than Firm A. Only the times interest earned (TIE) is lower for firm B. Although TIE is an important variable because it reflects the amount of income available for interest payments, Firm B can still be considered stronger overall because its TIE of 2.40 is still sufficient to ensure timely payment.

Or, is it?

A credit analysis is never complete without performing both cross-sectional and time series analysis.

Cross-sectional Analysis

The previous analysis indicated that Bank B is in a better financial position than Bank A. However, it is not clear whether both banks are above or below their peers. It is quite possible that the ratios for the industry is much higher than both banks. For example, assume both firms belong to the metal industry

and manufacture a range of pumping equipment.[34] Assume they are 10 metal companies in the United States manufacturing similar equipment. The average financial ratios of the industry are shown below:

ROA	ROE	TIE	CR	EPS
12.5%	25.6%	4.5	3.2	3.8

The above numbers indicate that both firms, A and B, are performing below their industry peers and both should be considered below par in credit quality. Credit analysis that employ financial ratios should always be referenced against some industry or sector benchmark.

Time-series Analysis

In addition to cross-sectional analysis, it is also necessary to compare the performance of the financial ratios across time. The recent three-year performance of the financial ratios for firms A and B are shown in Table 6.3 and compared to the industry benchmark in the last three columns.

Table 6.3

	Firm A			Firm B			Industry Benchmark		
	2013	2014	2015	2013	2014	2015	2013	2014	2015
ROA	7.33%	7.82%	8.01%	10.40%	9.52%	8.09%	8.11%	8.14%	8.15%
ROE	17.45%	18.05%	18.55%	25.10%	24.15%	22.50%	19.95%	20.55%	21.00%
TIE	3.05	3.10	3.13	2.15	2.85	2.40	2.25	2.30	2.50
CR	1.68	1.65	1.70	2.98	2.85	2.47	2.40	1.45	2.50
EPS	1.10	1.17	1.18	2.40	2.10	1.80	1,52	1.55	1.60

When the financial ratios are examined for their recent performance, Firm B is not as strong as it initially appeared using cross-sectional analysis. Although the ratios of Firm B are comparable to the industry average, their performance has been declining in the last three years. The ROA declined from 10.40% to 8.09% while the EPS decreased from 2.40 to 1.80. In contrast, although Firm A has lower financial ratios than Firm B, its performance has been improving steadily over the last three years. ROA increased from 7.33% to 8.01% and EPS increased from 1.10 to 1.16. The other ratios of Firm A also show similar improvements in comparison to Firm B. Thus, credit analysis that employ financial ratios should be examined over time to detect improvements or deteriorations in the financial condition of the firm.

Ratio analysis is simple to compute and can provide important and reliable information on the borrower. One problem with ratio analysis is identifying the relevant ratios for credit risk analysis. For example, which is a relevant ratio in determining default rates, cash balances or employee turnover? It may be both, neither, or one of them. High cash balances may suggest the company has sufficient cushion to protect it against a downturn and ensure a higher likelihood of repayment. However, if the company is

[34] The North American Industry Classification (NAIC) code is 333911.

experiencing high employee turnover, it may indicate bad management practices and a higher likelihood of the company failing altogether in the near future.

The financial industry has developed a variety of models to determine the relevant variables for assessing the creditworthiness of a borrower. These credit scoring models rely on some form of regression analysis on historical data to identify the relevant variables.

Regression Based Models

Most credit scoring models rely on regression analyses to identify the relevant factors that can predict the probability of default by a borrower. Two of the more common models used in credit risk analysis is the logistic regression and linear discriminant analysis. The basic structure of a regression analysis is described below, followed by an explanation of the relevant factors used by some of the major credit ratings agencies.

Assume you manage to collect data from a group of 20 borrowers, some of whom have defaulted on their loans. The sample has been identified as representing the average population of borrowers of a particular group, say premium car buyers. Define the dependent variable as zero if the loan has defaulted or one if the loan did not default. Take an independent variable such as "Education" and assign the variable one if the borrower has a college degree or zero if attended only high school, as shown in Table 6.4.

Table 6.4

Borrower	Education	Default=0 / No Default =1	Borrower	Education	Default=0 / No Default =1
1	College	1	11	High School	1
2	College	1	12	High School	1
3	College	1	13	High School	1
4	College	1	14	High School	1
5	College	1	15	High School	1
6	College	1	16	High School	0
7	College	1	17	High School	0
8	College	0	18	High School	0
9	College	0	19	High School	0
10	College	0	20	High School	0

A visual inspection indicates that individuals with college degrees tend to default less than those with high school degrees. A regression of the default variable (0 or 1) against the education variable is likely to confirm the finding and stipulate that education should be considered as a relevant variable when reviewing a loan application.

However, one should be cautious when applying statistical techniques to make forecasts because of the interdependencies among variables and the difficulty in identifying omitted variables. For example, if we include another variable to the above data – working and not working, additional information may be garnered. As Table 6.5 below shows, the working variable is a much stronger factor in predicting the probability of repayment. In this (extreme) example, the lender should focus more on whether the applicant is working rather than whether he or she has a college or high school degree.

Table 6.5

Borrower	Education	Currently Working	Default=0/ No Default =1	Borrower	Education	Currently Working	Default=0/ No Default =1
1	College	Y	1	11	High School	Y	1
2	College	Y	1	12	High School	Y	1
3	College	Y	1	13	High School	Y	1
4	College	Y	1	14	High School	Y	1
5	College	Y	1	15	High School	Y	1
6	College	Y	1	16	High School	N	0
7	College	Y	1	17	High School	N	0
8	College	N	0	18	High School	N	0
9	College	N	0	19	High School	N	0
10	College	N	0	20	High School	N	0

In the above example, all working individuals repaid the loans while some college educated borrowers defaulted. The simplified example shows that developing credit scoring models requires the use of rigorous statistical methodology and fine data. The goal is to identify not only the relevant variables but the correct combination of variables. For example, we have to ensure that there are no dependencies among the independent variables (multicollinearity). We will not discuss further on statistical modelling but instead focus on the relevant factors identified by some of the major ratings agencies.

Corporate Ratings

In the U.S., there are several established ratings organizations that provide credit ratings on a range of borrowers. They have amassed a vast collection of data on businesses and individuals over time and employ their own unique statistical techniques to score the borrowers.

For business lending and bond issues, three major ratings agencies provide a comprehensive rating on the ability of publicly traded corporations, state and local governments, sovereign nations and private companies, to fulfil their financial obligations.

a. Standard and Poor's
b. Moody's
c. Fitch.

All three companies provide ratings focused on the ability of firms to repay debt. The rating categories of the three companies are shown in Table 6.6.

Table 6.6

Moody's		S&P		Fitch		Classification
Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	
Aaa	P-1	AAA	A-1+	AAA	F1+	High Grade
Aa1		AA+		AA+		
Aa2		AA		AA		
Aa3		AA-		AA-		
A1	P-1	A+	A-1	A+	F1	Medium grade
A2		A		A		
A3	P-2	A-	A-2	A-	F2	
Baa1		BBB+		BBB+		
Baa2	P-3	BBB	A-3	BBB	F3	
Baa3		BBB-		BBB-		
Ba1	Below Prime	BB+	B	BB+	B	Below investment grade
Ba2		BB		BB		
Ba3		BB-		BB-		
B1		B+		B+		
B2		B		B		
B3		B-		B-		
Caa1		CCC+	C	CCC	C	Speculative
Caa2		CCC				
Caa3		CCC-				
Ca		CC				
		C				
C		D		Below DDD		In default

Long-term ratings apply primarily to bonds and reflect the ability of the firm to repay its debt over a long period of time. A rating of AAA would indicate a firm has been deemed to have sufficient and steady revenues over the long term to cover its interest and principal payments.

Short-term ratings reflect the company's ability to repay short-term obligations that include commercial paper and letters of credit. The higher the grade, the more likely the repayment.

Example: Durable Goods and Construction Industry

All credit rating agencies provide ratings by sectors and geographical distribution. As an example, the breakdown of Moody's ratings for the durable goods and the construction industries are shown in Table 6.7:

Table 6.7

	Durable Goods	Construction Industry
Scale (or size)	**20%**	**25%**
Business profile	**25%**	**25%**
Profitability	**5%**	
Leverage	**35%**	**30%**
Financial Policy	**15%**	**20%**
Total	**100%**	**100%**

For the durable goods industry, more weight is given to leverage (35%) and profitability (5%) than the construction industry (30% and 0, respectively). The construction industry is given more weight for scale and financial policy (25% and 20%, respectively). Business profile is given the same weight (25%) for both industries.

Individual Credit Scores

In the case of individuals, the following three agencies provide the bulk of the ratings to financial institutions and other lending agencies.

a. Experian
b. Equifax
c. Transunion

The agencies provide FICO scores based on the model developed by the Fair Isaac Corporation to evaluate the credit status of individuals. Recently, Experian developed its own Vantage Plus score and is also used by the financial services industry.

FICO SCORES

FICO uses the following variables to determine the final score of an individual.

Credit history	- 35%
Amounts owed	- 30%
Length of credit history	- 15%
Types of Credit in use	- 10%
New credit	- 10%
Total	-100%

Each variable has a number of sub-categories. The total score ranges from 350-800.

Ratings and interest rate

Once a rating has been assigned, the bank or lender has to decide the following:

a) is the borrower qualified for the loan, and
b) what should be the appropriate interest rate for the loan.

At the minimum, a bank has to ensure that the repayments cover the total cost of funding. There are two basic models that determine the interest rate.

Cost-Plus Model

The simplest model to determine the appropriate interest rate is the cost-plus loan pricing model. Similar to the estimation of the all-in costs of deposits, the cost-plus model adds all relevant costs to an average base rate to arrive at an interest rate for each risk class of clients. At the minimum, the model should include the following:[35]

1. Average funding cost. For a commercial bank, it is the cost of various deposits (demand, savings and time) and borrowings (CDs, Inter-bank lending and long-term bonds).
2. Average operating costs. For a commercial bank, it should include costs of origination and maintenance, processing, salaries and applicable overheads.
3. Risk premium. The premiums will vary based on the characteristics of the individual borrower (to be discussed later).
4. Appropriate profit margin. The margin is determined by market conditions and partly by the strategy adopted by the bank (high volume, low margin or low volume, high margin etc.).

Price-Leadership Model

The cost-plus model is impractical if a competitive bank has a lower average cost of funding or operating cost. An alternative method is the price-leadership model where a minimum competitive market rate is first established as the average cost of funds, such as the prime rate. As an example, assume a large bank is able to access a wider pool of funds and obtain a low average cost of funds relative to other banks. All banks, including the small bank, will have to work off the average cost of funds of the large bank. This requires the "other" banks to adjust its operating cost and profit margin to remain competitive with the large bank.

Risk premium

The major challenge in credit pricing is determining the risk premium. Credit scoring models, whether developed in-house or purchased through vendors, can provide a reasonable estimate on the likelihood of default by different risk classes of borrowers. However, translating them to risk premiums is a little more challenging. It is generally accepted that a borrower with a low credit score should be charged a higher premium. The exact premium depends on the characteristics of the borrower and the loan. They include credit score, collateral and maturity of the loan.

1. **Credit Score.** The lower the score, the higher the risk premium. Although this is straightforward, banks have to ensure that they apply the premium consistently across all borrowers. Assume the average cost of funds for the bank is 6.00%. A bank could set the risk premium as follows:

FICO Score	Premium
Above 750	1.50%
725-750	3.50%
700-725	5.50%
650-700	7.50%
600-650	9.50%
550-600	11.50%
Below 650	Deny Loan

[35] "How do lenders set interest rates on loans?" Federal Reserve Bank of Minneapolis, Nov 1, 2000. Available at https://www.minneapolisfed.org/publications_papers/pub_display.cfm?id=3030

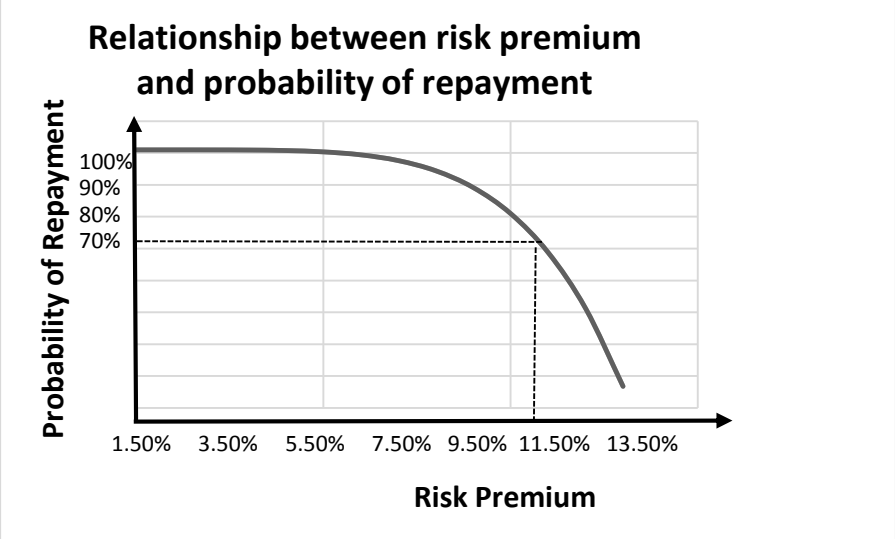
2. **Collateral.** The higher the collateral, the lower the risk premium. However, lenders have to be careful to ensure that the collateral is of sufficient value. In addition, collateral has to be monitored periodically to ensure that its value has not declined. As an example, assume an oil company pledges its oil rigs and equipment as collateral for a loan. When oil prices are high, the value of collateral will also be high. If oil prices decline however, the value of collateral could diminish significantly. In the event of a default, a bank may find itself with insufficient collateral to cover its losses.

3. **Maturity of loan.** The longer the length of the loan, the larger the risk premium. Longer term debt usually has higher rates because the funds of the lender is locked for a long period.

Limits to risk premium

Even if a bank manages to identify all the relevant variables to determine the risk premium, it faces an additional constraint - a ceiling on risk premiums. If banks charges too high a premium, it increases the likelihood of default. The relationship between risk premium and default is shown below in Figure 1. A bank is better off denying credit, termed credit rationing, than charge a high risk premium because it increases the likelihood of default.

Figure 1.



For each category of loans, a bank will determine an optimal risk premium that will ensure full repayment. In the above figure, based on the example shown earlier, the probability of repayment with a 5.50% risk premium added to the cost of funds is still 100%. As the risk premium goes past 7.50%, the probability of repayment declines. Beyond 11.50%, the probability of repayment is only 70% and the bank may choose to deny credit altogether.

Quantifying Risk Premium

One way to quantify the appropriate risk premium is to extract an estimate of the default risk from market data. Market prices can be considered reliable because companies are scrutinized by a wide range of analysts. Ratings agencies perform detailed analysis of companies that issue debt (bonds). They provide a credit score that reflects the ability of a company to repay the interest and principal of the bond. Analysts working for banks, mutual funds, hedge funds and other financial institutions all perform their own analyses and provide independent recommendations. If several analysts recommend selling the bond or

if the rating agencies downgrade a company, investors react by selling the bonds. This will lower the price and raise the yield of the bond. Conversely, if rating agencies upgrade a company or analysts recommend buying the bonds, the resulting purchases will increase the price and lower the yield of the bond. When investors from all over the world buy and sell bonds and stocks of companies based on all of these publicly available information, they collectively establish a price and interest rate.

If the market is sufficiently deep, i.e. there are multiple buyers and sellers, the bond rate established in the market should reflect the overall risk of the company. The continuous trading of bonds (and other assets) results in price discovery as new information on the company is released. The forms the basis for the market efficiency hypothesis which states that investors can safely assume that observed prices in the market are the "true" prices. Note that market efficiency does not imply the observed prices are always correct at every moment of time. Instead they are accurate on average since a number of factors can cause short-term deviations such as information asymmetry and contagion. There are many periods in history when markets have been wrong, mostly as a result of herd behavior, and prices have deviated from the appropriate price but over the long-term, they have proven to reflect the "true" price.

If one accepts the premise that, on average, markets are efficient, then one can extract the risk premium of a company from the rates of its bonds trading in the market. The example below highlights one method of deriving the risk premium from available market rates.

- First, a risk-free rate is required to serve as a lower bond where all investors have the opportunity to earn without fear of default. In most countries, the government bond rate serves as the risk-free rate. It is rare for governments to default on its obligation to its citizens.[36]

- Second, investors will buy bonds or lend to other companies only if they receive a premium over the risk-free rate to offset the likelihood of default.

- The observed difference between the risk-free rate and that of a publicly traded bond of a company can reveal the market's assessment of the probability of repayment by the company.

Assume a bank wishes to make a loan to a client in the retail industry under the sub-category 'Food and Drug Retailers'. Assume also the current rate on a one-year government bond is 3%, denoted by R_f. Research on firms under the "Food and Drug Retailing" indicate that most companies fall in the BBB category. Prior history of loans to firms in this category show that default rates are approximately 5%.

A brief explanation of the term default is in order when discussing pricing of bonds or debt. A default of a bond means that the company is unable to meet its periodic interest and principal payment. It does not mean that the bank will lose its entire principal. In most cases upon liquidation, banks will be able to sell off assets of the bankrupt firm and recover some of its principal. In some cases, bondholders and banks are able to recover 100% of their debt. In other cases, bondholders may recover nothing. Banks may even incur losses exceeding 100% if it has to pay for bankruptcy related costs or liquidate assets of the borrower, such as foreclosed properties.

The recovery rates of loans vary by type of loan and sector. One popular method to determine recovery rates is the Loss Given Default (LGD) or the difference between the principal minus the value of the liquidated assets, net of legal and other related expenses. In some cases, LGD can exceed 100% as the cost of disposing the assets and legal fees exceed the original amount. In a recent FDIC study covering over 15,000 Commercial and Industrial (C&I) loans, the mean LGD was found to be 54 percent. However,

[36] The debt restructuring of Greek sovereign bonds in 2011 and the Puerto Rican crisis in 2016 should remind readers that there will always be exceptions in the market.

the distribution was skewed at both ends, with a majority of the loans either fully recovered or incurring losses over 100%.[37] .

For our example, assume the bank has estimated that the loss given default (LGD) for the "Food and Drug Retailing" category is 50%. If the probability of default is 5% (or 0.05), then the probability of repayment is 95% or (1 – 0.05). We designate P as the probability of repayment and (1-P) as the probability of default, as shown in Table 6.8. To recap:

Table 6.8

P or probability of repayment	**= 95%**
(1 – P) Probability of default	= 5%
LGD or Loss given default	= 50%
R_f or risk-free rate	= 3%

If a bank has to decide between investing in a risk-free one-year government bond paying 3% or lending to the client in the "Food and Drug Retailing" industry, it has to be take into account the likelihood of default and LGD. If the bank's decision to lend is based strictly on expected return, i.e. the bank is risk neutral, then the expected rate on the corporate loan, r, should be equal to the government bond rate, R_f, of 3%.

This can be shown as follows:
$P(1 + r) + (1-P)*(1-LGD) = 1 + R_f$.[38]
$0.95(1 + r) + (.05)(.50) = 1 + .03$
$0.95(1 + r) = 1 + .03 – 0.025$
$(1 + r) = (1.005)/(.95) = 1.0579$
$r = .0579$ or 5.79%

A risk-neutral lender will be indifferent between investing in a 3% government bond or lending to a borrower in the "Food and Drug Retailing" sector that pays 5.79%.

Example

Assume a bank can invest $100 in government bonds at a risk-free rate of 3%. At the end of the year it can expect to receive $103.

Alternatively, it can invest in a corporate bond paying 5.79% with a default probability of 5%. If the client defaults, it expects to received 50% or $50. Its expected payment is:

= 0.95(1 + 0.0579)*$100 + 0.05 ($50)
= $100.50 + $2.50 = $103 (the same amount if it has invested in the government bond)

The interest rate, r, can be estimated directly:

$$r = \frac{R_f + LGD(1 - P)}{P}$$

[37] 1 Lynn Shibut and Ryan Singer, "Loss Given Default for Commercial Loans at Failed Banks," FDIC, June 2014. Available at https://www.fdic.gov/bank/analytical/cfr/bios/Shibut_SingerWP.pdf.

[38] An alternate version is $P(1 + r) + (1-p)*(1-LGD)*(1+r) = 1 + R_f$, i.e. the recovery (1 – LGD) is a percent of principal and interest instead of just principal.

For our example:

$$r = \frac{.03 + 0.50(1-0.95)}{0.95} = 0.05789 \text{ or } 5.79\%$$

Risk Averse Lenders

The above example assumed that investors are risk-neutral. However, in the real world most investors and lenders are risk averse. In the above example, a banker would likely opt for the risk-free rate because the 5% probability default of the corporate client is only an estimate. If the default rate turns out to be higher, the realized return at maturity will be lower. Hence, a risk averse lender will demand a larger premium to lend to the above borrower. In other words, the expected return on the loan has to be greater than 3%.

Assume, the lender demands an additional premium of 3% as a result of risk aversion. What will be the new rate demanded by the lender?

P(1 + r) + (1-P)*(1-LGD) = (1+R_f+RP)
.95(1 + r) + (.05)(.50) = 1 + .03 + .03
0.95(1 + r)= 1 + .06 – 0.025
(1 + r) = (1.035)/(.95) = 1.0895
r = .0895 or 8.95%.

Using the formula:

$$r = \frac{.06+.50(1-.95)}{0.95} = .0895 \; or \; 8.95\%.$$

Other Premiums

We have taken a simple approach to determine the risk premium to compensate for default risk. In reality, there are many other premiums to be included. Some of them have been discussed in an earlier chapter. In particular, investors will demand additional premium for the following:

- Liquidity risk
- Embedded options
- Convexity
- Time value of money

There are several different ways to estimate the contribution of the additional premiums to interest rates. They are beyond the scope of this book and will not be discussed.[39]

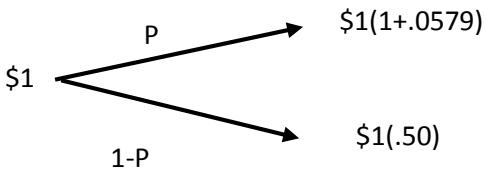
Determining the Probability of Default

In the previous section, we assumed a probability of default of 5% to derive the risk premium from market data. How should a probability of default be estimated from market data? We can use the same method as the previous example by comparing the current market rate to the risk free rate. In the prior example, we estimated the nominal rate given the probability of default. Here we estimate the probability of default

[39] These topics are usually covered in a course on fixed oncome securities.

given the current interest rates prevailing in the market. An example below highlights the methodology for a risk-neutral lender.

Assume the existing one-year risk-free rate is 3% and the average market yield of the one-year BBB-rated corporate bond in the "Food and Drug Retailing" sector is 5.79%, implying that the market is demanding a risk premium of 2.79%. If investors are indifferent between choosing the risk-free rate of 3% or investing in the BBB-rated bond at 5.79%, it would imply that the lender has estimated a probability P of receiving the principal and 5.79% interest and a probability (1-P) of receiving only 50% of the principal at the end of year. The present value of both expected payments is the initial investment of $1.



Solving P*(1+.0579) + (1-P)*(.50) = 1.03

P +.0579P + .50 - .50P = 1.03
.5579P = 0.53 or P = 0.95

The market has assessed a probability of repayment of 95% or a probability of default of 5%.

Another example:

Assume a one-year risk-free rate is yielding 3% and the probability of repayment of a BBB-rated corporate bond has been estimated at 80%. The recovery rate has been estimated at 65% or the LGD (loss given default) = 35%. What should be the risk-neutral rate of the corporate bond?

$P(1 + r) + (1-P)*(1-LGD) = 1 + R_f$.

.80(1 + r) + (.20)(.65) = 1+.03
.80(1 + r) = 1.03 – 0.13
(1 + r) = 0.90/(.80) = 1.1250
r = .1250 or 12.50%

Delinquency Rates

What has been the default rates of loans in the United States? Table 6.9 shows that the delinquency rates of loans of U.S. Commercial banks from 2006 to June, 2016, a period that covers the financial crisis of 2008. The default rates have ranged between 1-2% during normal years and exceeded 10% in the aftermath of the recession, as a result of business failures and high unemployment. Delinquency rates on

residential mortgages averaged 11.26 in 2010 while credit card rates reached 6.59% in 2009. The rates have been declining steadily since 2010 and have reached pre-recession levels in the first half of 2016.

Table 6.9

Charge-Off and Delinquency Rates on Loans and Leases at U.S. Commercial Banks											
	Real estate loans				Consumer loans			Leases	C&I loans	Agricultural loans	All
Year	All	Resid[1]	Comm[2]	Farm land	All	Credit Cards	Other				
2016	3.03	4.84	0.97	1.63	1.99	2.15	1.84	0.92	1.51	1.09	2.17
2015	3.99	6.16	1.41	1.59	2.01	2.11	1.92	0.72	0.75	0.84	2.49
2014	5.34	7.82	2.20	1.91	2.32	2.32	2.33	0.82	0.90	1.05	3.31
2013	7.16	9.70	3.66	2.38	2.56	2.65	2.46	0.83	1.11	1.22	4.41
2012	8.24	10.34	5.48	2.96	2.93	3.08	2.78	0.85	1.53	1.62	5.27
2011	9.08	10.41	7.56	3.63	3.45	3.85	3.00	1.20	2.45	2.36	6.20
2010	10.02	11.26	8.76	3.44	4.75	5.84	3.51	2.22	3.95	2.97	7.40
2009	7.18	7.85	6.59	2.49	4.68	6.59	3.53	2.15	3.20	1.80	5.65
2008	3.55	3.69	3.50	1.47	3.49	4.81	2.77	1.38	1.45	1.10	2.87
2007	1.77	2.03	1.43	1.48	2.93	3.98	2.29	1.21	1.20	1.19	1.74
2006	1.36	1.60	1.02	1.53	2.77	3.83	2.11	1.25	1.40	1.12	1.51
1. Residential real estate loans include loans secured by one- to four-family properties, including home equity lines of credit.											
2. Commercial real estate loans include construction and land development loans, loans secured by multifamily residences, and loans secured by nonfarm, nonresidential real estate.											

Bankruptcy and Liquidation

Although the measure of loss given default (LGD) is mostly determined using historical data, the actual losses and recovery of defaulted loans depends on the bankruptcy process. It usually involves a lengthy courts trial and numerous negotiations with the creditors before any final recover rate is established. In the United States, the Bankruptcy Code of 1978 is a uniform federal law that governs all cases of bankruptcy. The process and rules for filing bankruptcies is governed by the Federal Rules of Bankruptcy Procedures and the local rules of each bankruptcy court. There are 90 bankruptcy districts in the United States. The United States bankruptcy judge, a judicial officer of the United States district court, is the court official that oversees all federal bankruptcy cases. The Bankruptcy Code has been modified several times since 1978. The latest rule change occurred in 2005 when President George W. Bush signed the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCA) into law. The law has made it very difficult for individuals and businesses to file for bankruptcy.

There are five chapters in the Bankruptcy Code that determines the type of bankruptcies that can be filed by individuals and businesses.

Chapter 7 pertains to the rights of individuals and businesses to declare bankruptcy and for an orderly liquidation of their assets. An independent trustee will handle the distribution of the liquidated assets to the various claimants based on their priority and standing.

Chapter 9 is a special provision for bankruptcy by municipalities that are unable to meet its payments on bond and other debt.

Chapter 11 allows a company to restructure its business and attempt to revive and bring the company back to profitability. It allows the company to remain open while debtors and creditors created a new business plan and reorganize the company to repay all or part of its debt.

Chapter 12 is applicable to farmers and fishermen with debts below $1.5 million to file for bankruptcy or reorganize their debt. The individual should have earned more than 50% of their income in agriculture to qualify under this chapter.

Chapter 13 is called the wage-earner's bankruptcy and allows individuals or individual owned business to seek relief from current debt obligation be seeking a new repayment schedule to pay off debt between three to five years. They have to be currently earning income and the amounts have to be less than $1,250,000 if unsecured and $750,000 if secured.

Absolute Priority Rule

During a liquidation, the Absolute Priority Rile determines the order of payments to receive the proceeds on the liquidation of the assets.

1. Domestic support obligations that include alimony maintenance and child support. This was a recent upgrade under the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 (BAPCPA).
2. Administrative expenses associated with administrating the bankruptcy process and includes legal fees to lawyers and court fees.
3. Employee and wages up to $12,475 for the 180-days prior to closing of the company. The amount is adjusted for inflation every three years.
4. Contributions due to employee pension funds.
5. Claims by consumers with a limit of $2,775 each. The amount is adjusted for inflation every three years.
6. Government taxes and other obligations.
7. Payment to creditors
8. Payment to preferred shareholders
9. Payment to shareholders.

It should be clear that the absolute priority rule makes estimating the loss given default very case specific and will vary for each individual bankruptcy. Hence, only an average recovery rate can be estimated for different classes of loans.

Risk-Adjusted Return on Capital

Instead of measuring a risk premium over the risk-free rate, an alternate method is to directly determine a risk-adjusted return on economic capital. This methodology was originally developed by Bankers Trust (now part of Deutsche Bank) in the 1970s. It is currently used by most banks to measures the performance of loans based on the risk of the loan. This is different from the traditional measures of return.

The common measure of the return on a loan is defined as interest income over the loan amount. If you lend an individual $100 and earn $10 as interest income, the return is defined as:

$$Return = \frac{Interest\ Income}{Loan\ Amount} = \frac{\$10}{\$100} = .10\ or\ 10\%$$

In contrast, RAROC is defined as follows:

$$RAROC\ = \frac{Net\ Expected\ Income}{Economic\ Capital}$$

Expected income is defined as interest and fee income less interest expense. Economic capital is defined as maximum potential losses that can be sustained on the loan. In other words, RAROC captures a broader definition of risk that includes credit risk, market risk and operational risk. This approach is different from the traditional approach in that the nominal or book value of the loan is less relevant. The denominator is focused on the maximum potential loss of the loan in the coming future. As a result, it is a forward looking measure in contrast to the traditional book value measure.

Measuring Economic capital

Economic capital is defined as the difference between a projected loss and the expected loss, hence a measure of unexpected loss. A bank will price its loan to cover expected loss, as shown in the prior risk-neutral model. To determine the unexpected loss, we require to specify a statistical confidence level. For example, if we wish to have a 95% confidence level, we are estimating the likelihood of incurring a loss that occurs once in very 20 outcomes. If we prefer to use 99.98% confidence level, we are estimating the likely loss that occurs once in 5000 outcomes.

There are various methods employed to measure economic capital, sometimes referred to as loan at risk. We will use a simple non-parametric historical simulation method to determine the loan at risk. Assume the bank wished to use 99.5% confidence level, or one in 200 out comes, and the category of loans is the retail food and drug sector. It compiles a list of 600 retail food and drug loans that was made by the bank during the last five years. For each loan, it estimates the percentage lost on each loan and is listed in ascending order as show below.

Loan 1	0%	
Loan 2	0%	
Loan 3	0%	
.		
.		
.		
Loan 596	3.95%	
Loan 597	4.15%	=> 99.5% level of confidence
Loan 598	4.18%	
Loan 599	4.19%	
Loan 600	4.21%	

The third highest loss would represent the 99.5% level of loss at the tail end of the distribution. Hence the bank can assume that there is a 0.5% probability that an extreme event would result in a loss of 4.15% of

the loan. Thus, the economic capital (or loan at risk) of a $100,000 loan is measured by the unexpected loss or $4,150.

Assume the expected income on the $100,000 loan is as follows:

Interest rate : 6.00% or $6000
Interest expense : 4.00% or $4000
Operating expense : 1.00% or $1000
Expected loss : 0.55% or $ 550
Net expected Income : $ 450 or a spread of 0.45% ($450/$100,000)

$$RAROC = \frac{Net\ Expected\ Income}{Economic\ Capital} = \frac{\$450}{\$4150} = 10.84\%$$

If the minimum RAROC established by the bank is 15%, then the loan is unacceptable. Even though it has a spread of 0.45%, the risk is too high based on the unexpected loss value of $4,150. The loan application should be rejected. If this is an ongoing loan, the terms will have to be renegotiated if it is permissible.

Table 6.10

Example of ROE and RAROC for a portfolio of loans X and Y		
	Loan Portfolio X	Loan Portfolio Y
Portfolio Balances	$100,000,000	$100,000,000
Net Income before Losses[1]	$1,400,000	$1,100,000
Loan Parameters		
PD (Probability of Default)	0.50%	0.25%
LGD (Loss Given Default)	50%	40%
Expected Loss percent (bp)	25	10
Expected Losses	$250,000	$100,000
Income after Expected Losses	$1,150,000	$1,000,000
Economic Capital (credit only)[2]	$4,640,000	$2,460,000
Equity	$8,000,000	$8,000,000
ROE	14.38%	12.50%
RAROC	24.80%	40.70%
Economic Profit (10% hurdle rate)	$686,000	$754,000
[1]Defined as loan interest + fees - funding costs - operating costs.		
[2]Determined from a model. Source: FDIC		

Another Example

Table 6.10 highlights an example cited by the FDIC on a $100,000,000 portfolio of a bank. It shows an alternative model to estimate the economic capital using probability of default (PD) and Loss given default (LGD).

Assume a bank has two loans with net income before losses estimated as in Table 6.10. Loan portfolio X has a higher net income before losses than portfolio Y. The expected losses however are larger for portfolio X, estimated as follows:

Expected Loss = Loan Amount x PD x LGD

= $100,000,000 x .005 x .50 = $250,000

Net income after expected losses = $1,150,000 for portfolio X and $1,000,000 for portfolio Y.

Return on Equity ROE on portfolio X = $1,150,000/8,000,000 = 14.375%
Return on Equity ROE on portfolio Y = $1,000,000/8,000,000 = 12.50%

The book measure ROE would indicate that portfolio X would provide a higher return for the bank.

However, the result is different if we use RAROC. Assume the Economic Capital (or maximum potential loss) has been estimated as $4,640,000 for portfolio X and $2,460,000 for portfolio Y.

RAROC for portfolio A = $1,150,000/$4,640,000 = 24.80%
RAROC for portfolio B = $1,000,000/$2,460,000 = 40.70%

The RAROC measure indicates that portfolio Y provides a higher return when we include the likelihood of an unexpected loss on the loan portfolio, as estimated by the economic capital or loan at risk.

Credit Risk Management

So far, our discussion has focused on assessing the quality of the borrowers and estimating the probability of default. Credit risk management focuses on managing risk once the loans have been disbursed.

Credit risk management in banks primarily applies to loans but they can cover other instruments such as derivatives, letters of credit, lessors, and foreign exchange. Credit events include bankruptcy, failure to pay, loan restructuring and loan moratorium.

Credit risk management has become a very formal process for most banks. The Fed and Basel guidelines require financial institutions to have a very stringent process in place to ensure that banks are protected against all forms of counterparty failures.

Guidelines for credit risk management

A partial outline of the guidelines is listed below:

1. Establishing an appropriate credit risk environment.
    a. Banks should identify and manage credit risk inherent in all products and activities.
    b. The board of directors should have responsibility for approving and periodically (at least annually) reviewing the credit risk policies and strategies of the bank.
2. Operating under a sound credit granting process
    a. Banks should establish overall credit limits at the level of individual borrowers and counterparties and have a clearly-established process in place for approving new credits as well as the amending, renewing and refinancing existing credits.
3. Ensuring adequate controls over credit risk.
    a. Banks must have a system in place for early remedial action on deteriorating credits, managing problem credits and similar workout situations.
4. The role of supervisors

a. Supervisors should require that banks have an effective system in place to identify, measure, monitor and control credit risk as part of an overall approach to risk management.

Credit risk management should begin with the Board of Directors and filters all the way from the CEO to the loan officer granting the loans.[40]

Loan Restructuring

What happens when a loan is in default or in the process of being declared in default? Does it make economic sense for the bank to renegotiate the terms of the loan? The decision to restructure a loan is often based on the expected payoffs before and after a renegotiation. If a bank misses making an interest or principal repayment, the bank has the right to declare a firm bankrupt and proceed with the process of seizing the assets of the firm. It will attempt to dispose the assets of the firm at the highest price it can obtain. In the process, it will incur certain charges including legal fees. When all charges have been deducted, the remaining value is the net recovery value of the asset. The difference between net recovery and the book value of the loan will be charged-off and deducted from loan loss allowances.

The alternative to declaring bankruptcy is to reschedule the loan which requires the bank to renegotiate the terms of the loan. If the loan is renegotiated, the bank is likely to offer softer terms to give the borrower some relief from high payments in the short run. In most cases, it means reducing the interest rates as well as postponing principal payments to allow the borrower time to recover from their current adverse situation. The decision to restructure or to declare default will depend on the net payoff to the bank; the bank will choose the option that provides the higher payoff.

Example

Assume a company currently owes $5 million to a bank with three equal annual payments remaining. The interest rate is 12%. A recent recession has taken a toll on the company and the company is struggling to maintain its sales. Although the recent improvement in GDP indicates that sales may begin to increase, its cash flow is currently too low to make its annual interest and principal payments. The bank is considering renegotiating the loan terms to make it easier for the company to manage its cash flows for the next four years.

If the loan is defaulted today, the bank expects to recover the following:

1.	Liquidation of assets	: $ 3,700,000
2.	Expenses related to disposal	: $ 750,000
3.	Net recovery	: $ 2,950,000

New terms

1. Loan payments will be stretched to 10 years.
2. Interest rate will be reduced to 3% for the next 10 years.
3. Principal payment of $1 million per year beginning year 6 to year 10.
4. Upfront fee of ½% for administrative charges during renegotiations.
5. Increase in the cost of funds to 12% to compensate for the higher risk of the loan.

[40] Principles for the Management of Credit Risk, Basel Committee on Bank Supervision, www.bis.org

In order to determine if the restructuring terms are beneficial to the bank, we will determine the present value of the renegotiated loan ($PV_{renegotiated\ loan}$)and compare it to the loan value after liquidation ($PV_{liquidated\ Loan}$).

Present value of the liquidated loan is the net recovery amount, i.e. $PV_{old\ Loan}$ = $2,950,000

Cash Flows of Renegotiated Loans

	0	1	2	3	4	5	6	7	8	9	10
Interest	25000	$150000	$150000	$150000	$150000	$150000	$150000	$120000	$90000	$ 60000	$30000
Principal							$1000000	$1000000	$1000000	1000000	$1000000
Total	25000	$150000	$150000	$150000	$150000	$150000	$1150000	$1120000	$1090000	$1060000	1030000

$25,000 is up-front fee

$PV_{New\ loan}$ =
$PV_{r=12\%}$($150,000, $150,000, $150,000, $150,000, $150,000, $1,150,000, $1,120,000, $1,090,000, $1,060,000 $1,030,000)
= $2,809,085.12

Since the present value of the renegotiated loan is lower than the net recovery amount, the bank should proceed with the default.

However, the bank can opt to increase the present value of the new loan by changing one of the conditions in the terms. For example, assume the bank charges 3% interest for the first 5 years and increases it to 7% for the remaining five years. How does this change affect the net present value?

	0	1	2	3	4	5	6	7	8	9	10
Interest	25000	$150000	$150000	$150000	$150000	$150000	$350000	$280000	$210000	$140000	$70000
Principal							$1000000	$1000000	$1000000	$1000000	$1000000
Total	25000	$150000	$150000	$150000	$150000	$150000	$1350000	$1280000	$1210000	$1140000	$1070000

$25,000 is up-front fee

$PV_{r=10\%}$ (25000, $150000, $150000, $150000, $150000, $150000, $1350000, $1280000, $1210000, $1140000, $1070000)
= $3,072,980.94

Since the present value of the renegotiated loan is higher than the recovery amount, the bank will be better off with a restructured loan under the new terms.

The article below shows one example of a loan restructuring by an oil company in Argentine. In this case, the additional funding of $20 million pays the same interest rate but the maturity is extended to two years.

Table 6.11

President Energy provides update on Argentina operations and loan restructuring

President Energy (AIM: PPC), a South American oil and gas exploration and production company provides the following update on its Argentina operations and revised loan agreements.

1. President has now engaged drilling contractors for a 2016 three horizontal well programme due to commence by end July
2. Objective of the drilling campaign is to increase sustainable production above 1,000 bopd (barrels of oil per day).
3. Revised funding arrangements with IYA Global Limited ('IYA') provides the Company with the funding to undertake the 2016 drilling campaign and increased working capital headroom
4. Loan Restructuring provides increased funding of US$20.0 million comprising an additional US$5.0 million to the Company's existing US$10.0 million loan facility and US$1.0 million to the existing convertible loan of US$4.0 million
5. The maturity of both the loan facility and the convertible loan will be extended by two years to 30 June 2019 with the same interest rates and payment terms as the existing loan agreements
6. The revised funding arrangements will result in an increased facility of US$20.0 million, comprising an additional US$5.0 million to the Company's existing loan facility of US$10.0 million and a US$1.0 million addition to the existing convertible loan of US$4.0 million.
7. The maturity of both the loan facility and convertible loan will be extended by two years to 30 June 2019

July 16, 2016. Excerpts taken from the company press release.

http://www.presidentenergyplc.com/assets/downloads/2016_06_28_Argentina_Funding_Final.pdf

Debt for Equity Swaps

Another option for banks and lenders holding problems loans is to exchange the debt for equity of the troubled company instead of declaring a default. The determination of whether a debt-for-equity swap is the better alternative requires the same analysis as a loan restructuring; if the loss from declaring a default exceeds the expected loss from a debt-for-equity swap, the latter should be chosen. In most cases, lenders opt for debt-to-equity swaps only when the liquidation proceeds are expected to be very low.

Measuring the cash flows of a debt-for-equity swap is more challenging than loan restructuring, primarily because the expected cash flows depends on the success of the turnaround. In many cases, additional funding will be required to keep the company afloat, further diluting the stock.

The following example shows the steps in the determination of a debt-to-equity swap.

Assume a company has the following balance sheet in book values, as shown in Table 12A. It has long-term debt of 50 million paying an average interest rate of 10%.

Table 6.12A

Firm A			
Current Assets	$20 m	Current Liabilities	$20 m
		Long-Term Debt	$50 m
Fixed Assets	$80 m	Equity	$30 m
Total Asset	$100 m	Total Liab and SE	$100 m

The revenues of the firm have declined recently and they are unable to make the $5 million annual interest payment. The recent income statement (in millions) is shown below.

Revenues	$15.00
Variable Cost	-$ 8.00
Gross profit	$ 7.00
Interest	-$ 5.00
Depreciation	-$ 1.00
Earnings before taxes	$ 1.00
Taxes 40%	-$ 0.40
Net Income	$ 0.60
Add back Depreciation	$ 1.00
Cash Flows	$ 1.60

Assume the debt is held by a group of creditors (syndicated loan). If the company is declared in default and the assets are disposed of, the net proceeds to the creditors is estimated at $20 million or 40% of the face value of the debt.

A consulting firm hired to evaluate other options other than default has made the following report. If the company refocuses on its core business, disposes off some of its ageing assets, and invest in the state-of-the-art equipment, it should be able to gradually boost its cash flows for the next 10 years. The turnaround includes a change in management and a new slate of board of directors. The turnaround plan requires the creditors to invest an additional $ 40 million. Finally, the conversion of debt to equity will result in the creditors owning 95% of the firm and the old shareholders 5%.

The expected cash flows under the turnaround plan are shown below:

Cash	0	1	2	3	4	5	6	7	8	9	10
Flows	-$40m	$2	$4	$6m	$8m	$10m	$12m	$12m	$12m	$12m	$30m

$NPV_{15\%}$ = $2.70 million

The $30 million in year 10 includes after-tax salvage value of the equipment. If creditors are satisfied with a 15% rate of return because of the increased risk, the net present value of this plan is 2.70 million. Since the NPV >0, creditors should opt for this option instead of defaulting. Creditors have now become owners of the firm. The new balance sheet after the debt-for-equity swap is shown in Table 6.12B. The surviving old assets are assumed to be fully depreciated with a book value of zero.

Table 6.12B

Firm A (after debt-to-equity swap)			
Current Assets	$10 m	Current Liabilities	$10 m
Fixed Assets	$40 m	Equity	$40 m
Total Asset	$50 m	Total Liab and SE	$50 m

An example of a debt-for-equity swap including loan restructuring is shown in Table 6.13 for Postmedia company, a Canadian company specializing in media related business.

Table 6.**13**

Postmedia Announces Execution of Support Agreements for a Recapitalization Transaction

July 7, 2016 (TORONTO) – Postmedia Network Canada Corporation ("PNCC" or the "Company") (TSX:PNC.A, PNC.B) announced today a proposed recapitalization transaction (the "Recapitalization Transaction") that will significantly reduce Postmedia's outstanding indebtedness and annual interest costs, improve its capital structure and liquidity, and result in an enhanced financial foundation for Postmedia.
The Recapitalization Transaction has the following key elements:

- First Lien Notes extended by approximately four years to July 2021 and reduced to C$225 million with a cash repayment of approximately C$78 million at par;
- All of the Second Lien Notes in the aggregate principal amount of approximately US$268.6 million, together with all interest accrued from and after July 15, 2016, exchanged for approximately 98% of the total number of Shares of the Company upon completion of the Recapitalization Transaction;
- Approximately C$110 million of new capital (the "New Capital") invested in the form of new U.S. dollar denominated second lien secured notes due July 2023 with *no cash interest for the first three years*, subject to certain conditions;
- Obligations to employees, customers and suppliers will not be affected by the Recapitalization Transaction and will continue to be satisfied in the ordinary course.
- Upon completion of the Recapitalization Transaction, existing holders (the "Shareholders") of the outstanding variable voting shares and voting shares of the Company will collectively own approximately 2% of the outstanding Shares of the Company.
- As announced by the Company on April 7, 2016, Postmedia management, overseen by an independent special board committee and with the assistance of its financial and legal advisors, has been exploring and reviewing alternatives to improve its operations, capital structure and liquidity.
- The review has considered various options, including non-core asset sales, cost reductions, revenue enhancements and initiatives, refinancing or repayment of long-term debt, the issuance of new debt or equity and other potential strategic transactions.
- After an extensive review and consultation process, Postmedia concluded that the Recapitalization Transaction represents the best available alternative to improve the Company's capital structure and maximize and preserve value for the Company and its stakeholders.
- *Source: Company Press release.*

International Credit Risk

Credit risk analysis involving overseas transactions requires additional constraints to be addressed in models predicting the probability of default and loss given default. The constraints arise because of the different legal systems as well as differences in business practices and customs. For example, in the United States, lenders are able to acquire assets of defaulted companies in a short period of time. In contrast, the laws in many countries, including Europe, are quite stringent on seizing assets pledged as collateral. The process of debt collection can be very cumbersome and costly to implement.

There are two distinct law traditions in the world, common law and civil law, and their interpretation of business rights and enforceability varies, mostly based on tradition.

Common Law

Common law is based on a system where decisions are often decided by their peers, both in civil and criminal cases. Judicial precedent is also important and play a big role when applied to new situations. Judges rely on past decisions in interpreting new laws in order to make it consistent and provide continuity over the years. Common law originated in England and is most prevalent in its former colonies which include the United States, Australia, New Zealand, Hong Kong, Singapore, and India. Common law is considered friendlier to investors and creditors than civil law.

Civil Law

Civil law has its roots in Roman law and spread throughout Europe during the Roman conquests at the beginning of the first century. It is based on a system of statutes and codes developed by “wise men” or scholars. Over time, civil law adapted to the local culture and today is made up of three distinct versions: French, German and Scandinavian. The French tradition is based on the Napoleonic Code and is most common in their old colonies, including Turkey and Egypt. Similarly, the German version is prevalent in their old colonies that includes Austria and Croatia.

Many countries are incorporating features of the common law for business transactions. This is the result of the globalization of business and the blurring of national borders. As multinationals operate in multiple jurisdictions, it has become necessary to standardize the legal interpretations of business transactions across countries. The traditions and legal enforcement in a country play an important role in the evaluation of borrowers and the setting of the appropriate interest rate

International Credit Analysis Process

The credit analysis process for lending or investing overseas usually follows a multiple process.

1. Evaluate the credit risk of the borrower in the country.
2. Evaluate foreign exchange risk.
3. Evaluate the credit risk of the country (country risk).
4. Evaluate the sovereign risk.

Credit risk of borrower

Evaluating the credit risk of an international loan is similar in principle to the evaluation of a domestic customer except for the inclusion of foreign exchange risk if the loan is denominated in local currency. The same processes and criteria can be applied except that the data for estimating the metrics will be based on the local environment. Most countries have their own public rating agencies, providing an important source of information to banks. Some of the rating agencies include:

China : Dagong Global Credit Rating Co. Ltd
India : Crisil Ratings
Japan : Japan Credit Rating Agency, Ltd. (JCR)
Philippines : Philippine Rating Services Corporation
South Africa : Global Credit Rating Co. (Pty) Ltd

Foreign Exchange risk

Foreign exchange risk is included in international credit risk analysis when the funding currency of the loan or investment is different from the currency of the investor or lender. Assume you invest $100,000 in the Johannesburg Stock Exchange in South Africa and the exchange rate for the South African rand is ZA12/$. You first have to exchange your dollars to South African rand to receive ZAR 1,200,000. Assume at the end of the year the investment appreciates to ZAR 1,500,000 and you wish to repatriate the total amount back to the U.S.

If the exchange rate remains at 12 ZAR per dollar, you are able to repatriate 1,500,000/12 = $125,000. However, if the ZAR depreciates during this period to ZAR 15/$, you will only receive 1,500,000/15 = $100,000. This is an example of foreign exchange risk.

For a commercial bank, the inclusion of foreign exchange risk will depend on the source and use of the funds. We provide two examples below.

1. Assume Citibank's branch in South Africa accepts deposits in South African Rand and makes loans in the same currency. In this case, foreign exchange risk need to not be incorporated in the pricing of the loan because the funding and lending currency are the same.

2. Assume Chase Bank participates in a $500 million syndicated loan (where many banks join together to make a large loan) to a company in South Africa. If the loan is disbursed in local currency and the payments are in local currency, then the potential for losses due to exchange rate fluctuations will have to be incorporated in the risk premium.

Country Risk

Country risk analysis refers to the business of risk operating in another country. Factors such as economic activity, institutional framework, legal environment, political risk, and socioeconomic conditions can affect the operating environment for foreign businesses. Analysts and rating agencies use different measures for determining country risk but they all more or less consider the following factors when determining the probability of repayment and loss given default:

1. Economic Strength – the stronger the economic growth, the higher the likelihood of repayment.

   Some relevant variables include:
   a. GDP
   b. Inflation and Interest rates
   c. Exports and imports
   d. Income per capita

2. Institutional Framework – the stronger the legal protections and enforceability of contracts, the higher the likelihood of payment.

   Some relevant variables include:
   a. Corporate governance
   b. Judicial efficiency
   c. Accounting standards
   d. Corruption
   e. Regulatory red tape
   f. Level of bureaucracy

3. Political Risk – the more stable the government, the higher the likelihood of payment. Ironically, sometimes authoritarian governments provide a more stable business environment. However, history indicates then when authoritarian regimes fail, the repercussions on the company can be severe.

   Some relevant variables include:
   a. Form of government
   b. Government ownership of institutions
   c. Control of army
   d. Power of religious institutions
   e. History of expropriation

4. Socio-economic factors
   a. Income inequality
   b. Education
   c. Religious and ethnic diversity
   d. Freedom of speech

Quantifying the above factors can be challenging but as long as the criteria established is economical sound and consistently applied across countries, the rankings are likely to be unbiased.

Sovereign risk

The definition of sovereign risk has evolved in recent years Sovereign risk used to be defined as the inability of a country to provide sufficient foreign exchange for repatriation of income and profits to the foreign investors. Today, this is labelled as transfer and currency convertibility risk.

In 2012, Greece was forced to reschedule its government (sovereign) debt after investors agreed to a restructuring that resulted in a severe loss to bondholders. The extensive coverage on the crisis has led the term sovereign risk to be associated more with failure of government bonds.

Sovereign risk in this book will incorporate both definitions, transfer and currency convertibility risk and the risk that a country may renege on its sovereign debt obligations.

Transfer and Currency Convertibility risk

To repatriate foreign earnings, investors need to exchange the local currency back to dollars. Assume a central bank has insufficient reserves to convert their local currency into foreign exchange. In order to earn foreign exchange, the country has to export goods. It also pays for its imports with foreign

exchange. If exports are greater than imports, the country will be able to add foreign exchange to its reserves. Central banks usually allow conversion of foreign exchange by private companies and individuals for overseas payment when the surplus is deemed sufficient. If countries are unable to earn sufficient foreign exchange through exports, which can be temporary or permanent depending on their trading partner, central banks will be forced to restrict the amount of payments for repatriation.

Hence, it is possible that a foreign loan extended by a bank is in good standing and the borrower is willing and able to repay the debt in local currency but is unable to make the payment because of a lack of foreign exchange. This form of sovereign risk is highest in countries with non-convertible currencies where foreign exchange is controlled by the government or central bank. The government usually has an obligation to allocate the scarce foreign exchange to the most productive use for the economy. A *fully convertible currency* implies that an individual in a country can convert local currency into foreign currency on demand. Currently, only developed countries have full convertibility, including the U.S., Japan and Europe. China and India are hoping to achieve full convertibility in a few years.

In the previous examples, Chase bank faced the risk that the country may run out of foreign exchange reserves and restrictions placed on repatriations since the syndicated loans were funded from overseas. It was different for Citibank because the funding is in local currency. However, it should be noted that even for Citibank, it will have to repatriate profits and dividends back to the U.S. at the end of the ear. Hence, Citibank too will face transfer and currency convertibility risk.

Sovereign Debt Risk

Sovereign debt risk came into prominence in the United States after Mexico and Brazil announced in 1982 that they would have problems repaying its foreign denominated debt, most of which were owed to U.S. banks. Both countries had debt exceeding $100 billion, far beyond their capacity to pay from their exports of goods and services.

How did countries like Brazil and Mexico incur such a large volume of dollar-denominated debt? Partial blame can be laced on the oil crisis of 1973 and 1979 when OPEC (Organization of Petroleum Exporting Countries) raised prices dramatically. Since oil is priced in U.S. dollars, the increased earnings of oil-rich countries ended up as deposits in U.S. and European banks. The oil price hikes also led to recessions in many oil-importing countries, providing limited opportunities for the banks to recycle their deposits. One of the opportunities available was to lend to developing countries. In a short period of time, banks were tripping over each other lend to developing countries, with a majority of the funds flowing to emerging countries in South America. The loans were deemed safe because they were made to governments directly or government agencies.

Unfortunately, sovereign debt analysis was very rudimentary in the 1980s and most banks did not have an accurate measure of the total foreign debt disbursed to the countries. They attempted to mitigate credit risk by innovating certain features of the loan to prevent defaults, such as lending through syndicates and requiring cross-default clauses.

Syndicated lending

Syndicated lending became popular in the 1980s as banks increased their lending to developing countries. In a syndicate loan, many banks participate in a large loan. For example, assume Petrobas, the state-owned Brazilian oil company wished to borrow $500 million in dollar-denominated loans. Banks found it safer to lend in small amounts rather take the risk of lending the whole $500 million. Syndicate loans usually have one lead manager (also called the arranger) to underwrite the loans. The lead manager in turn invites banks to participate in the loan. In some cases, as many as 500 banks joined the syndicate to make the loan.

Cross-default clauses

Syndicated loans also carried cross-default clauses which stipulated that a country could not pick and choose which loan it would repay. In other words, if a country defaults on a syndicated loan, it would automatically trigger defaults on all syndicated loans. This prevented a country from choosing to default on the weakest lender.

Although syndicated lending and cross-default clauses minimizes the risk to individual banks, all debt faces the risk that a country may not be able to generate sufficient foreign exchange to make payments. Syndicated lending with cross-default clauses increased in volume significantly in the late 1970s and early 1980s. Unfortunately, the volume of loans increased beyond the capacity of the countries to earn the foreign exchange to repay. In 1982, Mexico has no choice but to declare a moratorium on its payments which eventually led to a successful restructuring of their debts. This event was followed by a series of restructurings of loans by Brazil, Argentine, Ecuador and Peru. The 1980s was a tumultous decade for U.S and European commercial banks as a number of international loans had to be rescheduled because of high interest rates and depreciating local currencies.

Hence, sovereign risk and country risk are intertwined and most of the time go hand in hand. Recently, however, there have been many cases where sovereign risk and country risk has diverged. Here are two examples.

1. China. The country has over $1.3 trillion in foreign exchange reserves. The likelihood of sovereign default or currency convertibility risk is minimal. However, investing and borrowing in China is still subject to country risk because the weak governance and corruption in the country increases business risk.

2. Greece. The country has defaulted on its sovereign debt. However, country risk analysis indicates that the business environment is still friendly and has not changed in spite of the increase in sovereign risk.

Most analysts and ratings agencies employ ceilings on ratings whenever there is a divergence between country and sovereign risk. For example, assume that the country of Jordon has the following ratings:

Sovereign Risk - CCC (because of its low foreign exchange reserves and high fiscal deficits)

Country Risk - B- (because the government is providing incentives to business)

In such cases, which are not very common, the country risk will be reduced to CCC because country risk cannot be better than the sovereign risk. In other words, sovereign risk sets the higher bound on country ratings.

Summary of the Chapter

This chapter provided an overview of the credit risk faced by banks and the methods employed to mitigate the risks. Banks face two types of defaulters, those that unable to pay and those that are unwilling to pay. As a result, banks have to implement a rigorous and thorough credit management policy to minimize their expected losses over the life of the loan.

Credit policy comprises of two components:

1. Credit risk analysis to determine the risk profile of the potential borrower
2. Credit risk management which focuses on minimizing losses after the loan has been disbursed.

Credit analysis focuses on the five Cs, - character, capacity, capital, collateral and conditions. Financial ratio analysis is the most common methodology to determine the capacity of the borrower to repay the debt. Both cross-sectional and time-series analysis are required if ratio analysis is to provide adequate information on the financial condition of the borrower.

There are several agencies that provide ratings for both commercial and individual borrowers. The ratings are estimated using credit scoring models that identify the major variables associated with the probability of default. The same variables are then used to score applicants to determine their eligibility for loans.

Three companies, S&P, Moody's and Fitch provide ratings for publicly traded company while three other agencies, Experian, Equifax and Transunion provide ratings for individuals, based on FICO scores developed by the Fair Isaac Corporation. The next step after obtaining a rating is to determine the risk premium to be charged. Two examples are provided, the cost-plus and the price-leadership models.

Additional quantitative models include obtaining the risk premium from market data and the RAROC model. These models provide alternative ways to determine the risk profile of the borrower and determine the eligibility to receive loans.

Credit risk management focuses on the management of loans once they are disbursed. Banks have developed several products to mitigate potential losses. One way is to restructure loans rather than declaring in default.

Finally, credit analysis for overseas loans requires an additional step in determining credit risk. Banks have to estimate sovereign risk, defined as the inability to obtain foreign exchange to repatriate earnings in local currencies back to the home country. It also includes severing debt risk where a country may be unable to meet its financial obligations on its debt.

In addition to sovereign risk, it is also important for lenders and investors to focus on country risk, which encompasses a broader set of factors and pertains to the risk of conducting business in the foreign=gn country.

End of Chapter Questions

1. Explain the five C's in determining the eligibility of a loan to a customer.

2. Explain why cross-sectional and time-series analysis is important in ratio analysis.

3. The following ratios have been estimated for borrower X. The industry benchmark is also provided.

   Industry

ROA	ROE	TIE	CR	EPS
12.5%	25.6%	4.5	3.2	3.8

   Borrower X

ROA	ROE	TIE	CR	EPS
10.5%	21.4%	2.5	5.2	4.8

   Comment on the financial condition of the borrower.

4. Continuing with Question 3, assume you estimate the following information on borrower X. How does it affect your comment in the previous question?

Borrower X			
	2013	2014	2015
ROA	9.15%	9.85%	10.5%
ROE	18.95%	20.56%	21.4%
TIE	1.65	1.85	2.5
CR	4.8	4.9	5.2
EPS	4.6	4.7	4.8

5. Explain how credit rating agencies determine the ratings of publicly rated companies?

6. The following information is given about a corporate bond:
   P or probability of repayment = 93%
   (1 – P) Probability of default = 7%
   LGD or Loss given default = 60%
   R_f or risk-free rate = 4%

   Determine the risk-neutral lending rate for the corporate bond.

7. Following up on question 6, assume the lender demands an additional premium of 4% as a result of risk aversion. What will be the rate charged by the lender?

8. The following information is given about a corporate bond:
   P or probability of repayment = 89%
   (1 – P) Probability of default = 11%
   LGD or Loss given default = 50%
   R_f or risk-free rate = 2%

Determine the risk-neutral lending rate for the corporate bond.

9. Following up on question 8, assume the lender demands an additional premium of 3% as a result of risk aversion. What will be the rate charged by the lender?

10. If the existing one-year risk-free rate is 1.21% and the average market yield of one-year AA-rated corporate bonds is 1.51%. What expected probability of repayment has been determined by the market?

11. Assume the existing one-year risk-free rate is 4% and the average market yield of one-year BBB-rated corporate bonds is 8.5%. What expected probability of repayment has been determined by the market?

12. Assume the following expected income on the loan of $200,000:

Interest rate on loans	: 7.00%
Interest rate on deposit	: 5.50%
Operating expense	: 0.75%
Expected loss	: 0.40

What is the RAROC if the economic capital has been estimated at $7,000? Should the bank lend if the hurdle RAROC rate is 15%?

13. Assume the following expected income on the loan of $1,000,000:

Interest rate on loans	: 11.00%
Interest rate on deposit	: 7.50%
Operating expense	: 0.85%
Expected loss	: 0.60%

What is the RAROC if the economic capital has been estimated at $200,500? Should the bank lend if the hurdle RAROC rate is 10%?

14. Assume a bank is in the process of restructuring a $1 million loan. The following information is provided. The current interest rate of the loan is 8% annually and matures at the end of this year. The cost of funds for this category of loan is 8%. There is a 20% probability that the loan will be defaulted and the recovery rate is 0.
Restructuring terms:
Loan payments will be stretched to 5 years
Interest rate will be reduced to 4% for the next 5 years.
Principal payment of $500,000 million per year in years 4 and 5.
No upfront fee.
15% cost of funds for the bank since the risk of the loan increases after restructuring
    a. Is the present value of the new loan greater than the present value of the old loan?
    b. What up-front fee will equate the present values of the old and new loans?

15. Assume a bank is in the process of restructuring a $4 million loan. The net recovery of the loan is $1,990,000.
Restructuring terms:
Loan payments will be stretched to 5 years
Interest rate will be reduced by 5% for the next 5 years.

Principal payment of $1 million in year 3 and $1.5 million per year from year 4 to 5.
No upfront fee.
12% cost of funds for the bank since the risk of the loan increases after restructuring.

a. Is the present value of the new loan greater than the present value of the old loan?
b. What up-front fee will equate the present values of the old and new loans?

16. A bank is in the process of renegotiating an amortizing $150 million loan that has two annual remaining payments. The agreement requires reducing the interest rates from the existing 7% to 5% and to extend the maturity from two to five years. A grace period of two years is offered during which time only interest will be paid. In the last three years, principal payments of $50 million are expected each year. An up-front fee of 1% will be collected as part of the renegotiating fee.
    a. If the cost of funds to the bank is 8% before rescheduling and 8.75% after rescheduling, what is the present value of the old and new loan?
    b. What should the approximate up-front fee in percent be in order for the bank to have the present value of the old and new loan be equal?
    c. At what costs of funds after rescheduling will the present value of the new and old loan be equal?

17. Assume a company with a loan of $10 million is experiencing cash flow problems and may be unable to make its next interest payments. The bank has estimated that, at the most, it will receive $7 million if the company is declared bankrupt and the assets are liquidated. The other option is to convert the debt to equity and invest an additional $4 million to reorganize the company with new management and a new marketing campaign. The turnaround is expected to generate after-tax cash flows of $1.15 million for the next five years. The since the turnaround is carries a lot of risk, the bank will accept the debt-to equity conversion if it earns a 15% rate of return.

    a. Should they choose the debt-to-equity swap or liquidate the assets?
    b. What after-tax terminal value at the end of 5 years will the bank be better off choosing the debt-to-equity swap?

18. What is the difference between sovereign risk and country risk?

19. Explain how political factors can affect the probability of default and loss given default in international loan transactions?

20. Distinguish between common and civil law.

ProBanker Assignment 5

This assignment will

e. Highlight the necessity of setting aside sufficient loan loss reserves.
f. Estimate the costs of setting aside insufficient reserves.

Create a new Autosim and call it "Your Name Assignment 5" as stated below under Assignment 1.

Please note that in Autosim you are playing solo against the computer. If you are in a competitive game, the results can be different because demand and supply are affected by the decisions of your competitors.

Assignment 5:

1. Create a personal **Autosim**.

   d. Click on *Games*.
   e. Click on *New Autosim game*.
   f. Select ***Assignments Regional Bank*** template in *using template.*
      Note: *Make sure* ***NOT*** *to choose* ***Sample Regional Bank*** *template.*
   g. Type a name for the new Autosim in *New game's name*
   h. Example "John Roger Assignment 5"
   i. Click on *Create Game*

2. Input decisions to your new Autosim. There are four categories of decisions – '**Account *Quantities, Account Interest Rates, Advertising*** and ***Other Decisions.***

Click on ProBanker icon on the top left to go to the home page.
g. Click on *View Games.*
h. Select your newly created Autosim.
i. Click on *Play bank.*

3. **Account Quantities** – change the following

   a. Target Reserves for Deposits = $200,000
   b. Federal Funds Purchased (not Sold) = $100,000
   c. 360 Days CDs to Issue = $100,000
   d. New Bonds to Purchase = $ 52,500
   e. The remaining boxes should all be zeroes.

4. **Account Interest Rates** - Reduce loan rates by 0.3 percent and increase deposit rates by 1%
   a. Reduce Fixed Rate Corporate Loan Rate = 9.00 percent
   b. Reduce Floating Rate Loan Spread = 3.70 percent
   c. Reduce Installment Loan Rate =10.70 percent
   d. Reduce Mortgage Loan Rate = 8.70 percent
   e. Increase Retail CDs Rate = 7.00 percent
   f. Increase Passbook Savings Rate = 6.00 percent
   g. Increase Long-Term Retail Deposits Rate = 8.50 percent
   h. The remaining boxes should all be zeroes.

5. **Advertising** – Leave as is (150, 80,410,580,290,140, 60)

6. **Other decisions** – Input $500 for Provision for Loan Losses. Leave the rest as is (0, 0, 0, 100, 100)

7. *Simulate next period* (on left side of the screen). After a few seconds, you will notice a flicker and it should say **End of Period 1.** You are ready to review the results.

Questions:

From the summary balance sheet and income statement reports for quarter 1, answer the following:

a) What was the total loan loss allowance (LLA) at the end of quarter 1? Explain.

b) How much provision for loan losses was deducted from your income statement? Explain.

c) Did you put in adequate provisions for loan losses? If less, what was the penalty incurred for setting aside less than 100% of current non-performing loans?

Assignment 5 continued

8. Input decisions for quarter 2 as given below:

9. **Account Quantities** – change the following
   a. Target Reserves for Deposits = $200,000
   b. Federal Funds Purchased = $100,000
   c. 90-day CDs to issue = $ 75,000
   d. 180-day CDs to issue = $ 75,000
   e. 360 Days CDs to Issue = $100,000
   f. New Bonds to Purchase = $ 52,500
10. The remaining boxes should all be zeroes

11. **Account Interest Rates** - Reduce loan rates by an additional 0.3 percent and increase deposit rates by an additional 1%
    a. Reduce Fixed Rate Corporate Loan Rate = 8.70 percent
    b. Reduce Floating Rate Loan Spread = 3.40 percent
    c. Reduce Installment Loan Rate =10.40 percent
    d. Reduce Mortgage Loan Rate = 8.40 percent
    e. Increase Retail CDs Rate = 8.00 percent
    f. Increase Passbook Savings Rate = 7.00 percent
    g. Increase Long-Term Retail Deposits Rate = 9.50 percent

12. **Advertising** – Leave as is (150, 80,410,580,290,140, 60)

13. **Other decisions** – Input $2,000 as Provision for Loan Losses. Leave the rest as is (0, 0, 0, 100, 100)

Questions:

From the summary balance sheet and income statement reports for quarter 2, answer the following.

a) What was the total loan loss allowance (LLA) at the end of quarter 2? Explain.

b) How much provision for loan losses was deducted from your income statement? Explain.

c) Did you put in adequate provisions for loan losses? If less, what was the penalty incurred for setting aside less than 100% of current non-performing loans?

7

Chapter 7 – BANK CAPITAL

The financial crisis of 2007-09, termed the Great Recession, resulted in a recession that lasted 18 months from December 2007 to June 2009. Unemployment peaked at 10% in October 2009 and factory output declined 27% between July 2008 and May 2009. A total of 140 banks failed in 2009. On October 3, 2008, Congress passed the Troubled Asset Relief Program (TARP) providing nearly $700 billion to rescue troubled financial institutions which included some of the world's largest financial institutions including AIG and Citibank. The market value of the assets of banks declined dramatically as investors fled the stock market in a frenzy, sending stock prices crashing to the bottom.

The crisis caused the delinquent rates of loans of nearly all banks to rise dramatically and a decline in the value of bank assets. As the recession intensified, bank insolvencies continued to increase and peaked at 157 failures in 2010. The primary cause of the bank failure was a lack of liquidity as short-term credit dried up and insufficient capital or equity to absorb the losses. A simple example is illustrated below:

Assets	Liabilities
Loans = $100	Deposit = $90
	Equity (capital) = $10

Assume the assets are made up of ten loans of $10 each. As explained in the previous chapter, a loss of even two loans is sufficient to put the bank in bankruptcy. The more capital held by the bank, the larger the amount of losses it can absorb.

Banks and regulators are both aware that it is critical to hold appropriate levels of capital to prevent bankruptcy from unanticipated defaults. However, the definition of "appropriate" can differ between bankers and regulators. Regulators prefer banks to hold more capital (equity) by estimating the likelihood of default conservatively. Banks on the other hand would prefer to hold less equity because the lower the percentage of equity, the higher the return on equity (ROE) for given profits. They are more than likely to estimate the probability of default liberally.

Reserve Requirement versus Capital

In the previous chapter, we discussed the role of reserve requirement as a safeguard against unexpected withdrawals. Reserve requirements can be held either as cash at vault or reserves at the central bank. As Table 7.1A shows, Bank A has less reserves than Bank B, allowing it to make more loans than Bank B. However, this bank is riskier because it is susceptible to an unexpected withdrawal of greater than $10 whereas bank B can withstand an unexpected withdrawal as high as $20. Hence, reserves serve as a cushion against unexpected withdrawals.

Table 7.1A

Bank A			
Reserves	$10	Deposits	$95
Loans	$90	Equity	$5
Total	$100	Total	$100

Bank B			
Reserves	$20	Deposits	$95
Loans	$80	Equity	$5
Total	$100	Total	$100

Table 7.1B shows that Bank A holds less capital than Bank B. In this case, capital serves as a cushion again loan defaults. In this example, if $20 million of loans are defaulted, Bank A will be bankrupt while Bank B will still be able to absorb the losses.

Table 7.1B

Bank A			
Reserves	$10	Deposits	$95
Loans	$90	Equity	$5
Total	$100	Total	$100

Bank B			
Reserves	$10	Deposits	$80
Loans	$90	Equity	$20
Total	$100	Total	$100

For banks, holding either excess reserves or excess capital is a direct drain on the revenues. Table 7.1C demonstrates the difference in earnings between Bank A than Bank B. Bank A holds less reserves and capital, making it a riskier bank than Bank B.

Table 7.1C

Bank A			
Reserves	$10	Deposits	$95
Loans	$90	Equity	$5
Total	$100	Total	$100

Bank B			
Reserves	$20	Deposits	$80
Loans	$80	Equity	$20
Total	$100	Total	$100

Assume the loan rates are 8%, deposit rates are 3% and the cost of equity is 15%. The net earnings of both banks are shown below.

Bank A	
Income on Loans $90 x 0.08	$7.20
Deposit Expense $95*.03	-$2.85
Equity Cost $5 x 0.15	-$0.75
Net Earnings	$3.60

Bank B	
Income on Loans $80 x 0.08	$6.40
Deposit Expense $80*.03	-$2.40
Equity Cost $20 x 0.15	-$3.00
Net Earnings	$1.00

Bank A's earnings are significantly higher at $3.60 compared to Bank B's earnings of $1.00. This clearly demonstrates ***that a bank that hold less reserves and less capital are riskier but their earnings are higher.***

Determining the optimal capital

Determining the optimum capital for a bank is a challenging task. The analysis is similar to determining the appropriate level of debt in a nonfinancial company. In the case of a nonfinancial company, the higher the debt, the higher the return on equity because debt is cheaper than equity. However, as a firm incurs more debt, the cost of equity increases to offset the benefits of the cheaper debt. This trade-off does not occur for commercial banks because deposits are insured by the FDIC. Thus, a bank has an incentive to hold as little capital as permissible, just sufficient to absorb expected defaults. The higher the expected default rates, the higher the capital held by a bank.

Default rates vary and are affected by several factors including macroeconomic conditions, competitive behavior and management expertise. Historically, banks kept large amounts of capital as a protection against failures. In the early 1960s, U.S. banks held 49% of their assets in cash, reserves and government securities. The approximately 4,500 national banks also held an average of 8% of their total assets as capital. The ratios began to decline as competition encouraged banks to lend aggressively. By the late 1970s, capital-to-asset levels had fallen to below 5%. Regulators began to take notice and in 1983 asked large banks to hold a minimum of 5% in capital-to-assets.[41] In December 1991, community banks were told to maintain a minimum capital-to-asset ratio of 6% and regional banks 5%.

Bankers and regulators have long recognized that requiring banks to hold a fixed level of capital-to-asset ratios is unlikely to prevent bank failures because it ignores the risks of the assets. The example in Table 7.2 will highlight the case which features two banks with assets of $100 each. Bank A has loans outstanding to AAA-rated companies such as IBM. Bank B has loans outstanding to B-rated companies such as Caesar's Casino. With a fixed capital-to-asset ratio, both banks meet the regulatory requirements by holding $5 in capital.

Table 7.2

Bank A			
Loans AAA-rated	$100	Deposits	$95
		Equity (Bank Capital)	$5
Total	$100	Total	$100

Bank B			
Loans B-rated	$100	Deposits	$95
		Equity (Bank Capital)	$5
Total	$100	Total	$100

It is obvious from a regulatory and economic perspective that Bank B should hold more capital since its loans are riskier. Banks will prefer to lend to B-rated clients than AAA-rated clients because they can

[41] Eugene N. White, "The Comptroller and the Transformation of American Banking," 1960-1990. Available at books.google.com.

charge a higher interest rate. Fixed capital-to-asset ratios encourages banks to engage in ***capital arbitrage*** and make risky loans to earn a higher return for the same level of capital.

Basel I

In 1988, the Bank for International Settlements (BIS) based in Basel, Switzerland, came out with a proposal to determine the minimum amount of capital for banks. At that time, the BIS comprised of central banks of the G-10 countries plus Belgium and Luxembourg.[42] Their goal was to level the playing field among international banks in the provisioning of capital by addressing the issue of capital arbitrage. The proposal mapped out a methodology that would require banks with riskier assets to hold more capital. The accord was agreed in 1988 for final implementation in 1992 and became known as the Basel 1 Accord.

Basel 1 required loans to be classified according to the risk characteristics of the borrowers and their ability to repay the debt. If a bank invested in government securities or made loans to government agencies, the likelihood of repayment should be higher relative to loans made to corporations or individuals. The hurdle facing the Basel group was establishing a common criterion for classifying the risk of various loans, as borrower characteristics were not uniform across countries. At the end, four categories of assets were agreed upon for conversion into risk-weighted assets using the following weights.

Borrower category	**Risk weight**
Government bonds	0%
Government agency debt and bonds	20%
Mortgages	50%
Loans (individuals and corporations)	100%

The process outlined by Basel was to apply these weights to convert book value of loans to risk-weighted (sometimes referred to as risk-adjusted) assets, providing a mechanism to differentiate assets of different risk. As an example, Table 7.3A and 7.3B shows two Banks, A and B, with different proportions of assets. The assets consist of

a. cash and government securities (T-Bonds)
b. government agency bonds
c. mortgages
d. commercial loans.

The assets are reported in book value. The last column reports the risk-weighted assets (RWA) after conversion using the weights specified in Table 7.2.

Table 7.3A shows that Bank A holds riskier assets than Bank B in Table 7.3B; it has a higher concentration of corporate loans compared to Bank B which holds safer assets such as T-Bonds, agency bonds and mortgages. On a risk-weighted basis, Bank A has RWA of $131 million while Bank B has RWA of $88 million. The proposed standards, termed Basel 1 standards, would require Bank A to hold more capital than Bank B.

[42] A small private holding of shares was discontinued in 2001. In 2014, there were 60 central banks as members of the BIS.

Table 7.3A

Bank A (in millions)			
	Assets	**Basel Weights**	**Risk-adjusted Assets**
Cash and T-Bonds	$20.00	0%	$0.00
Agency bonds (GNMA)	$30.00	20%	$6.00
Mortgages	$50.00	50%	$25.00
Loans (B-rated)	$100.00	100%	$100.00
Total	$200.00	Total	$133.00

Table 7.3B

Bank B (in millions)			
	Assets	**Basel Weights**	**Risk-adjusted Assets**
Cash and T-Bonds	$40.00	0%	$0.00
Agency bonds (GNMA)	$40.00	20%	$8.00
Mortgages	$80.00	50%	$40.00
Loans (B-rated)	$40.00	100%	$40.00
Total	$200.00	Total	$88.00

How much capital should each bank hold?

Basel 1 classified capital in two forms, Tier I and Tier II.

- Tier I capital is composed primarily of stockholder's equity along with qualifying perpetual preferred stock and minority interest in consolidated subsidiaries.
- Tier II capital is composed primarily of debt instruments, including preferred stock, hybrid securities and subordinated debt with original maturities exceeding 5 years.

All banks had to maintain a minimum Tier I capital of 4% and total Tier I + II of 8%.[43]

For our two examples above, assume Banks A and B both have the same liabilities and stockholder's equity as shown in Table 7.3C. Do they meet the minimum requirements of Basel 1?

[43] Under Basel 3, this minimum has been increased and will be discussed later.

Table 7.3C

Bank A and B and Stockholder's equity	Liabilities
Demand deposits	$128.00
Time Deposits	$58.00
Subordinated Debt (Tier II)	$6.00
Preferred Stock (Tier II)	$3.00
Stockholder's equity (Tier I)	$5.00
Total	$200.00

The tabulation of the Tier I and Tier I+II capital ratios for each bank are shown in Table 7.3D.

Table 7.3D

Bank A: Risk-weighted assets = $131 million	**Bank B: Risk-weighted assets = $88 million**
Tier I:	Tier I:
Required = 4% of $131 = $5.24 mil.	Required = 4% of $88 = $3.52 mil.
Available = $ 5 million	Available = $ 5 million
Conclusion: Not sufficient	Conclusion: **Sufficient**
Tier I+II:	Tier I+II:
Required = 8% of $131 = $10.48 mil.	Required = 8% of $88 = $7.04 mil.
Available = $ 14 million	Available = $ 14 million
Conclusion: Sufficient	Conclusion: **Sufficient**

The results show that Bank A does not meet the minimum Basel 1 standards because it fails to meet the minimum 4% requirement of Tier I assets. However, it has sufficient combined Tier I+II capital (8% of risk-weighted assets). Bank B meets both Tier I and the combined Tier I + II minimum capital ratio of 8%.

Eligible Tier I and Tier II Capital

Table 7.4 provides an expanded list of the eligible capital that can be classified by tiers in the 1988 accord. Shareholder's equity is considered the strongest form of capital because it represents owner's capital and if a loan defaults, it will take the first hit.

Note that perpetual preferred stock is limited to 25% for estimation of Tier 1 capital. The difference between cumulative and non-cumulative preferred stock is as follows:

a. If the bank is unable to pay preferred dividends in the current year, it is obligated to pay cumulative perpetual preferred stockholders in the next or subsequent years. Preferred dividends are held in an arrearage account till it is paid. Common stockholders will not receive any dividends until all preferred dividends have been paid.

b. Non-cumulative preferred stock will not be able to accumulate dividends if payments are missed in any year (similar to common stock).

Perpetual debt is similar to perpetual preferred stock but receive interest payments instead of preferred dividends forever. The major difference is that if interest payments are not missed, holders of perpetual debt can declare the bank insolvent, similar to other debt. Hence perpetual debt is more risky to banks than perpetual preferred stock.

Table 7.4

Eligible Tier I and II - Basel Accord 1988	
Tier I	**Tier II**
Common Stock including par value, Paid-up surplus and retained earnings	Allowance for loan losses and leases
Qualifying cumulative and non-cumulative perpetual preferred stock (limited to 25%)	Perpetual Preferred stock (unlimited) and hybrid capital including convertible stock and perpetual debt
Minority interest in consolidated subsidiaries	Subordinated debt and fixed term perpetual stock (with original weighted maturity > 5 years)
Minus goodwill	Minus selected deductions

Off-balance sheet capital requirements

Basel 1 also recognized that global banks were increasing their use of off-balance sheet instruments such as letters of credit, foreign exchange, interest rate swaps, options and futures. As a result, they required banks to set aside additional capital for off-balance sheet activities.

A major problem with determining the optimal level of capital to cover potential losses from off-balance sheet items is the lack of real tangible assets. Off-balance sheet activities have either no face value or have notional values. The potential losses to a bank however is determined by a contingent event and can be quite different from the notional value. We will discuss off-balance sheet activities in a later chapter, including estimation of capital requirements under Basel.

Basel 2

Basel 1 was successfully implemented in 1992. Not only did the banks of the signatory countries implement the rules, but banks from many non-signatory countries around the world also adopted the rules. Basel 1 is considered a major achievement in global regulatory harmonization.

The Basel committee spent the next decade trying to fine-tune the rules. Among the major weaknesses identified in Basel 1 was the lack of differentiation in loans. Loans provided to AAA-rated and B-rated companies carried the same risk weight of 100%.

Unfortunately, it was not an easy task for countries to agree on a formula to distinguish between risky loans. The U.S., along with a few other countries, proposed using credit ratings by the rating agencies to

distinguish between loans of different risk. However, other countries objected, notably Germany, because a majority of their companies did not access the public markets for bonds and hence had no ratings. In the end, a compromise allowed the use of credit ratings but banks in countries that did not have public ratings had the option of using internal rating methods, as long as they were approved by domestic regulators.

In 2006, the Basel 2 accord was signed that included modifications to the assessment of risk weights. As shown below, banks, corporate and even sovereign bonds had risk weights that varied based on their public ratings.

Risk Weightings on Sovereign (Government), Bank and Corporate Bonds					
AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	Below B-	Unrated
0%	20%	50%	100%	150%	100%
Risk Weightings on Banks					
AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	Below B-	Unrated
20%	50%	100%	100%	150%	100%
Risk Weightings on Corporate Bonds					
AAA to AA-	A+ to A-	BBB+ to BB-	Below BB-	Unrated	
20%	50%	100%	150%	100%	

The final Basel 2 rules were very comprehensive and not only specified quantitative standards but also focused on the supervisory process and disclosure of information. Together, they were termed the three pillars.

Three pillars

Pillar 1: Specified the requirement for quantitative estimations of regulatory capital. In addition to credit risk, Basel 2 also specified capital to be set aside for two other risks, market risk and operational risk.

a. Credit risk – applied to loans and other assets that could default as a result of counterparty failure.
b. Market risk – applied to short-term trading instruments that could decline in value due to changes in interest rates, commodity prices, foreign exchange rates and interest rates.
c. Operational risk - the risk of losses resulting from inadequate or failed internal processes, people, and systems or from external events.

We will discuss market risk separately in a later chapter.

Pillar 2: Specified the importance of a well-defined supervisory review to encourage banks to assess capital requirements rigorously and timely and to provide access to supervisors on their assessments. Management and an independent board were expected to play an important role in formulating and implementing adequate risk management processes.

Pillar 3: Specified a set of disclosure requirements to allow market participants to assess the risk exposure and capital adequacy of the bank. It was expected that adequate disclosure would result in easier monitoring by market participants. Firms will be disciplined if they deviated away from conservative business practices.

Basel 2 Example

The following example will highlight the difference between Basel 1 and Basel 2 standards by re-estimating the capital requirements for Bank A. We extend the example to include the new ratings on the classification of loans in Basel 2.

Table 7.4A

Bank A (in millions)			
	Assets	**Basel Weights**	**Risk-adjusted Assets**
U.S. T-Bonds (AAA rated)	$10.00	0%	$0.00
Greek Sovereign Bonds (BBB rated)	$10.00	50%	$5.00
Agency bonds (GNMA)	$30.00	20%	$6.00
Mortgages	$50.00	50%	$25.00
Loans (AAA rated)	$50.00	20%	$10.00
Loans (BB- rated)	$50.00	100%	$50.00
Total	$200.00	Total	$96.00

Table 7.3A is reclassified as Table 7.4A with two changes. The original cash and T-Bonds of $20 is now replaced by $10 of AAA rated T-Bonds issued by the U.S. Treasury and $10 of BBB rated Greek sovereign bonds. The $100 loan is split into $50 of AAA rated bonds and $50 of BB rated bonds.

The new capital requirements are estimated as shown in Table 7.4B.

Table 7.4B

Bank A: Risk-weighted assets = $96 million
Tier I:
Required = 4% of $96 = $3.84 mil.
Available = $ 5 million
Conclusion: Sufficient
Tier I+II:
Required = 8% of $96 = $7.68 mil.
Available = $ 14 million
Conclusion: Sufficient

Bank A has sufficient Tier 1 capital under Basel 2 standards in comparison to Basel 1 which designated insufficient capital. The risk-weighted assets are $96 under Basel 2 compared to $131 under Basel 1. The decrease of $35 is the result of

1. $50 of the $100 loans was classified in the 20% category instead of 100%, lowering the risk-weighted assets by $40.
2. Greek sovereign bonds however were classified in the 50% category as opposed to 0% under Basel 1, increasing the risk-weighted assets by $5.

3. The net reduction in risk-weighted assets is $40 - $5 = $35 (or from $131 to $96)

Basel 2 was never fully implemented because the deadline for implementation was extended to January 1, 2008 for most countries and January 1, 2009 for the U.S. Unfortunately, the financial crisis began in late 2007 and sent the global markets into a recession. In the aftermath of the recession, tougher standards were demanded and the regulators responded initially with Basel 2.5 followed by Basel 3 which will be implemented fully by 2019.

Basel 3

The financial crisis exposed several weaknesses in Basel II. Counterparty risk and the lack of liquidity were found to be more severe than predicted in prior models. As a result, additional rules were specified to ensure that financial institutions are able to withstand these risks. The key changes are as follows:

1. The definition of core capital has been strengthened. Instead of Tier 1 and 2, there are now four categories of capital ratios to be fulfilled by financial institutions.
2. Introduction of capital charge on mark-to-market losses as a result of a decline in the credit worthiness of counterparties. Previously, capital was determined on the outright default of loans. The financial crisis revealed that deterioration of loans can be gradual and regulators would like banks to recognize and protect themselves against the gradual decline in the market value of loans.
3. Forward looking provisioning which includes establishing a capital conservation and countercyclical buffers.

In the U.S., Basel 3 rules will apply to all national banks, state member banks, state nonmember banks, state and federal savings loan associations, large bank holding companies and top-tier savings and loan holding companies that do not engage in substantial insurance or other commercial activities. The minimum amounts are specified in Table 7.5.

Common equity tier ratio (CETI) consists strictly of shareholder's equity. The purpose is to ensure that equity capital provides the strongest cushion against any deterioration in the value of assets.

The requirements will be phased in from 2015 and the numbers shown above refer to the final amount applicable as of January 1, 2019. The minimum amount of CET1 is 4.5% and could increase to as high as 9.50% when two additional requirements are implemented, capital conservation buffer and countercyclical buffer, and will be explained shortly. Tier 1 capital ratio, defined as CET1 plus Additional Tier 1, has been increased to 6% while total capital ratio, defined as Tier 1 and Tier 2, will increase gradually from 8% to as high as 13%. Finally, a leverage ratio of 4% has been introduced as an additional requirement. This ratio is similar to the capital-to-asset ratio discussed at the very beginning except the denominator, total exposure, also includes off-balance sheet assets.

A separate group of large, internationally active banking organizations--generally those with at least $250 billion in total consolidated assets or at least $10 billion in total on-balance sheet foreign exposure, including the depository institution subsidiaries of those firms, will be subject to a supplementary leverage requirement of 3%. These banks will use an "Advanced Approaches" capital framework while standardized models will be used by the rest of the banking community.

Table 7.5

Basel 3 - Minimum Capital Requirements for Banking Institutions by the year 2019				
	Minimum	Capital Conservation Buffer	Maximum Countercy clical Buffer	Total
	2019	2019	2019	2019
Common Equity Tier I (CET1) capital ratio, defined as common shares, retained earnings and selected minority interest.	4.50%	2.50%	2.50%	9.50%
Tier 1 ratio, defined as CETI plus additional Tier 1, defined as those assets not included in CET1 plus a few more eligible equity like instruments.	6.00%	2.50%	2.50%	11.00%
Total capital ratio, defined as Tier 1 and Tier 2. Tier 2 includes debt like instruments including preferred stock, subordinated debt and limited allowance for loan losses	8.00%	2.50%	2.50%	13.00%
Leverage Ratio, defined as Tier 1 capital over total exposure (on- and off-balance sheet assets)	4.00%			4.00%

Capital Conservation Ratio

During the financial crisis of 2008, several banks were criticized for paying dividends and hefty bonuses even as the banks were heading towards bankruptcy. For example, Lehman brothers that declared bankruptcy on October 15, 2008 had just competed repurchasing $1 billion in shares in 2008. Capital conservation buffer is meant to ensure that banks are refrained from paying bonus payments, dividend payments and repurchasing share if they do not have sufficient capital. If banks do not have sufficient capital buffers, limits will be placed on their payouts, as shown in the Table 7.6.

The maximum conservation buffer has been set at 2.5% and will begin in January 1, 2016. For example, if their conservation buffer is less than 2.5% but greater than 1.875%, they will be allowed to distribute only 60% of their retained earnings as dividends or share repurchases.

Table 7.6

Capital Conversation Buffer and Maximum Payout Ratio	
Capital conservation buffer (as a percentage of standardized or advanced total risk-weighted assets, as applicable)	Maximum payout ratio (as a percentage of eligible retained income)
Greater than 2.5 percent	No payout ratio limitation applies
Less than or equal to 2.5 percent, and greater than 1.875 percent	60 percent
Less than or equal to 1.875 percent, and greater than 1.25 percent	40 percent
Less than or equal to 1.25 percent, and greater than 0.625 percent	20 percent
Less than or equal to 0.625 percent	0 percent

The following will also be affected by the capital conservation requirement:

- Dividends
- Share buybacks
- Discretionary payments on Tier 1 instruments
- Discretionary bonus payments

Example:

A bank has estimated that its net income for the year is $1.4 million and it has 500,000 shares outstanding. It has estimated that its Common Equity Tier 1 (CET1) ratio is 6%. Its normal dividend payout ratio is 50%. Under the capital conservation buffer requirements of 2019, is it able to pay 50% of its net income as dividends? If not, what is the maximum dividends it can pay per shares?

Answer: No.

Maximum dividends payable:	= 0.40 x $1,400,000 = $560,000
Maximum dividends per share	= $560,000/500,000 = $1.12 per share

Reason: between 1.25-1.875% above the 4.5% minimum Common Equity Tier 1, the maximum a bank can pay is 40% dividends.

Countercyclical Buffer

Another concern to regulators is the impact of business cycles on the conditions of financial institutions. During the expansionary (rising) phase of the business cycle, bank credit tends to expand and lending

standards tend to weaken. A decline in economic activity after a rapidly rising phase creates a larger impact on loan losses than when the business cycle is gradual. Hence, losses and after a prolonged period of growth can leave banks inadequate to withstand the shock. Countercyclical buffer is designed to counter this phase by requiring banks to hold more capital during the rising stage of the business cycle. Regulators can set a maximum of 2.5% for countercyclical buffer. They also have the flexibility of setting different minimum amounts for different categories of lending.

Prompt Corrective Action

The capital ratios also serve as a measure for regulators to intervene and prevent any further deterioration in the condition of the bank. Termed prompt corrective action or PCA, it was established under the Federal Deposit Insurance Corporation Improvement Act (FIDCIA) of 1992. The Act was implemented in the aftermath of the savings and loans crisis of the 1980s. Specifically, it mandated that the Fed take specific actions when a bank is determined to be near insolvency, as defined below.

Capital Categories for Prompt Corrective Actions			
Category	Total Risk-based	Tier 1 Risk-based	Leverage
Well-capitalized	10% or more	6% or more	5% or more
Adequately capitalized	8% or more	4% or more	4% or more
Undercapitalized	less than 8%	less than 4%	less than 4%
Significantly undercapitalized	less than 6%	less than 3%	less than 3%

In addition, they can take some discretionary actions, as shown in the below.

Well-capitalized

a. No action is required

Adequately capitalized

a. Waiver is required to renew or accept new brokered deposits.
b. If a waiver is granted, a bank may not offer more than 75 basis points higher than the effective yield paid on deposits of comparable size and maturity.

Undercapitalized

a. The bank must file a plan with regulators outlining their capital restoration schedule.
b. The bank is not allowed to pay dividends or management fees.
c. The bank may not accept, renew or roll over any brokered deposits.

Significantly undercapitalized

a. In addition to above rules for undercapitalized banks, the chartering authority (OCC, Fed or FDIC) will have to appoint a receiver within 90 days.
b. The bank cannot pay interest or principal on subordinated debt without FDIC approval after 60 days.

In sum, PCA will ensure that regulators have the authority to implement changes to banks well before they begin their downward spiral during a crisis.

Risk Weights under Basel 3

Basel 3 has also made additional modifications to the risk weighting of assets. In some cases, they have been simplified and in other cases they have been extended.

There are now over 13 categories and some of the major classes of assets are listed below.

Risk Weight 0%

1. Cash and gold
2. U.S. government securities
3. Securities of other countries whose country risk classification (CRC) as ranked by the Organization of Economic Cooperation 9OECD) is 0 and 1.
4. Foreign banks from countries with CRC of 0 and 1

Risk Weight 20%

1. Cash in float
2. Securities of U.S. government agencies like Fannie Mae
3. General obligation municipal bonds issued by state, country and local governments
4. Securities of countries with CRC of 2
5. Foreign banks from countries with CRC of 2

Risk Weight 35%

1. 1-4 Residential mortgages with loan-to-value (LTV) less than 60 percent

Risk weight 50%

1. Revenue municipal bonds issued by state, country and local governments
2. 1-4 Residential mortgages with LTV between 60 and 80 percent
3. Securities of countries with CRC of 3
4. Foreign banks from countries with CRC of 3

Risk Weight 75%

1. 1-4 Residential mortgages with loan-to-value 80 and 90 percent

Risk Weight 100%

1. All commercial and consumer loans
2. 1-4 Residential mortgages with loan-to-value greater than 90 percent
3. Non-primary mortgages (such as home equity loans) with LTV less than 80 percent
4. Securities of countries without a CRC or CRC between 4 to 6
5. Foreign banks from countries without a CRC or with CRC between 4-6
6. Certain equity exposures that are not deemed non-significant
7. All other balance sheet assets not listed above

Risk Weights 150%

1. Loans that are 90 days past due

2. High volume commercial real estate loans (includes financing for development, construction and acquisition)
3. Non-primary mortgages (such as home equity loans) with LTV between 80 to 90 percent
4. Securities of countries with CRC 7 or in default
5. Foreign banks from countries with CRC 7 or in default

Risk Weights 200%

1. Non-primary mortgages (such as home equity loans) with LTV between 80 to 90 percent

Risk Weights 250%

1. Significant investments in the capital of unconsolidated financial institutions that are not deducted from capital

Risk Weights 300%

1. Publicly-traded equity exposures and includes the ineffective portion of a hedge pair

Risk Weights 400%

1. Any equity exposures that is not publicly traded

Risk Weights 600%

1. An equity exposure to a leveraged investment firm that has characteristics of securitization

Risk Weights 1250%

1. if a bank has weak due diligence and does not demonstrate a comprehensive understanding of securitization exposures to regulators.

The new weights show that the mortgages have been classified more finely.

1. They are now based on the loan-to asset value; the higher the equity owned by borrowers, the less risk to the bank.
2. In addition, all loans are now risk weighted at 100% instead of based on credit ratings. The reason is that private rating agencies like S&P, Moody's and Fitch, did a poor job in ratings prior to the financial crisis. Governments recognized that there is a conflict of interest because issuers pay them for ratings.
3. In addition, sovereign nations will be ranked based on classification provided by an international agency, OECD.
4. Finally, real estate and securitization has been reclassified to be riskier and a higher capital charge.

Regulation Today

The financial crisis of 2007-09 resulted in a comprehensive set of regulations on the financial services industry, equivalent to those implemented in the 1930s. It reverses a trend of deregulation that began in the 1960s as new banking practices, globalization and technology transformed the industry. A spate of financial innovations expanded the scope and breadth of services offered by commercial banks. Unfortunately, the liberal regulatory environment allowed some of the larger banks to take excessive risk, resulting in the financial crisis of 2008, whose intensity was similar to the Great Depression.

One positive news in this crisis was the increased coordination by the global central banks, something that was missing in the 1930s. The Bank for International Settlements (BIS) in Basel played a very positive role in helping central banks act collectively to ensure there was sufficient liquidity in the marketplace. In the U.S., it appears that the quantitative easing strategies of the Fed and the subsequent purchases of trillions of mortgage-backed instruments prevented the recession from worsening and put the economy on a slow but steady recovery. Europe, on the other hand, was slow to intervene in the markets and may have been responsible for the multiple recessions experienced by some of the countries in the Eurozone.

The post-crisis resulted in a range of new laws to prevent excessive risk-taking by banks. In the U.S. the Dodd–Frank Wall Street Reform and Consumer Protection Act was passed on July 21, 2010 covering nearly every aspect of the financial services industry. Basel 3 implementation forms one of the components of the law. Whether these laws are needed and whether can prevent another crisis is yet to be determined.

Summary of the Chapter

In addition to managing monetary policy, the Fed is also responsible for the safety and soundness of the financial system. In the case of commercial banks, the Fed requires banks to maintain minimum reserve requirements and minimum capital. Reserve requirements safeguard banks against unexpected withdrawals while minimum capital requirements serve as a cushion against unexpected decline in the value of assets, primarily loans.

In 1998, the Banks for International Settlements in Basel, Switzerland, proposed a set of guidelines for maintaining minimum capital standards for commercial banks. Its goal was to ensure that banks with riskier assets held more capital relative to less risky banks. For example, loans made to government or government entities arte less risky and hence did not require as much capital to be held as loans made to corporations. Known as the Basel 1 Accord, the standards were successfully implemented throughout the world. Basel 1 also required banks to hold capital for off-balance sheet instruments.

One of the weaknesses of the Basel 1 accord was that all loans were classified as of equal risk. Basel 2 resolved the problem by allowing banks to hold less capital if borrowers had higher ratings issued by pubic crediting rating agencies. For countries where public ratings were not commonly used, local regulators could approve internal rating models to rate borrowers. Basel 2 also specified three pillars to ensure the safety and soundness of commercial banks. Pillar I focused on ensuring the adoption of rigorous quantitative models to estimate capital requirements. Pillar II focused on implementing a rigorous review process by local regulators. Pillar III focused on disclosure and transparency, requiring banks to provide timely and accurate information to depositors and investors for accessing the conditions of banks.

Delays in finalizing Basel 2 pushed the implementation dates to 2008 and 2009. The financial crisis of 2008 that originated in the United States and spread to many countries interrupted the implementation. An post-crisis evaluation led to calls for tighter standards and resulted in the adoption of Basel 3 in 2013 for final implementation in 2019. It not only increased capital requirements but also introduced two new provisions, capital conservation and countercyclical buffers. Capital conservation buffer prevented banks for distributing dividends or repurchasing shares if they held insufficient capital while countercyclical buffer required banks to hold additional capital when an economy is growing rapidly and in danger of peaking at the top of the business cycle.

Whether the new standards will prevent another financial crisis is an open question.

End of Chapter Questions

1. Explain capital arbitrage in the risk management of banks.
2. What is the major difference between Tier I and Tier II capital?
3. Which bank, A or B, can be considered to be risker, shown below, based on Basel 1 criteria for risk classification? Explain the results.

Bank A (in millions)			
	Assets	Basel Weights	Risk-adjusted Assets
Cash and T-Bonds	$ 300.00	0%	
Agency bonds (GNMA)	$ 400.00	20%	
Mortgages	$1,500.00	50%	
Loans (AAA rated)	$2,000.00	100%	
Total	$4,200.00		
Bank B (in millions)			
	Assets	Basel Weights	Risk-adjusted Assets
Cash and T-Bonds	$ 600.00	0%	
Agency bonds (GNMA)	$ 900.00	20%	
Mortgages	$2,000.00	50%	
Loans (B rated)	$ 700.00	100%	
Total	$4,200.00		

4. Using information from Question (3), if both banks have the same liabilities as shown below, are they in compliance with Basel 1 standards?

Bank A and B Liabilities and Stockholder's equity (in millions)	
Demand deposits	$2,000.00
Time Deposits	$1,990.00
Subordinated Debt (Tier II)	$75.00
Preferred Stock (Tier II)	$25.00
Common Stock (Tier I)	$35.00
Retained Earnings (Tier I)	$75.00

5. How much Tier 1 capital should Bank B substitute for Tier II in order to be complaint with Basel 1 standards?

6. Based on Basel 2 criteria for risk classification, is Bank A risker than Bank B? Explain.

Bank A (in millions)			
	Assets	**Basel Weights**	**Risk-adjusted Assets**
Cash and T-Bonds	$ 800.00	0%	
Agency bonds (GNMA)	$ 500.00	20%	
Mortgages	$1,000.00	50%	
Loans (AAA rated)	$1,200.00	20%	
Total	$3,500.00		
Bank B (in millions)			
	Assets	**Basel Weights**	**Risk-adjusted Assets**
Cash and T-Bonds	$ 500.00	0%	
Agency bonds (GNMA)	$ 800.00	20%	
Mortgages	$1,200.00	50%	
Loans (B- rated)	$1,000.00	150%	
Total	$3,500.00		

7. Using information from Question (6), if both banks have the same liabilities as shown below, are they in compliance with Basel 1 standards?

Bank A and B Liabilities and Stockholder's equity (in millions)	
Demand deposits	$1,000.00
Time Deposits	$1,500.00
Subordinated Debt (Tier 2)	$85.00
Preferred Stock (Tier 2)	$25.00
Common shares (Tier 1)	$35.00
Retained Earnings (Tier 1)	$45.00

8. Second Bank has the following balance sheet in millions of dollars with the Basel risk weights given in parentheses.

U.S. Govt T-Bonds (0%)	$100m	Deposits	$ 850m
Govt. Agency FNMA Bonds (20%)	$200m	Subordinated Debt ((Tier II)	$ 10m
University Dorm bonds (50%)	$300m	Preferred Stock (Tier II)	$ 20m
Consumer Loans (100%)	$200m		
Commercial Loans (100%)	$200m	Equity (Tier I)	$ 20m
Total	$1000m		$1000m

a. Does the bank have enough capital to meet the requirements as specified by Basel II?
B. the bank wishes to keep its Tier 1 ratio at 5%. They will sell a portion of their consumer loans and invest them in U.S. government bonds. How much consumer loans should they sell?

9. First Bank has the following balance sheet in millions of dollars with the Basel 2 risk weights given in parentheses.

U.K. Sovereign T-Bonds (0%)	$150m	Deposits	$ 1420m
Municipal Bonds (20%)	$250m	Subordinated Debt ((Tier II)	$ 20m
Mortgages (50%)	$350m	Preferred Stock (Tier II)	$ 25m
Consumer Loans (100%)	$300m		
Commercial Loans (20%)	$450m	Equity (Tier I)	$ 35m
Total	$1500m		$1500m

a. Does the bank have enough capital to meet the requirements as specified by Basel II?
B. The bank wishes to keep its Tier 1 ratio at 5%. They will sell a portion of their consumer loans and invest them in U.S. government bonds. How much consumer loans should they sell?

10. Explain capital conservation buffer under Basel 3.

11. A bank has estimated that its net income for the year is $2.0 million with 500,000 outstanding shares. It has estimated that its Common Equity Tier 1 (CET1) ratio is 6.25%. Its normal dividend payout ratio is 60%. Under the capital conservation buffer requirements of 2019, is it able to pay 50% of its net income as dividends? If not, what is the maximum dividends it can pay per shares?

12. The net income for a bank is $1.5 million with 300,000 outstanding shares. The Common Equity Tier 1 (CET1) ratio is estimated to be 6.75%. Its normal dividend payout ratio is 85%. Under the capital conservation buffer requirements of 2019, is it able to pay 80% of its net income as dividends? If not, what is the maximum dividends it can pay per shares?

13. Explain countercyclical buffer in Basel 3.

14. Explain Prompt Corrective Action (PCA) established under the FDICIA Act of 1992.

15. How the risk weights of Basel 3 different from Basel II?

ProBanker Assignment 6

This assignment will demonstrate the impact of selected factors on the estimation of Basel I and II ratios in ProBanker.

1. The impact of substituting loans to government bonds on Basel ratios.
2. The impact of substituting installment and corporate loans to mortgage bonds on Basel.
3. The impact of issuing shares on Basel ratios.

Please note that in Autosim you are playing solo against the computer. If you are in a competitive game, the results can be different because demand and supply are affected by the decisions of your competitors.

For this assignment, you will create three Autosim games, 6A, 6B and 6C.

Assignment 6A: Create a personal **Autosim**.

a. Click on *Games*.
b. Click on *New Autosim game*.
c. Select ***Assignments Regional Bank*** **template** in *using template.*
Note: *Make sure* ***NOT*** *to choose* ***Sample Regional Bank*** *template.*
d. Type a name for the new Autosim in *New game's name.*
e. Example "John Roger Assignment 6A."
f. Click on *Create Game.*

1. Input decisions to your new Autosim. There are four categories of decisions – '**Account *Quantities, Account Interest Rates, Advertising*** and ***Other Decisions.***

Click on ProBanker icon on the top left to go to the home page.
a. Click on *View Games.*
b. Select your newly created Autosim.
c. Click on *Play bank.*

2. **Account Quantities** – change the following:
a. Target Reserves for Deposits = $25,000
b. Federal Funds Purchased (not Sold) = $25,000
c. 360 Days CDs to Issue = $50,000
d. New Bonds to Purchase = $100,000
e. The remaining boxes should all be zeroes.

3. **Account Interest Rates** - Increase loan rates by 1% percent and increase deposit rates by 1%
a. Reduce Fixed Rate Corporate Loan Rate = 10.30percent
b. Reduce Floating Rate Loan Spread = 5.00 percent
c. Reduce Installment Loan Rate =12.00 percent
d. Reduce Mortgage Loan Rate = 10.00 percent
e. Increase Retail CDs Rate = 7.00 percent
f. Increase Passbook Savings Rate = 6.00 percent
g. Increase Long-Term Retail Deposits Rate = 8.50 percent
h. The remaining boxes should all be zeroes.

4. **Advertising** – Leave as is (150, 80, 410 ,580, 290, 140, 60)

5. **Other decisions** – Leave as is (0, 1, 0, 0, 100, 100)

6. *Simulate next period* (on left side of the screen). After a few seconds, you will notice a flicker and it should say **End of Period 1.** You are ready to review the results.

7. Answer the following:

    a. Estimate the risk-weighted assets in Quarter 0 and Quarter 1. Note the following risk-weights used in ProBanker.

Excess Reserves	0.20
Federal Funds Sold	0.20
Fixed-Rate Loans	1.00
Floating Rate Loans	1.00
Installment Loans	1.00
Mortgages	0.50
Fixed Assets	1.00

    b. Estimate the Basel 1 and Basel 2 ratios? Note the following:
    Tier 1 Capital = Net worth and retained earnings
    Tier II capital = Loan Loss allowances with a limit of 1.25% of risk-weighted assets

    c. Explain the increase or decrease in Basel ratios in Quarter 1?

<u>Assignment 6B</u>

8. Create a personal **Autosim**.

    g. Click on *Games*.
    h. Click on *New Autosim game*.
    i. Select ***Assignments Regional Bank*** **template** in *using template.*
    Note: *Make sure* ***NOT*** *to choose* ***Sample Regional Bank*** *template.*
    j. Type a name for the new Autosim in *New game's name*
    k. Example "John Roger Assignment 6B"
    l. Click on *Create Game*

9. **Account Quantities** – change the following:
    a. Target Reserves for Deposits = $25,000
    b. Federal Funds Purchased (not Sold) = $25,000
    c. 360 Days CDs to Issue = $50,000
    d. New Bonds to Purchase = $100,000
    e. The remaining boxes should all be zeroes.

10. **Account Interest Rates** - Increase Fixed, Floating and Installment loan rates by 1.5% percent BUT decrease mortgage rates by 1%. Also increase deposit rates by 1%
    a. Reduce Fixed Rate Corporate Loan Rate = 10.80 percent
    b. Reduce Floating Rate Loan Spread = 5.50 percent
    c. Reduce Installment Loan Rate =12.50 percent

d. Reduce Mortgage Loan Rate = 8.00 percent
e. Increase Retail CDs Rate = 7.00 percent
f. Increase Passbook Savings Rate = 6.00 percent
g. Increase Long-Term Retail Deposits Rate = 8.50 percent
h. The remaining boxes should all be zeroes.

11. **Advertising** – Leave as is (150, 80, 410 ,580, 290, 140, 60)

12. **Other decisions** – Leave as is (0, 1, 0, 0, 100, 100)

13. Simulate next quarter and record the results of quarter 2 under Quarter 2 in the table and estimate the percent change from Q1 to Q2.

a. Estimate the risk-weighted assets in Quarter 0 and Quarter 1.
b. Estimate the Basel 1 and Basel 2 ratios?
c. Explain the increase or decrease in Basel ratios in Quarter 1?

Assignment 6C

14. Create a personal **Autosim**.

a. Click on *Games*.
b. Click on *New Autosim game*.
c. Select ***Assignments Regional Bank*** **template** in *using template.*
Note: *Make sure* ***NOT*** *to choose* ***Sample Regional Bank*** *template.*
d. Type a name for the new Autosim in *New game's name*
e. Example "John Roger Assignment 6C"
f. Click on *Create Game*

15. **Account Quantities** – change the following:
a. Target Reserves for Deposits = $25,000
b. Federal Funds Purchased (not Sold) = $25,000
c. 360 Days CDs to Issue = $50,000
d. New Bonds to Purchase = $100,000
e. The remaining boxes should all be zeroes.

16. **Account Interest Rates** - Increase loan rates by 1% percent and increase deposit rates by 1%
a. Reduce Fixed Rate Corporate Loan Rate = 10.30 percent
b. Reduce Floating Rate Loan Spread = 5.00 percent
c. Reduce Installment Loan Rate =12.00 percent
d. Reduce Mortgage Loan Rate = 10.00 percent
e. Increase Retail CDs Rate = 7.00 percent
f. Increase Passbook Savings Rate = 6.00 percent
g. Increase Long-Term Retail Deposits Rate = 8.50 percent
h. The remaining boxes should all be zeroes.

17. **Advertising** – Leave as is (150, 80, 410 ,580, 290, 140, 60)

18. **Other Decisions –** Sell 100,000 shares and increase loan loss provisions to $5,000

- *a.* Number of shares to Sell = 100,000
- *b.* Provision for Loan Losses = 5000
- *c.* Leave the remaining boxes as is (0, 0, 100, 100)

19. Simulate next quarter and record the results of quarter 2 under Quarter 2 in the table and estimate the percent change from Q1 to Q2.

a. Estimate the risk-weighted assets in Quarter 0 and Quarter 1.
b. Estimate the Basel 1 and Basel 2 ratios?
c. Explain the increase or decrease in Basel ratios in Quarter 1?

8

Chapter 8 – OFF-BALANCE SHEET INSTRUMENTS

Financial institutions have always been adept at innovating products to help businesses succeed throughout history. As discussed in an earlier chapter, when Pope Gregory IX deemed interest on loans as usury, financiers created the bill of exchange amounting to the purchase and sale of an asset in order to avoid requiring interest payments. The same principle is applied today in Islamic finance. Since sharia law prevents banks (and any lenders) from making interest payments (riba), the financing methods employed are similar to the bill of exchange. It is designed to bestow risk to both counterparties, which is allowed under sharia law (lending with interest does not bestow risk on the borrower).

In the case of a mortgage, for example, the financing under the sharia law is structured in one of the following two ways:

1. Bank purchases the property and sells it to the owner at a higher price. The payments for the sale however can be made in installments. This form of financing is termed **murabahah.**
2. Bank purchases the property and the potential owner agrees to pay lease (rent) payment until a final purchase price is pad at the end of the contract. This form of financing is termed **ijara.**

Financial institutions historically have always managed to avoid restrictions on the free flow of money in an economy. New products have appeared throughout history to circumvent restrictions imposed by governments, religion or culture. Although financial institutions have been responsible for some of the major economic crises around the globe, they have also been responsible for development of the modern economy by ensuring capital has been allocated to productive users, resulting in increased production, consumption and wealth.

The 20th century in particular has seen some major innovations in finance, helped by improvements in technology and transportation. They include the development of the Eurodollar market, special drawing rights (SDRs), multiple-currency bonds, global depository receipts, swaps, options, futures, asset-backed securitization and bitcoins. They were developed to serve specific needs of financial clients or fill in niches of financial markets that were previously unserved. A majority of the innovations have also been off-balance sheets instruments that have provided significant benefits to businesses but they have also increased the risk exposure of banks.

In this chapter, we will discuss several popular off-balance sheet instruments used by banks to help businesses with their financial transactions and or reduce risks. In particular, we focus on three instruments, letters of credit, loan commitments and interest rate swaps. Other off-balance instruments include foreign exchange and financial derivatives such as options and futures that are also used extensively by businesses to reduce risks. These instruments will not be covered in this book.

Off-Balance Instruments or Contingent Assets and Liabilities

Off-balance instruments are also called continent assets and liabilities because they can potentially become on-balance assets and labilities in the future under certain conditions. As an example, take a bank that currently has $200 in deposits and $100 in loans and $100 in Reserves at the Fed, as shown in Table 8.1.

Table 8.1

Bank A			
Reserves at the Fed	$100	Deposit	$200
Loans	$100		
Total Assets	$200	Total Liabilities	$200

One of its client has to make a $50 payment in three months to a group of investors. The bank guarantees to make a $50 payment on behalf of a client. If the client is unable to make the payment for whatever reason, the bank will step in and make the payment. Why will the bank issue such a guarantee (called the standby letter of credit)? There are two reasons.

1. It will generate a fee income. If it charges $1 or 2% of the $50 contract value, it provides a valuable source of revenue, especially if it on an ongoing basis.
2. It has an established relationship with the client and is confident that the client will make the payment. If it is a new client, the bank will likely ask for some deposit as collateral.

As with all loans and guarantees, there will be unexpected events that can impact even the most successful and competent businesses. If such an unforeseen was to occur and the company is unable to make the payment, the bank will have make the promised payment of $50. The new balance sheet will look as shown in Table 8.2:

Table 8.2

Bank A			
Reserves at the Fed	$50	Deposit	$200
Loans	$100		
New Loan	$50		
Total Assets	$200	Total Liabilities	$200

In order to make the $50 payment, it will use its current cash holding at the Fed to make the payment and issue a new loan to the client. Alternatively, it may borrow additional money from other sources, such as increasing deposits or borrowing from the federal funds market to make the payments. If it borrows federal funds, the balance sheet will look as in Table 8.3.

Table 8.3

Bank A			
Reserves at the Fed	$100	Federal Funds	$50
Loans	$100	Deposits	$200
New Loan	$50		
Total Assets	$250	Total Liabilities	$250

If the loan is paid by the client, the new $50 loan will not be created. Hence, the term "contingent asset and liability." The asset and liability is created only upon a contingent event. In this case, the contingent event is a nonpayment by the client.

Finally, what would happen if the borrower's firm goes bankrupt and the loan is defaulted. The bank will lose the $50 and the new balance sheet will look as in Table 8.4.

Table 8.4

Bank A			
Reserves at the Fed	$100	Federal Funds	$50
Loans	$100	Deposits	$200
Loan $50 Defaulted	$0	Net Worth	($50)
Total Assets	$250	Total Liabilities	$200

Thus, an off-balance sheet instrument like a guarantee can create both a liability and asset if a contingent event takes place. The default rate of guarantees will depend on the credit worthiness of the client pool. If the default rate increases, the bank would charge a very high fee income or not provide the guarantee at all.

Guarantees are just one of the two types of off-balance sheet instruments offered by commercial banks. The other type are financial derivatives such as options, futures and swaps. Within these two categories, there are many different instruments, all of which provide some form of benefit to businesses. As with on-balance sheet instruments like loans and securities, excessive off-balance sheet instruments can expose a bank to potentially large losses.

Guarantee instruments

Most commercial banks offer two forms of guarantee instruments, letters of credit and loan commitments. We have already discussed the basic outline of a letter of credit with the example above on a payment guarantee. Loan commitments are somewhat different in that the bank provides a lie of credit to a client. The bank approves a maximum limit that can be drawn down by the client at an agreed upon interest rate. This guarantee is similar to credit card where the borrower can spend or withdraw up to the limit of the credit card. As soon as the client borrows from the line of credit, the loan amount of the client increases by the additional amount borrowed.

Letters of Credit

Similar to the example of a guarantee discussed above, letters of credit (LC) are guarantees offered by a bank on behalf of a client that promises to pay a specified amount if the client is unable to make the

payment. It is similar to an insurance contract. Assume the LC promises to pay $100,000 in the event of a non-payment by the client. Since this is a guarantee, it is not recorded as a liability in the balance sheet. It becomes a liability only when the contingent event occurs, nonpayment by their client. Since the bank has guaranteed the payment, it will be liable to make the payment. If it does not recover the amount from the client, it will be charged-off as a loss, similar to a loan default.

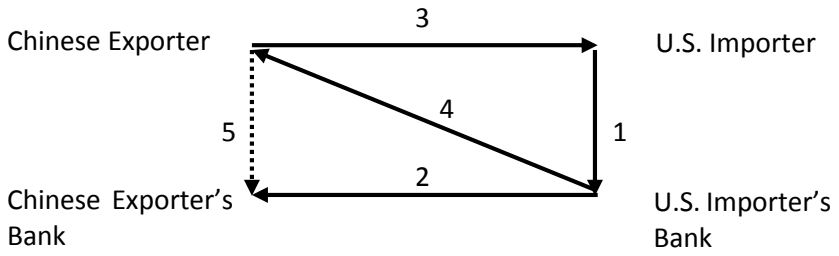
There are two major kinds of letters of credit – commercial letter of credit and the standby letter of credit.

Commercial Letter of credit

Most banks offer letters of credit for their clients for their international transactions. There are domestic letters of credit because of the strong legal enforcement of contracts in the United States. A commercial documentary letter of credit (LC) guarantees an exporter the payment of an invoice when the goods are shipped to their client. The diagram below explains execution of an LC in an international transaction.

Assume a U.S. importer orders goods from a Chinese exporter worth $1 million for shipment in one month with payment terms of three months. The typical payment process is shown in Figure 1.

Figure 1



1. U.S. Importer will ask its bank to issue a letter of credit to guarantee payment in three months to the Chinese exporter once the goods have been shipped with the proper documentation. The U.S. Importer's bank may demand between zero and 100% cash upfront from the client to issue the guarantee. The exact amount will depend on the relationship and familiarity between the bank and the client.

2. U.S. importer's bank will send the LC to the Chinese exporter's bank assuring the Chinese exporter that payment is guaranteed by the U.S. importer's bank.

3. As soon as the goods are shipped, the Chinese exporter (or its bank) will ship the documents to the U.S. importer (or the U.S. importer's bank) which usually includes the bill of lading, insurance coverage and other documentation specified in the order.

4. The U.S. importer's bank will stamp the LC as "accepted" and send it back to the exporter indicating that the obligation of the payment has been transferred to the U.S. bank. If the client does not make the payment, the U.S. bank is liable for the payment.

5. Once the LC is received, the Chinese exporter can wait for three months for payment by the U.S. importer's bank. Alternatively, the exporter could discount (sell) the LC to the Chinese exporter's bank or another dealer and receive payment up-front.

The LC is considered an off-balance sheet liability because of the risk that the importer may not be able to pay the bank when payment is due. The bank is obligated to pay the U.S. exporter even if its client defaults on his or her obligation. As a result, regulators prefer that banks set aside capital to protect against potential defaults on LCs by some of their clients.

Banker's acceptance

Another popular money market instrument is the banker's acceptance which originates from a letter of credit. As stated above, assume the Chinese exporter prefers to have the payment as soon as the LC is stamped by the importer's bank instead of waiting for three months. The exporter has an option of selling the LC in the market at a discount. Once it is sold, it is termed as a banker's acceptance and is a very popular short-term instrument. If a company, financial institution, or an investor has excess cash for a few days, one option is to purchase a banker's acceptance. It is a popular instrument because the market is deep and liquid, indicating it can be sold at short notice. Whoever owns the banker's acceptance on maturity date is entitled to the face value of the LC from the importer's bank.

The pricing of an LC sold at a discount is similar to a T-Bill. Assume the 3-month rate on $1,000,000 banker's acceptance is currently trading at 5% p.a. (per annum). The exporter could sell the LC for the following

$$Price = \$1{,}000{,}000 - \frac{.05}{360} * 90 * 1{,}000{,}000 = \$987{,}500$$

What happens if the current holder wishes to sell the BA after 30 days? The price will depend on the interest rate 30 days later. Assume the 60-day BA rate has dropped to 4.60%. The new price will be

$$Price = \$1{,}000{,}000 - \frac{.0460}{360} * 60 * 1{,}000{,}000 = \$988{,}500$$

As the BA approaches maturity, the price will approach the face value of $1,000,000, similar to a T-Bill.

Standby Letter of Credit

A standby letter of credit (SBLC) is also a guarantee by a bank to pay a fixed amount to a designated beneficiary if a client defaults. It is an irrevocable contract and the bank is obligated to make the payment if the client is unable to complete the promised obligations. The obligations are of two forms, financial and performance-related. A financial SBLC is used to enhance the credit rating of borrowers such as when issuing commercial paper. A performance-related SBLC guarantees payment if a project is not completed such as construction of a building or an obligation to deliver a specified set of goods.

An example of a standby letter for a financial transaction is shown below. Assume an AAA-rated company issues commercial paper regularly for short-term funding. Commercial paper is unsecured short-term borrowing from the public; companies approach investors directly or through dealers. Assume the company wishes to borrow $1,000,000 for 3 months at the current rate of 3.75%. The company could reduce its funding cost to 3.50% if it can obtain a standby LC from a bank. It assures holders of commercial paper that the bank will make the payment if the client, for any reason, is unable to make the payment.

The cost saving to the company depends on the price charged by the bank for guaranteeing the payment. If it charges 10 basis points (bps), the savings is as follows:

Without SBLC, company receives

$$Price = \$1{,}000{,}000 - \frac{0.0375}{360} * 90 * 1{,}000{,}000 = \$998{,}437.50$$

With SBLC, company receives

$$Price = \$1{,}000{,}000 - \frac{(0.0350)}{360} * 90 * 1{,}000{,}000 = \$998{,}541.67$$

The company has to pay the bank $1,000,000 * (.0010/360)*90 = $62.50.
With SBLC, company receives a net of $998,541.67 – 62.50 = $998,479.17

Savings = $998,479.17 - $998,437.50 = $41.67 per million or 16.67 bps.

From the bank's perspective, it is insuring a payment of $1,000,000 for 10 bps.

Regulators would prefer banks to set aside capital to withstand unexpected defaults from some of their clients' standby letters of credit. The distinction between a performance and financial SBLC is determined by the trigger event that burdens the bank with payment. If the event that triggers the payment is financial in nature, such as non-payment of interest or principal, then the SBLC is deemed financial. If the event trigger is based on the performance of a company such as completion of a construction project or delivery of goods on time, the SBLC is performance-related. Financial SBLCs (termed direct credit substitutes) are considered riskier than performance-related because non-payment of financial obligations usually indicates a company is likely to default.

Loan Commitments

A loan commitment is an agreement between a bank and client specifying a maximum amount that can be borrowed for a specified period of time. The line of credit assures the client of being able to borrow on demand and not request a new loan each time. It is similar to a credit card where a maximum limit is specified for a borrower that can be drawn down when required. The bank charges an up-front fee for providing this commitment and in some cases, also charges for the unused portion of the loan commitment.

Example: Assume IBM receives a loan commitment from Chase Bank for $10 million with the following payment terms: 3-year commitment to lend at prime plus ½%. The commitment fee is 50 bps (0.50 percent) and the drawdown fee is 10 bps (0.10 percent). What is the net cost of the loan if IBM borrows $5 million of the $10 million for a year? Assume the prime rate is 6%.

Up-front fee for the loan commitment	= 0.0050 x $10,000,000	= $ 50,000
Interest rate of $5,000,000	= 0.0650 x $5,000,000	= $325,000
Drawdown fee	= 0.0010 x $5,000,000	= $ 5,000
Total		= $380,000

Net cost = $380,000/$5,000,000 = .0760 or 7.60%

The cost of the loan borrowed under a loan commitment is slightly higher than the nominal rate because of the additional fees.

In 2014, the total loan commitments by U.S. commercial banks totaled $3.39 trillion. About 80% of commercial and industrial loans are borrowed through loan commitments. The risk to banks in providing loan commitments is two-fold:

a. ***Credit risk.*** Borrowers are likely to increase drawdown when adverse events impact the company and it runs out of short-term funding. A classic example cited is the drawdown of approximately $3 billion in loans by Enron Corporation in 2001 just before it went bankrupt, resulting in losses to a number of

major banks. Similarly, during the financial crisis of 2007-09, many companies drew down on their credit facility as a precaution against banks tightening of credit.

b. ***Interest rate risk.*** This is more appropriate for loan commitments with fixed interest rate. In the example above, assume IBM was provided with a loan commitment at a fixed rate of 6%. The bank is then exposed to interest rate risk if rates increase over the three-year life of the loan commitment.

Regulators would like to see banks hold additional adequate capital to cover both credit and interest rate risks associated with loan commitments.

Capital Levels for Off-Balance Sheet Liabilities

As banks began to increase their off-balance sheet activities in the 1980s, regulators were grappling with different methodologies to determine the appropriate amount of capital. The notional value of the contracts is not an appropriate benchmark for off-balance sheet instruments. For example, letters of credit issued by banks are just guarantees and is a contingent liability only if the client defaults. The bank is obligated to make the full payment to the beneficiary of the LC only if their client defaults. The appropriate capital will depend on the average default rate of letters of credit.

Basel 1 adopted a simple method to determine capital levels for off-balance sheet instruments. The first step was to first convert the off-balance sheet contracts to on-balance sheet credit equivalents using fixed conversion rates. Once the on-balance sheet equivalents are established, they are converted to risk-weighted assets using the same methodology described in the chapter on capital adequacy. The conversion rates from off-balance sheet to on-balance sheet equivalents are specified by regulators. The example below provides an example of estimating the minimum requirement for two off-balance sheet contracts.

Assume a bank has $100 million in commercial letters of credit to a private company and $300 million standby letters of credit to a U.S. government agency. How much additional capital should the bank hold to cover potential losses? The credit conversion factor required by Basel 1, and adopted by the U.S. Fed, is shown below:

Off-balance Sheet Contracts	**Conversion Factors**
Standby letters of Credit	100%
Commercial letters of credit	20%

The conversion factor states that the notional value of standby letters of credit (also termed direct credit substitutes) should be of equivalent value on balance sheet. In other words, providing the guarantee is same as making a loan of the same value. If a bank guarantees $100 of payment in the event of a default by the client, it is equivalent to providing a $100 loan to the client. If the expected default rate of loans is 8%, it is the same for standby letters of credit.

On the other, routine commercial letters of credit do not have the same equivalency. If a bank guarantees $100 in the event of non-payment by a client for non-delivery of goods, the on-balance sheet equivalence is only $20. It indicates that the default rates of commercial letters of credit is one-fifth that of standby letters of credit.

For our example, the conversion is shown in Table 8.5.

Table 8.5

Off-balance Sheet Contracts	Amount	Conversion Factor		On-Balance Equivalent
Direct credit substitute SBLCs	$ 300 million	100%	=	$ 300 million
Commercial letters of credit	$ 100 million	20%	=	$ 20 million

Table 8.5. shows that the guarantees of $400 million is the equivalent of giving a loan of $320 million. The next step is to convert the $320 on-balance sheet equivalents into risk-weighted assets. As explained in the chapter on bank capital, the conversion is based on the classification of borrowers. If a loan is made to the government, the risk is zero while a government agency carries a risk weight of 20%. In our example, the standby letters of credit were made to a government agency while the commercial letters of credit were made to a corporate client. The conversion to risk-weighted assets is shown in Table 8.6

Table 8.6

Off-balance Sheet Contracts	On-Balance Equivalent	Basel Weights		Risk-Assets
Direct credit substitute SBLCs	$ 300 million	20%	=	$ 60 million
Commercial letters of credit	$ 20 million	100%	=	$ 20 million
Total			=	$ 80 million

Thus, $400 million of off-balance sheet guarantees is converted to $80 million in risk-weighted assets. The bank will have to hold the following:

Tier I capital	4% of $80 million	= $3.2 million
Tier I + II capital	8% of $80 million	= $6.4 million

Basel 1, 2 and 3 have maintained the same formula for estimating capital of off-balance sheet instruments. However, as the financial crisis of 2008 reveals, the amount of capital based on the above formulas was woefully inadequate as many banks that either failed or were bailed out were heavily engaged in off-balance sheet activities.

Derivative contracts

Financial derivatives such as options, futures and swaps form the other set of off-balance sheet instruments of commercial banks. Derivative contracts differ from off-balance sheet guarantees in that the contracts require taking delivery of the financial instrument (or cancelling the position by an offsetting trade). As an example, assume a bank agrees to sell £100,000 to a client for delivery in three months (a forward contract) at an exchange rate of $1.35/£. The bank simultaneously buys pounds at $1.34/ £ for delivery in three months, to lock into a spread of $0.01 per pound ($1,000 total). Three months later, assume the rate drops to $1.30/£ and the client goes bankrupt. The bank will have to take delivery of the pounds at $1.34 and sell it at $1.30, losing $0.04 per pound or $4,000 in total. This transaction does not show up in the balance sheet at all, i.e. it is all off-balance sheet. The sale of $135,000 of pounds and the purchase of $134,000 of pounds in the future is likely to a loss of about $4,000 or about three percent of the notional value of £100,000.

Swaps is another common financial derivative employed by commercial banks. There are two kinds of swaps arranged by banks on behalf of their clients, currency swaps and interest rate swaps. In a currency swap, a bank with swaps payment in one currency for another currency. In interest rate swaps, a bank

swaps foxed rate payments for floating rate payments or vice versa. The next section will discuss interest rate swaps in detail.

Before we discuss interest rate swaps, the following provides a background on the ways bank use derivative contracts.

1. Banks purchase and sell financial derivatives on behalf of their clients. As shown in the earlier example on foreign exchange, the risk faced by banks is that one of the counterparties will default, either their client or the party providing the other side of the transaction.

2. Banks also make a market in financial derivatives and trade for their own accounts, termed proprietary trading. Only very large banks engage in proprietary trading and by their very nature of trading, hold the assets for only short periods. Trading derivatives are subject to two kinds of risks, counterparty default as well as market risk. Market risk is incurred when traders predict the movement of prices incorrectly resulting in losses. Market risk is covered in the next chapter.

3. Banks also have the option of purchasing financial derivatives on organized exchanges. For example, they can purchase and sell options on the Chicago Board of Exchange and futures contracts on the Chicago Mercantile exchange. Purchases on organized exchange carry very little counterparty risk because once the trade is confirmed, the counterparty is the clearing house. However, if the sale and purchases are part of their proprietary trading, they are still subject to trading losses.

4. Thus, the concern for regulators is counterparty risk as a result of trading between banks and other major market-makers. These one on one trades are termed over the counter or OTC trades. The Dodd-Frank Act is trying to limit OTC trading by banks and forcing them to move more towards trading on organized exchanges.

Interest Rate Swaps

An interest rate swap is a legal agreement between two firms to exchange payments at specific periods of time. The first swap instrument is credited to the World Bank and IBM, when both firms agreed in 1981 to swap dollar payments for Swiss Francs and German Deutschemarks. The World Bank could borrow at a lower rate in the United States than in Switzerland. IBM, on the other hand, could borrow cheaper in Switzerland than in the United States. Since IBM had accumulated significant debt in Swiss francs and German marks, they wished to make payments in the U.S. dollars. Solomon Brothers, then a major investment bank, arranged for IBM to borrow in Switzerland and the World Bank in the U.S., but swapped the payments so IBM could pay off World Bank's debt in the U.S. while the World Bank paid off IBM's debt in Swiss francs and German marks. This eventually led to the development of interest rate swaps where, instead of currencies, only interest payments were exchanged. Interest rate swaps ultimately became a standard form of financing for most global institutions.

The extent of its popularity can be gauged by the notional amount of interest rate swaps outstanding issues between 1980 and 2014.[44]

Size of Swap market	**Interest rate Swaps**	**Currency Swaps**
1980	$0	$0
1988	$50.0 trillion	$18.0 trillion

[44] Source: BIS at www.bis.org

2004	$190.5 trillion	$29.3 trillion
2007	$393.1 trillion	$56.2 trillion
2014	$563.3 trillion	$74.8 trillion

As can be seen, the growth of interest rate swaps far outpaced currency swaps over the 35 period.

Interest rate exposure

The dramatic growth of interest rate swaps can only occur if there is a strong demand for the product. One contributing factor to the growth in demand was the use of swaps by financial institutions to hedge their portfolios against interest rate risk. An example below will highlight the case.

Assume Bank A's cheapest source of funding is in the London Eurodollar market where it can currently borrow at a floating rate of LIBOR (London Interbank Offer rate) + ½% premium. It prefers to also lend at floating rates, i.e. LIBOR plus a fixed premium so it earns a fixed spread. However, if a market segment is competitive, the bank may at times be forced occasionally to lend at a fixed rate. Assume the bank made a fixed-rate $100 million loan at 6%. Also assume the current LIBOR rate is 4% and the deposit rates are reset every year.

Bank A			
Loan AAA 5-year	$100 million	Time Deposit 5-year	$100 million
Fixed rate 6%		Floating LIBOR + 1/2%	
Total Assets	$100 million	Total Liabilities	$100 million

The current LIBOR rate enables the bank to earn a spread of 1½% or 150 bps (6.0 – 4.5 percent).

A fixed-rate asset and floating-rate liability however exposes the bank to interest rate risk. If LIBOR increases above 5.5%, the bank will end up in a loss. If interest rates fall, the bank will earn a higher spread.

Question

What is the expected loss if LIBOR dramatically increases to 5.0%, 6.0%, 7.0% and 8.0% in the next four years? In the first year, the cost is already fixed at 4.5%. Use the current cost of funds, 5.5% to discount the cash flows.

Answer

Profits in year 1 = (6% - 4.5%) * $1,00,000,000 = $1,500,000
Profits in year 2 = (6% - 5.5%) * $1,00,000,000 = $500,000
Profits in year 3 = (6% - 6.5%) * $100,000,000 = -$500,000
Profits in year 4 = (6% - 7.5%) * $100,000,000 = -$1,500,000
Profits in year 5 = (6% - 5.5%) * $100,000,000 = -$2,500,000

0----------1----------2----------3----------4----------5
$1,500,000 $500,0000 -$500,000 -$1,500,000 -$2,500,000

The present value of the loss at the current cost of funds 5.5% is:

$PV_{5.5\%}$ = -$1,678,440.68

Question

What is the expected gain if the LIBOR rates falls to 3.5%, 3.0%, 2.5% and 2.0% over the next four years?

Answer

0----------1----------2----------3----------4----------5
$1,500,000 +$2,000,000 +$2,500,000 $3,000,000 $3,500,000

The present value of the loss at the current cost of funds 5.5% is:

$PV_{5.5\%}$ = +$6,177,075.93

Question

What is the expected loss or gain if the LIBOR rates remain the same, i.e. 5%?

0----------1----------2----------3----------4----------5
+$500,000 +$500,000 +$500,000 +$500,000 +$500,000

$PV_{5.5\%}$ = $2,135,142.24

This, the earnings can swing between -$1.9 million to +$6.2 million depending on the direction of the interest rates over the next four years. Such wide fluctuations will be considered too risky for a bank because of the potential wide variation in the future cash flows.

Hedging with interest rate swaps

If a bank is risk-averse, it will attempt to protects itself against fluctuations in cash flows. In the above example, the bank is exposed to increases in interest rates. One way to hedge this exposure is to transform the floating-rate liability into a fixed-rate liability. If the bank is able to find another bank with the reverse exposure, i.e. a floating-rate loan funded by a fixed-rate deposit, it would benefit both parties to swap their payments and lock into a fixed spread.

For the above example, assume the bank is able to swap the LIBOR + ½% interest payment to a fixed rate of 5.75% for a notional value of $100 million. In other words, a counterparty will pay the bank LIBOR + ½% ($5.5 million if LIBOR is 5%) every year and the bank will pay to the counterparty 5.75% (5.75 million). The new balance sheet will be as follows:

Bank A			
Loan AAA 5-year	$100 million	Time Deposit 5-year	$100 million
Fixed rate 6%		Fixed rate 5.75%	
Total Assets	$100 million	Total Liabilities	$100 million

The bank has locked into a 0.25% spread (6% - 5.75%) or $250,000 on this loan. It has removed any uncertainty due to movements in the LIBOR rate.

Pricing a Vanilla swap

How are prices determined in the swap market? For example, could the bank in the above example received a rate lower than 5.75%? As with nearly all financial products, the prices are determined by demand and supply for the products. However, they are boundaries established based on the several conditions, including arbitrage opportunities, transactions costs and easy availability of substitutes. In the case of interest rate swaps, the markets are able to take advantage of differences between floating and fixed rate spreads if one counterparty has an advantage over the other counterparty in either the fixed or floating rate market, termed comparative advantage.

The pricing of an interest rate swap as a result of comparative advantage is illustrated in the following example. Assume Bank A, rated AAA, wishes to borrow a floating-rate loan of $100 million. Assume Bank B, rated BBB, wishes to borrow $100 million at a fixed rate. The loan can be in the form a bond issue. The following fixed and floating rates are available to both banks:

	Bank A (Rated AAA)	Bank B (BB rated)
	Notional Value: $100 million	
Fixed Rate	6.0%	8.0%
Floating	LIBOR + 0.5	LIBOR + 3.75

Assume the current LIBOR rate is 4%. The above rates indicate that Bank B has a relative advantage in the fixed rate market, as explained below.

1. Bank A can either borrow at 4.5% floating (LIBOR +1/2%) or 6.0% fixed. If it chooses fixed over floating rates, it pays 1.50% more.
2. Bank B can borrow at 7.75% floating or 8.0% fixed. If Bank B chooses fixed over floating rates, it pays only 0.25% more.

Although both rates are lower for Bank A, on a relative basis, Bank B has an advantage in the fixed rate market.

Looking at it the other way, Bank A has a comparative advantage in the floating rate market. If Bank A chooses floating over fixed rates, it will pay 1.50% less. If Bank B chooses floating over fixed, it will pay 0.25% less. Hence Bank A is said to have a comparative advantage in the floating rate market.

The differences in the comparative advantages is defined as the quality spread differential (QSD). In this example, the QSD is 1.25%, as shown below:

	Bank A (Rated AAA)	Bank B (BBB rated)
Fixed Rate	6.00%	8.00%
Floating	4.50%	7.75%
Difference	1.50%	0.25%
	QDS = 1.50% - 0.25% = 1.25%	

By swapping payments between Banks A and B, a financial intermediary can take advantage of the QSD of 1.25% and lower the costs to both banks and itself. The total benefits that can be shared among the three parties is 1.25%

Example:

Assume Bank A wishes to borrow $100 million at fixed rates while Bank B wished to borrow at floating rate. We will bring in an intermediary to arrange the swap.

Step 1:

a. Bank A borrows at a floating rate of LIBOR + 0.50% (where it has an advantage)
b. Bank B borrows at fixed rate of 7.75% (where it has an advantage).

Step 2: When the time comes for the annual payments, the intermediary asks:

1. Bank A to pay 5.75% and saves it 0.25% because If it had issued fixed rate on its own, it would have paid 6%.
2. Bank B to pay LIBOR + 3.50% and saves it 0.25% because it would have paid LIBOR + 3.75% if it has issued on its own.
3. Intermediary keeps 0.75% for itself.

To Recap:

	Bank Issues	Bank pays	Difference Left over
A	LIBOR + 0.50%	5.75%	
B	Fixed 8.00%	LIBOR + 3.50%	
Total	LIBOR + 8.50%	LIBOR + 9.25%	0.75% (kept by intermediary)

1. The comparative advantage rule states that the bank should borrow at the rate in which it has a relative advantage and swap payments with a counterparty that has advantage in the other rate.
2. The savings to both parties and the intermediary should total to the quality spread differential (QSD).
3. In this example, Bank A could have paid 5.5% (and saved it 0.50%) and Bank B could have paid LIBOR + 3.25% (and saved It 0.50%), leaving the intermediary with 0.25%. The rates that will be finalized will depend on the negotiating power of each borrower.

One major feature of interest rate swaps is that no principal is exchanged because the notional face value of the loans is the same. The interest rate swap discussed above is termed as a vanilla swap because it is the most popular swap among financial intermediaries.

Risk of interest rate swaps

The interest rate swap market has grown significantly over the years. The nominal amount outstanding is a staggering $400 trillion in 2016. It is no wonder that regulators are concerned about this market. Although interest rates swap allows financial intermediaries to hedge, they still face counterparty risk. However, the loss is limited to the counterparty having to pay a fixed interest rate instead of the desired floating rate, and vice versa. For example, in the above example, if Bank B fails, then the AAA rated bank

is forced to make floating rate payments and as opposed to fixed rate payments. If a bank is using the interest rate swap to hedge a position, it would be left unhedged. Thus, an interest rate swap's risk is primarily the replacement of the swap with another counterparty.

The depth of the market however has made it possible for a swap to be replaced immediately. Today there are swap dealers that will purchase or sell one side of the transaction in exchange for LIBOR. Thus, it is no longer necessary for an intermediary to step in the middle and arrange for the swaps. Bank A and Bank B can each independently arrange a swap transaction. We will use the previous example to demonstrate this transaction.

The benchmark used in the swap market is LIBOR. An alternative way of looking at the previous swap is as follows:

1. Bank A issues borrows at LIBOR + 0.50%. It swaps payments by purchasing LIBOR in exchange for 5.25%.
   When Bank A received LIBOR it will pay the LIBOR + 0.50%. In total, it will pay a fixed rate of 5.75 (5.25% + 0.50%) every year.

2. Bank B borrows at 8.00%. It swaps payments by selling LIBOR in exchange for 4.50%.
   When Bank B receives the 4.50%, it will add 3.50% to pay off the 8%. In total, it will pay LIBOR + 3.50%

3. Therefore, the dealer quote for this transaction will be 4.50-5.25/LIBOR. In other words, the dealer is willing to buy LIBOR at 4.50% and willing to sell LIBOR in exchange for 5.25%

Another Example

Assume a firm is planning to issue a floating rate bond with a face value of $100 million. The choices available are as follows:

1. Borrow floating at LIBOR + 2%
2. Borrow fixed at 11%
3. Borrow fixed and swap for floating. The dealer is quoting 8.50-8.75/LIBOR.

Question

Which option should it choose, with or without a swap?

Answer

1. If the borrower were to directly borrow floating, it will cost LIBOR +2%
2. If the borrower were to issue fixed at 11% and then swap LIBOR for 8.75, it will cost LIBOR the borrower LIBOR + 2.25%.
3. It should borrow directly from the market.

Question

What rate should it be indifferent between borrowing directly and borrowing with a swap?

Answer

1. If the swap ask rate is 9.00%, it would be indifferent between the two options.
2. It will pay LIBOR and receive 9%. It will add 2% and pay off the bond it issued at 11%.

Capital Levels for Off-Balance Derivatives

Basel 1 required banks to set aside capital for credit risk for off-balance sheet derivative contracts in addition to off-balance sheet guaranty contracts. The exceptions are for derivative contracts that are traded in organized exchanges.

As stated earlier, derivative contracts are off-balance sheet contracts whose values are tied to an underlying asset. They include contracts such as options, futures and swaps and the underlying assets could be foreign exchange, interest rates, commodities and indices. The basic methodology employed by Basel 1 to determine appropriate capital is similar to those for off-balance sheet guaranty contracts but with a few changes. We will only briefly discuss the methodology in this book. Detailed information on the methodology is available at www.bis.org.

1. Nominal amounts are first converted to on-balance sheet equivalents, according to conversion factors provided by Basel.
2. Unlike off-balance sheet guaranty contracts, conversion rates are provided for two kinds of exposures, potential exposure and current exposure. Potential exposure is based on past defaults while current exposure is based on the cost of replacing the instrument if the counterparty fails.
3. Risk weights are then to determine the risk-weighted equivalent. The same 4% of Tier 1 and 8% of Tier 1 and 2 are applied to the risk-weighted total on-balance sheet equivalents.

Summary of the Chapter

Financial institutions have always been adept at providing different forms of financing to their clients to manage risks or avoid regulations. Many of the instruments are off-balance sheet instruments and include commercial letters of credit, loan commitments, and financial derivatives such as options, futures and swaps. Regulators are concerned that the use of off-balances sheet instruments can increase the risks of banks significantly and increase the probability of defaults if sufficient capital is not set aside to compensate for the higher risk.

Off-balance sheet instruments can be classified into two: guarantee contracts and financial derivatives. Common form of guarantee contracts and include letters of commitment and loan commitments. Commercial letters of credit protect exporters of goods to other countries by receiving guarantees from banks of importing countries. Basel has required banks to set aside capital for off-balances sheet instruments by converting off-balance sheet items into on-balance sheet equivalents.

The swap market has been one of the bigger success stories in financial innovation of the 1980s. There are many different kinds of swaps contracts but the most successful has been the interest rate swaps, allowing counterparties to swap between fixed and floating rate payments. The market that was negligible at the beginning of the 1980s is now estimated at over $450 trillion dollars in notional value. Since swaps are off-balance sheet contracts, banks required to set aside capital to protect the institution from both credit risk and market risk.

Large institutions such as Fannie Mae, Freddie Mae, AAA-rated companies have benefitted from the use of swaps in their borrowing needs. The swap market is a success because it makes an ideal instrument for hedging interest rate risk. Banks and corporations have expanded their use significantly over the years.

End of Chapter Questions

1. Explain the difference between ijara and murabahah in Islamic finance using mortgages as an example.

2. Explain commercial letters of credit? Why should a bank set aside capital if they issue letters of credit?

3. How does a financial instrument use interest rate swaps to hedge their portfolios?

4. Assume the following borrowing options for Bank A and Bank B.

	Bank A	Bank B
Fixed Rate	12%	18%
Floating	LIBOR + 4%	LIBOR +7%

   1. What is the quality spread differential?
   2. Arrange a swap where the intermediary keeps 50 bps and the rest is shared equally between both banks.

5. Assume the following borrowing options for Bank C and Bank D.

	Bank C	Bank D
Fixed Rate	11%	14.50%
Floating	LIBOR + 1.5%	LIBOR +2%

   a. What is the quality spread differential?
   b. Arrange a swap where the intermediary keeps 1% and the rest is shared equally between both.

9

Chapter 9 - MARKET RISK

Market risk refers to the potential losses in the trading book of a bank because of changes in equity prices, interest rates, credit spreads, foreign-exchange rates, commodity prices, and other market-based prices. The trading books differs from the banking book in that assets are expected to be held for short-term only.

Banking versus Trading Book

Trading Book: When a bank holds securities with the intent to sell, it is referred as a trading activity. They include the purchase and sale of foreign exchange, bonds, commodities, options, futures and swaps. Most large banks have trading desks that make a market on these instruments. Market making activity refers to active engagement in the purchase and sale of the instrument. A market maker stands ready to always offer a bid and an ask price.

Banking Book: When a bank holds a security till maturity, such as a loan, it is referred to as a traditional banking activity. Banking book activities include accepting deposits, making loans and investing in bonds.

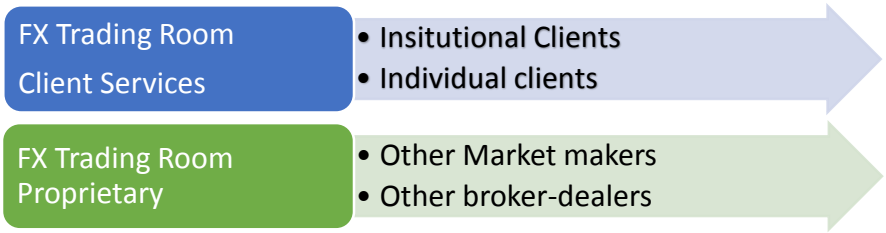
There are several difference between banking and trading book activities.

a. Banking book assets and liabilities are expected to be held till maturity while those of trading book are held for a short-term, usually less than a year.
b. Banking book assets and liabilities are reported in book values while those of trading book are reported in market values.
c. Trading book assets and liabilities are usually marked-to-market daily while those of the banking book are reported quarterly and yearly.
d. New regulations have made it very difficult to move assets between trading and banking books.

Proprietary Trading: Within the trading book, there is a distinction between proprietary trading and trading for clients. In the 1980s, banks began to recognize that their market-making activities generated significant fee income. Trading activities initially began as a service to clients but as their expertise increased, banks began to commit capital to engage in the same business separately for themselves.

Engaging in proprietary trading while providing the same services to their clients poses the risk of a conflict of interest. Banks are expected to maintain a Chinese firewall between these two separate services. An example for a bank engaged in foreign exchange (FX) trading is shown blow.[45]

[45] The term Chinese firewall is meant to denote a strict separation between activities conducted under one room to prevent conflicts of interest or to maintain confidentiality. For example, if a law firm is representing a client in one case but representing against the same client in another case requires a strict artificial barrier be maintained



In the above figure, the FX trading room for client services provides foreign exchange to their clients, institutional and individuals. If a client calls for a quote, the bank is responsible for providing the best available quote from other dealers and brokers. The fee earned is usually a commission for providing the brokerage services. In the FX trading room for proprietary trading, market-makers buy and sell in large quantities from other market-makers ad broker-dealers. The spread between the bid and ask returns accounts for most of their earnings. They take speculative positions by attempting to beat the market and constantly tracking demand and supply in the market. Assume a proprietary trader forecasts that the dollar against the Euro will strengthen, i.e. it will go from $1.50/€ to 1.40/€ to 1.30/€ because he or she observes that the sell order for Euros has increased. If this information is passed on to the Client Services trading room, the sales team could motivate or persuade their clients from delaying the purchase of euros. This will enable the sales team to generate larger profits based on information from traders who make the market.

The financial crisis of 2007-09 revealed a number of organizations that had breached the firewalls to generate enormous profits for trading divisions. Even without any collusion, the volume of proprietary trading had increased steadily over the years leading up to the financial crisis. For example, Lehman brothers that collapsed in September 2008 had increased its proprietary trading revenues to 58% of total revenues. Although collusion is rare, the possibility that it can take place is a concern for regulators.

Market Risk

Proprietary trading and other activities fall in the category of the trading book because the investment horizon is usually less than a year. In foreign exchange division, traders are constantly buying and selling foreign exchange. In the commodities trading division, banks are making markets in a number of energy and mineral-related products. In the derivatives division, assets or derivative products are bought and sold continuously during the day. The risk is that the market prices may change dramatically and bring the whole institution down. There are numerous cases of such events where the loss in one division has led to the closure of the institution.

One such example is that of Barings Bank in 1995 where one single trader, Nick Leeson, brought down one of the oldest and venerable merchant banks in England. Its history dated back several hundred years, funding the Napoleonic wars and held the accounts of the royal monarchy. In 1992, Nick Leeson moved to their Singapore office and began trading Nikkei futures and options. He was also in in charge of back office that processes the transactions. His unique position of both as a trader and a recorder of the translations allowed him to hide the losses he incurred that year. The triggering event was the Kobe earthquake on January 17, 1995 that sent the price of Nikkei futures downward, leading to large losses of Nick Leeson's large holdings of long positions. It led to a massive margin call from the Singapore exchange which the London office was not able to fund, forcing Nick Leeson to flee the country. The total loss

to ensure confidentiality. The term originated in the early 1920s presumably based on the Great Wall of China to separate the north and the south.

exceeded £800 million and wiped out the equity of Barings Bank. It was taken over by ING Bank of the Netherlands.

Since Nick Leeson controlled the back office, he managed to hide the losses by reporting false numbers. The lack of separation between the trading and back office functions was a major management lapse. It should be noted that market risk was a new phenomenon for banks during that period and senior management and the staff back in London had no idea of the nature of transactions undertaken by Nick Leeson.

There have been other similar scandals in the years following the Barings Bank scandal. A few years later, a trader in the New York branch office of the Japanese bank, Daiwa Securities, was found to have hidden over $1 billion in losses related to trading government bonds. The losses went undetected for over a 12-year period. A more recent scandal involved Jerome Kerviel of Societe Generale Bank in Paris. His unauthorized trades resulted in a $4.9 billion loss in January 2008. He too managed to hide the losses by falsifying records. It should be mentioned that a year earlier, he made profits of $1.5 billion for the bank.

The likelihood of market risk losses was recognized by Basel even as they were drafting Basel I in 1998. When Basel 1 was launched and deemed a success, they began working on market risk and issued the first consultative document in 1996. Among the first tasks to identify were the sources of market risk.

Sources of market risk

The main sources of market risk are changes in interest rates, exchange rates, equity, commodity, and option prices.

Interest rate risk: Changes to Interest rate risk impact nearly all financial assets but they impact the following assets directly:

a. fixed-interest rate debt instruments
b. derivatives whose underlying is based on debt instruments
c. derivatives whose value is impacted by market interest rates

The risk inherent in the trading of the above instruments is the greatest for open short and long positions. However, hedged positions are also susceptible to interest rate changes if they are not offset perfectly and can incur “basis risks’ and “yield curve risks.”

Exchange rate risk: Changes to exchange rate risks impact all assets denominated in other currencies. Interest rate and exchange rate changes tend to be correlated, hence any analysis of exchange rates requires an understanding of the interrelationship between the two rates. Instruments subject to market risk in the trading book include:

a. spot and forward foreign exchange contracts
b. options, futures, and derivatives of assets denominated in foreign currencies
c. cross-currency interest rate swaps

Equity price risk: Changes to prices of equity products such as stocks and derivatives related to stocks. The price risk changes can be broken down into two components:

a. market risk or non-diversifiable risk
b. idiosyncratic risk or diversifiable risk

Most banks hold well-diversified portfolios including index funds and derivatives on broad indices. The portfolios are sensitive to changes price movements of market indices such as the Dow or S&P 500 and not to changes in individual stocks prices.

Commodity price risk: Commodity prices are more volatile than other markets and can impact both trading on the commodity itself or its derivatives. Commodities include the following categories.

- Metals such as silver, copper, platinum, palladium and gold
- Energy such as crude oil, natural gas, propane and electricity
- Grains such as corn, wheat, soybean, rice and oats
- Food and fiber such as sugar, orange juice, coffee, lumber and cotton
- Meats such as livestock, pork bellies and hogs

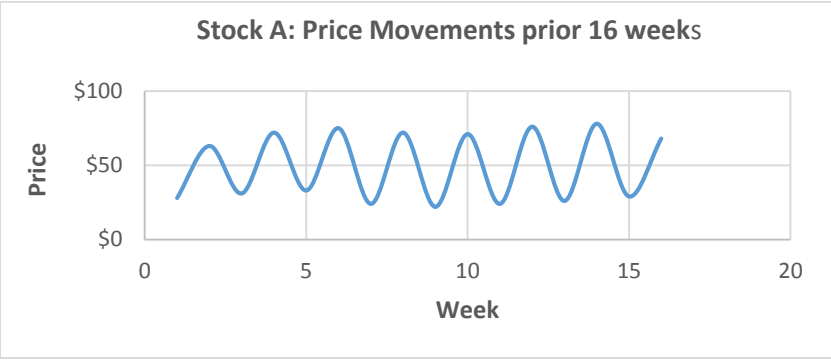
Measurement of market risk

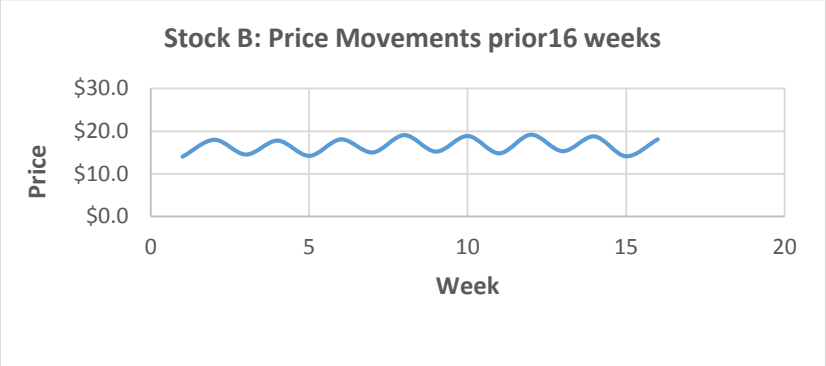
Banks trading short-term instruments face the likelihood of an unexpected and large change in the price of the product that can result in significant losses. Although, these occurrences are rare, it is necessary to prepare for the likelihood and take adequate measures to ensure the bank is able to withstand the event.

Value at Risk

The methodology to determine the market risk for trading instruments is called value at risk. VAR can be defined as an estimate of a likely loss in the trading book of a bank during a specific period of stress conditions. The normal period used is two weeks (or ten working days). A level of confidence is usually specified in determining the probability of the adverse outcome. The level of confidence used by most banks is either 95% or 99%. VAR continues to be a popular measure for determining likely losses in the banking industry in spite of the underestimation of trading risk during the financial crisis of 2008.

One of the important and sensitive ingredient in the measurement of VAR is volatility, usually measured by the standard deviation of past prices. Prior volatility has always been an indicator of future expected volatility or risk of the assets. As early as 1975, the Securities and Exchange Commission (SEC) introduced haircuts on different assets classes to determine the net worth to be maintained by broker-dealers. The higher the volatility, the higher the capital (net worth) to be maintained by broker-dealers. For example, take the following two stocks:





It is obvious that stock A is more volatile than stock B and the broker dealer is better off holding extra capital if he or she is trading stock A. Historically, the same principle has been applied in the futures market to determine the initial margin to open an account. The more volatile the security, the higher the initial margin. As a result, standard deviations of past prices as a proxy for volatility features prominently in the estimation of future losses in most risk models. Although it does not guarantee future volatility, it provides a benchmark that can be compared across securities.

The pioneer in deriving explicit measures of potential losses began with Banker's Trust development of the risk-adjusted return on capital or RAROC measure in 1986 to determine the likelihood of losses on a loan portfolio. They introduced the term *economic* capital in contrast to *required* capital. Economic capital was estimated to protect the bank against large unexpected losses. Unexpected losses occur rarely and its likelihood was measured in terms of probability.

Three popular methods are used in the industry to measure market will be discussed next, delta-normal, historical simulation and Monte Carlo.

Delta-normal method

This method requires an assumption of normality in the returns of the security being measured for VAR. We know that if a series follows a normal distribution and the mean and standard deviation is known, the probability of an outcome can be estimated by transforming the series to a standard normal distribution.

Standard deviation and probability

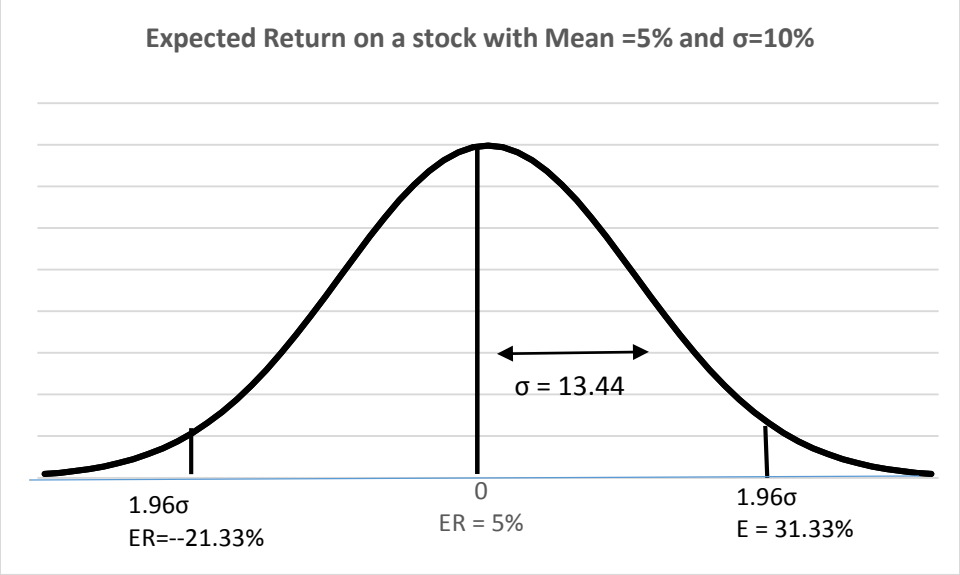
Assume an investor owns a stock and is able to forecast the expected returns for the year using the following probability estimates.

Economic Conditions	Probability (P)	Return (R)
Boom	0.2	24.0%
Above Average	0.2	14.5%
Normal	0.2	5.0%
Below Average	0.2	-4.5%
Recession	0.2	-14.0%

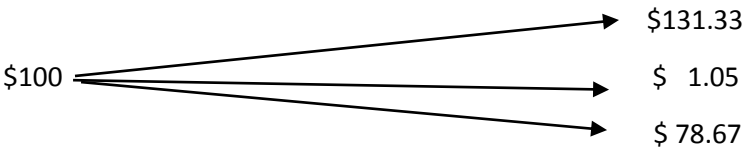
The standard deviation or volatility of the returns is derived as follows.

Economic Conditions	Probability (P)	Return (R)	P_i*R_i	$[R_i - (ER)]$	$[R_i - (ER)]^2$	$p_i[R_i - (ER)]^2$
Boom	0.2	24	4.8	19	361	72.2
Above Average	0.2	14.5	2.9	9.5	90.25	18.05
Normal	0.2	5	1	0	0	0
Below Average	0.2	-4.5	-0.9	-9.5	90.25	18.05
Recession	0.2	-14	-2.8	-19	361	72.2
		E(R)=	5		σ^2=	180.5
					σ =	13.44

The expected return is 5% and the standard deviation is 13.44%. If the returns are normally distributed, we can make the following projections; the returns can range +/- 1.96 standard deviations from the mean. In this example, we can forecast the stock to pay a return as high as 31.33% (+1.96σ) or a negative return of 21.33% (-1.96σ), as shown in the diagram below.

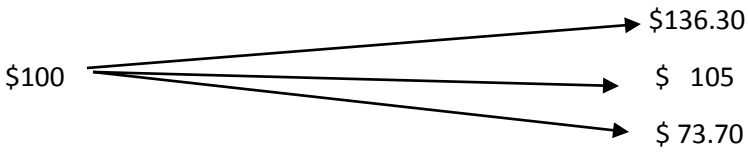


If the stock price is currently trading at $100, we can expect the prices at the end of the year to fluctuate within this range.



If an investor is risk averse and requires a much higher level of confidence, say 99%, then the two-tailed z-score for 99% is 2.33 standard deviations from the mean, assuming normal distribution. For our example, the range for the returns will be +/- (2.33)*13.435029 = 31.30

5% + 2.33*(13.435029) = 5% + 31.30% = 36.30%
5% - 2.33*(13.435029) = 5% - 31.30% = -26.30%



The prices can range between $73.70 and $136.30 for a 99% level of confidence.

The delta-normal model, also called the variance-covariance model, is the simplest of the three models. It assumes the returns are normally distributed and the portfolio exposures are linear. A portfolio composed of stocks with normal distributions will also be normally distributed.

To determine VAR using delta-normal method, requires the following three specifications.

1. The level of confidence on the probability of an adverse event
    a. The industry has generally used 95 or 99% level of confidence. Most regulators require banks to estimate capital levels using the 99% level of confidence.

2. The standard deviation as a measure of volatility
    a. The time period to determine the standard deviation can vary based on the instrument. If the time frame is short It may ignore changes in volatility during business cycles while too long a period may give less weight to recent volatility.

3. The time horizon for estimating the VAR.
    a. The relevant horizon should be for unwinding the portfolio in an orderly manner without incurring panic sales prices.

The following examples will determine the VAR for three different instruments found commonly in the trading book of a bank.

Stocks

Assume a bank holds a portfolio of stocks that is worth $1 million (MV=market value). Assume the standard deviation of the market portfolio (σ) is 3%. Recall that the relevant volatility of a portfolio is only the market volatility because the individual idiosyncrasies will have been diversified away. The returns are assumed to be normally distributed.

Confidence level.
As discussed earlier, the level of confidence for determining the potential loss is based on the risk-averseness of the bank. We will assume the bank uses 95% confidence levels in estimating its capital requirements. The one-tailed 95% confidence level will indicate that the parameter value will be 1.645 standard deviations from the mean.

Does the level of confidence matter whether the bank is long or short the position? It will not make a difference because we are only looking at adverse events. If the bank is long on the stock, then the adverse event is defined as the likelihood of prices falling in the near future. If the bank is short on the stock, the adverse event is the likelihood of prices increasing in the near future.

Holding period.
Assume the bank uses a ten-day holding period as required by regulators. This will require multiplying the daily loss by √10. Why 10 days? We assume that during a crisis it will take at least two weeks to unwind your position in an orderly manner. That would mean 10 business days. We take the square root of N because we assume that the prices changes are independent of the previous day's change. This assumption can be modified if during a crisis, the rate of price decline depends on the previous day's rate.

Market value
All assets will be priced at market value. Since these assets are traded, the only relevant value is the mark-to-market value. If prices are unavailable, then they will have to be imputed using comparable instruments.

VAR = expected volatility * current market value * holding period
where expected volatility is given by (z)*(σ)

In the above example;
VAR = 1.645*(σ)*MV*√10
VAR = 1.645 * .03 * 1,000,000 *8√10 = $49,350 *3.1623 = $156,532.74

In other words, the bank stands to lose $156,532.74 on its $1 million of stocks if there is an adverse event occurs and the prices of its portfolio change dramatically.

Foreign Exchange

Assume a bank has purchased €1,000,000 at $1.30/€. The cost to the bank of this purchase is $1,300,000. It faces the risk of a dollar appreciation, i.e. $1.25/€ -> $1.20/€. What is the ten-day VAR using a 95% confidence level?

The loss estimate will depend on the volatility of the price changes in the recent past. Assume that the standard deviation of price movements over the last year has been estimated at 0.45% or 45 basis points (bps).

VAR = expected volatility * current market value * holding period
VAR = 1.645 *(.0045) * $1,300,000 * √10
VAR = $30,431.39

In other words, the bank stands to lose $30,431.29 on its $1.3 million holdings of Euro if there is an adverse event that impacts the price of the Euro.

Bonds

In the case of bonds, the analysis is a little more complicated because of the impact of duration. Assume a five-year Treasury bond with coupon payments of 8% and a face value of $1,000,000. Assume the yield on the bond is 9%. The current price of the bond using the standard methodology is:

Time: 0	1	2	3	4	5	
	$80,000	$80,000	$80,000	$80,000	$80,000	Interest payments
					$1,000,000	Principal
Cash Flows	$80,000	$80,000	$80,000	$80,000	$1,080,000	

$PV_{n=5,r=9}$ = $961,103.49

Assume that the standard deviation of changes to interest rates for government bonds is estimated at 25 basis points. Thus if we use 95% level of confidence, the expected change in the interest that is likely to occur in one of 20 occurrences.

= 1,645*.0025 = .0041 or 41 bps.

What will be the expected loss if the interest rates increase by 41 bps for those banks holding these bonds? We will estimate the fall in prices using three methods, duration pricing, traditional pricing and forward rate pricing. The first method was popular until the advent of cheap computing power made traditional pricing easy to compute and avoid the duration and convexity bias. However, the use of one interest for all years in traditional pricing is problematic if the term structure of interest is sloped steeply. As a result, the appropriate methodology is to use zero-coupon rates to determine the price of a bond.

Duration Pricing

The duration of the above bond is 3.942

Δ in price = (-MD*Δr *Loan Amount)
= (-3.942 * .0041 * 961,103.49) = -$14,250.96

10-day VAR = $14,250.96 * √10 = $45,065.49

Traditional Pricing

$PV_{n=5,\ r=9.41}$ = $945,734.43

Δ in price = $945,734.43 - $961,103.49 = $15,369.06

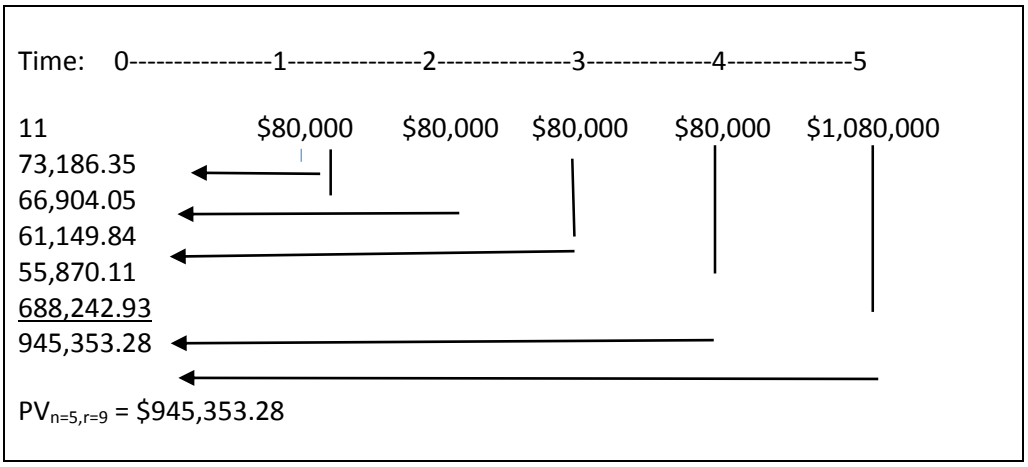
10-day VAR = $15,369.06 * √10 = $48,601.12

Zero-coupon pricing

One of the weaknesses of the traditional pricing is that a single interest rate is used to discount the future cash flows (interest payments). However, if the term structure of interest rates is positively sloped, the five-year rate represents an average of the one-year rates over the five years. This can potentially bias the results by over or under discounting the rates based on the steepness of the slope of the curve. An appropriate method to rectify this bias is to use zero-coupon rates for individual years.

Assume the following zero-coupon rates are available for Treasury bonds.
z_1 = 8.90%
z_2 = 8.94%
z_3 = 8.96%
z_4 = 8.98%
z_5 = 9.01%

z_3 for example is the three year zero-coupon rate for Treasury bonds.[46] If we use zero coupon rates to discount the rates, we will have to predict the increase in the term structure of interest rates. Let us assume that the terms structure shifts in a parallel manner by 41 basis points, i.e. z1 = 9.31%, z2 = 9.35%, z3 = 9.37%, z4 = 9.39% and z5 = 9.43%. We obtain the following price for a 41 basis points increase in rates.



Δ in price = $945,353.28 - $961,103.49 = -$15,750.21

10-day VAR = -$15,750.21 * √10 = -$49,806.54

The difference is not minor when you consider than banks holds hundreds of millions in bods. Note for banks with short positions on the bonds, the expected loss will occur when interest rates fall by 41 bps.

Aggregating and netting portfolios

An important consideration in the measurement of VAR is whether assets should be aggregated and netted in the estimation of the optimal capital. Both has the potential to reduce the amount of capital required as a cushion against a potential adverse event. We will address both issues separately.

Netting

Netting refers to the cancelling of contracts if a bank has positions that are opposite to each other. For example, assume a bank with the following positions on the British pound:

1. Long on £1,000,000 at $1.40. (That is, it bought £1 million at $1.40 per £)
2. Short on £1,000,000 at $1.40 (That is, it sold £1 million at $1.40 per £)

Assume the standard deviation has been estimated at 30 bps. Using 95% level of confidence, the 1-day VAR for the long position is:

VAR = 1.645*(.0030)*$1,400,000 = .004935 * $1,400,000 = $6,909

[46] Zero coupon bonds can be obtained from treasury strips whereby investment bankers strip Treasury bonds into two classes, interest only and principal only.

Assume the unlikely event takes place and the dollar appreciates by 49 basis points, i.e.
1.40 x (1 - 0.004935) = $1.3931/£.
The long contract will be worth 1.3931 x 1,000,000 = $1,393,091.
The contract has decreased in value by $6,909 ($1,393,091 – $1,400,000).

However, the bank has also a short position of £1,000,000 which would have increased in value. The appreciation of the dollar results in a similar profit of $6,909. The net loss or gain is zero.

Hence for banks holding offsetting positions, there should be no need to hold additional capital as the net loss is zero.

By and large, regulators have been sympathetic to the idea of netting within a class of securities. That is, they will allow netting if the short and long positions of the same currency with similar features.

Aggregation

Another issue similar to netting is the aggregation of assets to determine an overall VAR. For example, assume the bank only has two contracts:

1. Long positon on the pound, currently priced at $1.40/£
2. Long positions on the 5-year bonds with current yield-to-maturity of 9%

Assume the bank has only the above two assets in its trading book portfolio. When estimating the VAR of all the assets in a portfolio, should a bank take into account the correlation between the assets? If the assets are negatively correlated, a loss incurred in one asset may be offset by a gain in the other assets. This may result in a lower VAR requiring banks to hold less capital to cushion the losses. The banking lobby in the U.S. has strongly recommended to the Fed that banks be allowed to aggregate different assets

For the above example, assume that the correlation ($\rho_{£,Bond}$) between the two assets is -0.4. What will be the combined VAR of both assets?

$VAR_{£}$ = $30,431.39
VAR_{Bond} = $49,806.54

If we are to aggregate the VAR, we will use the standard method to derive the portfolio VAR_p.

$$VAR = ([VAR_{£})^2 + (VAR_{Bond})^2 + 2*(VAR_{£})* (VAR_{Bond})* (\rho_{£,Bond})]^{1/2}$$

$$VAR_p = [(30,431.39)^2 + (49,806.54)^2 + 2*(30,431.39)*(49,806.54)*(-0.4)]^{1/2}$$
$$VAR_p = [926,069,497.3 + 2,480,691,427 -1,212,545,795]^{1/2}$$
$$VAR_p = [2,194,215,129)^{1/2}$$
VAR_p = $46,842.45

This is lower than the combined VAR estimated separately, $80,237.93

Regulators however have been reluctant to allow banks to aggregate their assets to lower VAR estimates. Their reasons is that during a crisis, the correlations converge as prices all head into one direction – downwards. This assumption was proven true during the recent financial crisis of 2007-09. Markets for nearly all financial assets froze and it was impossible to unwind during the crisis. In other words, all assets exhibited a correlation of 1 against each other.

Historical Simulation Method

The historical simulation method is a non-parametric method, i.e. it does not require the assumption of normality or any other distribution. The method was described in the previous chapter in the estimation of RAROC. We will discuss the benefits and weaknesses of the historical simulation method.

Benefits

The benefits of the historical simulation method is

a. it is easy to compute if you have sufficient trading data
b. It does not require any assumption on the distributions of the returns
c. It can be targeted to very precise assets, whether it be 42-day forward contract or a 193-day bond.

Weaknesses

There are however many weaknesses.

a. It gives equal weights to all observations. In some cases, it may be appropriate to give more weight to the recent observations. If volatility has increased in the recent past, it will underestimate VAR.
b. It assumes the past will be repeated in the future.
c. It applies to instruments where there is active trading. This rules out applying the method for new instruments.

Monte Carlo Method

The Monte Carlo method provides an alternative to the normal-delta method in that repeated random sampling with a given set of initial data results in a distribution that can be used to generate VARs. An economic relationship will have to be specified for the asset and then random variables are drawn till the relationship value is determined over repeated sampling. Then we can select the VAR using a given level of confidence. For example, if we require 95% level of confidence, and have values generated from 500 random samples, the 475th lowest observation will be the VAR estimate.

Benefits

a. Any kind of distribution can be specified to model the economic value; normality is not required
b. If the model is well specified, one can be confident about the generated distribution since it is drawn from repeated random sampling

Weaknesses

a. It requires large amount of computing power
b. The results are still contingent on historical data due to the initial specification

Summary of the Chapter

Market risk is defined as the potential loss in the short-term trading activities of banks in a variety of instruments. The bulk of the activity falls under proprietary trading where banks allocate their own capital to make a profit from trading. However, proprietary trading can pose a risk to banks because it may conflict with the same services are also provided to their clients. If the Chinese firewall between these two trading rooms are breached, opportunities can arise for the proprietary trading division to profit at the expense of clients.

There are four major sources of market risk, changes to exchange rates, interest rates, commodity, and equity prices. The popular measure to determine market risk is the value at risk or VAR. VAR requires the prior or forward-looking volatility in order to predict the future loss for an unforeseen change in price.

There are three popular methods to determine the value at risk (VAR) of assets in a trading book.

1. Delta-normal method
2. Historical simulation method
3. Monte Carlo method

The delta-normal method is the simplest to compute but is requires an assumption of normality, which may not be the case for many traded assets.

Finally, in all VAR estimations, the bank has the option of netting and aggregating the assets. Regulators have generally netting of assets but have been less open to the idea of aggregating assets when estimating VAR.

End of Chapter Questions

1. Distinguish between a trading book and banking book.

2. Explain proprietary trading and why it can pose a conflict of interest to banks.

3. Why is it important to maintain the separate the trading room operations from the back office functions in a bank?

4. What are the four sources of market? Explain.

5. Explain why it makes sense to demand a larger initial margin when trading securities that are more volatile.

6. Assume a bank has a portfolio of stocks with a current market value of $1,500,000 million. If the recent volatility of the portfolio, as measured by the standard deviation, is 2.6%, what is the estimated value at risk (VAR) using a 95% level of confidence. Assume the returns are normally distributed. Assume a 10-day time horizon.

7. A portfolio of stocks has $800,000 market value. If the recent volatility of the portfolio, as measured by the standard deviation, is 3.2%, what is the estimated 10-day value at risk (VAR) using a 99% level of confidence. Assume the returns are normally distributed.

8. A bank has a short position of ¥5 billion in Japanese yen. The current exchange rate is $0.0098/¥. What is the VAR using a 95% level of confidence if the standard deviation is 3.5%? Assume a 10-day time horizon.

9. A bank has a short position of £500,000 in British pounds. The current exchange rate is $1.45/£. What is the VAR using a 99% level of confidence if the standard deviation has been estimated at 50 basis points? Assume a 10-day time horizon.

10. Assume a bank holds 5-year $1,000,000 face value in corporate bonds paying 5% annual coupons. The yield is currently 6%. If the standard deviation of the returns is estimated at 35 basis points, what is the 10-day VAR if we use a 95% level of confidence? Use the duration pricing method.

11. Do the above using the zero-coupon method assuming the zero-coupon rates are the following: $z_1 = 5.90\%$, $z_2 = 5.94\%$, $z_3 = 5.96\%$, $z_4 = 5.98\%$, $z_5 = 6.01\%$.

12. Assume a bank holds 4-year $1,500,000 face value in corporate bonds paying 4% annual coupons. The yield is currently 8%. If the standard deviation of the returns is estimated at 50 basis points, what is the 10-day VAR if we use a 99% level of confidence? Use the duration pricing method.

13. Do the above using the zero-coupon method assuming the zero-coupon rates are the following: $z_1 = 6.20\%$, $z_2 = 6.40\%$, $z_3 = 6.60\%$, $z_4 = 6.80\%$.

14. Distinguish between aggregation and netting in the estimation of VAR.