PART I: MONEY AND THE FINANCIAL SYSTEM

1 Chapter 1: An Introduction to Money and the Financial System

1.1 The Five Parts of the Financial System

1. Money: Good which is used as a means of payment for exchanging goods. The US uses paper money, known as fiat money, as a means of payment. This has not always been the case, we once used gold and silver coins as a means of paper. Further back people used things likes beads as a means of payment.

2. Financial Instruments: Written legal obligations of one party to transfer something of value to another party at some future date under certain conditions. These obligations usually transfer resources from savers to investors. Examples: Stocks, bonds, insurance policies.


4. Financial Institutions: These entities provide services and allow agents access to financial instruments and markets. Examples: Banks, securities firms, insurance companies.

5. Central Banks: Government entity which monitors the state of the economy and conducts monetary policy. Example: Federal Reserve System, European Central Bank

1.2 The Five Core Principals of Money and Banking

1. Time has Value: Everyone prefers to have something sooner rather than later. This basic idea makes time influence the value of financial transactions. Take an example of a buying a home. Every buyer has a choice either wait save and buy a home, or finance the home with a mortgage. Most everyone takes the second option. The buyers uses a mortgage to buy the home now, even though the total payments for the house will be higher with a mortgage than buying the house with savings. On the flip side, the lender had to give up the money to finance the house since that money can not be used to immediate consumption there is a cost passed
on to the lender. To make up for this cost the lender typical charges an interest rate on borrowed funds. This interest rate compensates the lender for delaying consumption.

2. Risk Requires Compensation: Time is not the only factor that generates interest rates. The risk associated with a financial transaction can also influence an interest rate. Simply, the riskier the transaction, the higher the interest rate. This explains why credit cards have high interest rates and student loans have low interest rates. In most any situation, risk must be compensated. If not, certain transactions would never occur. Examples: auto insurance in big cities, hurricane insurance in Florida, life insurance for the elderly, credit cards, small business loans.

3. Information is the Basis for Decisions: Information is gathered before a decision is made. The larger the decision the more information that is collected. Role of information, or even the lack of information is key in financial arrangements. Examples: stock vs bond trades, health insurance.

4. Market Set Prices and Allocate Resources: Just as other parts of the economy, markets are the key to the entire financial system. The laws of supply and demand will dictate the prices of financial instruments and who will get these goods. Examples: insurance markets, New York Stock Exchange.

5. Stability Improves Welfare: Stability is preferred throughout the financial system. Sometimes agents can do things which can help to maintain stability like investing in CDs or buying insurance. However, these tools only work on sources of volatility which we can control. Some shocks in the economy can not be insured (business cycles). The desire of stability is the key reason we have things like unemployment insurance and progress taxes. The goal of stability is also a goal of monetary policy. Many moves by the Federal Reserve are driven by stability. Example: Raising the Fed Funds rate to curb inflation (make prices more stable).

2 Chapter 2: Money and the Payments System

2.1 Money and How We Use It

Money takes on several meanings in everyday discussions. In this class, the word *money* takes on a specific definition which is that money is anything that can be readily used to make economic transactions. The following is the technical definition

**Definition 1** *Money:* An asset that is generally accepted as payment for goods and services or repayment of debt.

No matter what we use as money (paper, gold, beads), every type of money has the same three basic characteristics:
1. A Means of Payment
2. A Unit of Account
3. A Store of Value

We will now discuss these traits.

2.1.1 Means of Payment

The primary characteristic of money is that it is used as a means of payment. Most all transactions will take money as a form of payment. This is because other forms of payment typically will not work. Without money, transactions would rely on barter. Barter is a situation where two agents exchange goods directly in a transaction. Suppose I have a baker and a farmer who wish to make a transaction. The baker wants eggs from the farmer, and the farmer wants bread from the baker. Without money, the baker and farmer would simply exchange bread and eggs. In this situation barter works just fine. However, suppose the farmer does not want bread, he wants a tractor. Without money, the baker cannot offer anything to the farmer, he does not have a tractor to give to the farmer. So the baker will not be able to trade for the eggs which he wants. In a barter situation, both parties have to want what the other party has. Thus we have what is called the "double coincidence of wants" problem.

Money solves this problem. Take the same situation with money. The baker wants eggs and the farmer wants a tractor. In a world with money the baker would simply buy the eggs from the farmer in exchange for money. The farmer can then take this money to the tractor store and purchase a tractor. The baker need not have what the farmer wants. Thus, trading is now easier with money present.

2.1.2 Unit of Account

Money is also a unit of account. A unit of account is simply how we measure prices and debts. In the US, we measure prices in dollars and cents. This unit of measurement allows for a quick comparison of prices across goods. Remember, what is important is the relative prices of goods. So, the unit of account allows use to measure the price of each good relative to a dollar bill. Without this, we would have to construct relative prices for each good against each other good. For a world with two goods we would only need one price. In a world with three goods we would need 3 prices, which is exactly how many we have in a world with money. However, with four goods we need 6 prices. The following table shows the pattern
<table>
<thead>
<tr>
<th>Number of Goods</th>
<th># of Money Prices with a unit of account</th>
<th># of Goods Prices without a unit of account</th>
</tr>
</thead>
<tbody>
<tr>
<td>s</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>45</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>4950</td>
</tr>
</tbody>
</table>

For a world with $n$ goods you will need $n$ prices with a unit of account, and $\frac{n(n-1)}{2}$ prices without a unit of account.

### 2.1.3 Store of Value

Money is also an asset which can serve as a store of account. If money is to be valuable for transactions, it needs to be able to retain value over time. A dollar today needs to have the power to purchase goods in the future. Many other assets also serve as a store of value: stocks, bonds, and savings account. What makes money unique is it’s high liquidity. Liquidity is simply a measure of how easy it is to turn assets into consumption. Since, money serves as a means of payment it has a high liquidity. So, although money is not a perfect store of value, it loses buying power over time, the high liquidity can explain why everyone holds some of their assets as money.

### 2.2 The Payments System

The payments system is the organization of arrangements which allow for the exchange of goods and services. This system is how parties receive and pay funds in exchange for goods. Money is the core to this system, but as we will see, the economy no longer relies on passing along a few dollar bills. Technology has made many types of payments common throughout the economy.

#### 2.2.1 Commodity and Fiat Monies

The form of money has evolved over time. In the beginning, money took the form of commodity money. Commodity money is a means of payment that is in terms of an actual good. Different places have used different things as money: Silk in China, butter in Norway, furs by European Colonists, and most commonly precious metals like gold and silver. These monies a have one thing in common: intrinsic value. All of these goods have uses other than money. People could actually consume the money.

The easiest way to prevent people from consuming money was to make money worthless (as far as consuming). Thus, governments issued paper money, fiat money. A fiat money has little to no intrinsic value and the purchasing power of the money depends on the government backing the currency. In the US we
use dollar bills for a couple of reasons. First, everyone else accepts them, and we expect to be able to use our currency in the future. Second, the law states that these bills can be used to pay for all debts, public and private. Thus, by law everyone must accept the US dollar as a means of payment. That is why every bill has the phrase "THIS NOTE IS LEGAL TENDER FOR ALL DEBTS, PUBLIC AND PRIVATE".

2.2.2 Checks
Currency is not the only way we pay for things. Another common technique is to write a check. First, it should be noted that a check is not legal tender, this is why some places do not take checks. A check is nothing more than an instruction for a bank to transfer funds from one account to another. The actual transfer is the final payment for goods and services.

2.2.3 Electronic Payments
The third and fastest growing form of payments are electronic payments. The two most common electronic payment instruments are credit and debit cards. A debit card works the same way as a check. The card sends an instruction to a bank to transfer money from one account to another. A credit card is a promise by a bank to lend money to the cardholder to make purchases. In this case, money is transferred from the bank to another account. The cardholder is taking out a loan which must be paid back to the bank with interest. Thus, credit cards are NOT MONEY.

More and more transactions are becoming electronic. The simple fact is that using a paper trail is more costly than electronic payments. To this end more and more firms are using automated clearinghouse transactions. The money is automatically withdrawal from your account.

2.3 The Future Of Money
The future of money is hard to predict. We have only had paper currency for about 150 years and ATMs for only 35. Thus it is hard to forecast how money will evolve. Clearly there is a huge movement towards electronic payments. So, maybe in the future we will simply carry cards and no cash.

2.4 Measuring Money
As we will study later in the course, changes in the amount of money can be related to other changes in the economy: interest rates, economic growth, and inflation. Inflation is a sustained rise in the price level of the economy. Basically, the price of everything goes up more or less at the same time. The primary cause of inflation is too much money. To know if we have too much money, we must first measure how much money is in the economy. Unfortunately this is not as simple as counting dollar bills and coins. There are other things in
the economy which are money and not dollar bills (debit cards). So, how is money measured. The typical method is to use monetary aggregates. These aggregates measure the amount of money in the economy with each aggregate using a slightly different definition. The most common aggregates are: M1, M2, and M3. The following table (take from the textbook) shows how these three aggregates are measured in relation with each other.

<table>
<thead>
<tr>
<th>Money aggregate</th>
<th>Component</th>
<th>Value in August 2004 (billions $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1 =</td>
<td>Currency</td>
<td>686.2</td>
</tr>
<tr>
<td></td>
<td>Travelers’ Checks</td>
<td>7.6</td>
</tr>
<tr>
<td></td>
<td>Demand Deposits (Checking Accts No Interest)</td>
<td>315.3</td>
</tr>
<tr>
<td></td>
<td>Other Checkable Deposits (With Interest)</td>
<td>328.5</td>
</tr>
<tr>
<td>Total M1</td>
<td></td>
<td>1337.6</td>
</tr>
<tr>
<td>M2 =</td>
<td>M1</td>
<td>794.7</td>
</tr>
<tr>
<td></td>
<td>Small-Denomination Time Deposits</td>
<td>3415.3</td>
</tr>
<tr>
<td></td>
<td>Savings Deposits and money market</td>
<td>735.5</td>
</tr>
<tr>
<td>Total M2</td>
<td></td>
<td>6283.1</td>
</tr>
<tr>
<td>M3 =</td>
<td>M2</td>
<td>1036.3</td>
</tr>
<tr>
<td></td>
<td>Large-Denomination Time Deposits</td>
<td>1104.7</td>
</tr>
<tr>
<td></td>
<td>Institutional Money-Market Mutual Fund</td>
<td>516.6</td>
</tr>
<tr>
<td></td>
<td>Repurchase Aggrements</td>
<td>344.5</td>
</tr>
<tr>
<td>Total M3</td>
<td></td>
<td>9285.2</td>
</tr>
</tbody>
</table>

The main difference between these three aggregates is their degree of liquidity with M1 being the most liquid and M3 the least.

The following graph displays the growth of these aggregates over the last 20
plus years

As we can see from this figure, the growth rate of money is highly volatile. This is especially true if we look at the more liquid measure M1. Also notice that the aggregates need not all grow at the same time. The link between money growth in M1 vs M2 and M3 is weak. There is a much stronger tie between M2 and M3. The growth rates of M2 and M3 are also less volatile than M1. Later on in the course we are going to return to this picture and see if these patterns in money growth can be tied to any changes we can measure in the economy (growth, inflation, etc.).

3 Chapter 3: Financial Instruments, Financial Markets, and Financial Institutions

The financial system has come a long way from crop share arrangements where families in a community agree to support each other in times of poor harvests. We still use financial arrangements for the same basic reason that village used to use crop sharing. We seek protection from risk in order to insure consumption. We now use financial instruments, markets, and institutions to achieve this protection.
3.1 Financial Instruments

We start this section by defining what is meant by a financial instrument:

**Definition 2 Financial Instrument:** Written legal obligation of a transfer of something of value from one party to another party at some future time under certain conditions.

Let’s break this definition down into four parts:

1. Legal Obligation→ Financial Instruments are backed by government rules and regulations. If you violate the agreement set forth in an instrument, you are subject to legal penalties.

2. Transfer something of value from one party to another→ Typically a financial instrument will dictate the payments of money from one person/firm to the other.

3. At some future date→ So instruments will have a time dimension tied to them. My student loans require a monthly payment for the next years. The instrument will be specific on when money changes hands.

4. Under specific conditions→ Some instruments will have rules on when money is to be transferred. The simplest example is that of insurance. The insurance company will pay a claim only under certain conditions.

3.1.1 Uses of Financial Instruments

Financial Instruments are typically used for three uses:

1. Means of Payment → purchases of goods and services, Ex. stock options as part of employment.

2. Store of Value → Transfer of buying power into the future, Ex. Retirement Accounts, Stocks, Bonds etc.

3. Transfer of Risk → Typically transfers risk from a person to a company, Ex. Insurance, Options

Of these uses, the last two are the most common. Not too many financial instruments are used directly for purchasing goods and services. That’s what money is for. The typically behavior is to take a financial instrument, turn it into money, and then make a purchase.

3.1.2 Characteristics of Financial Instruments: Standardization and Information

Given the definition and multiple uses of financial instruments, it is not surprising that these instruments can have very complex contracts. These complications make financial agreements costly to maintain and monitor. Thus we find a
substantial amount of standardization of instruments. This is simply the practice having several instruments with the same basic rules and payouts. Even though hundreds of companies offer auto insurance. Each policy has several of the same features. Without standardization the buying and selling of financial instruments would become extremely costly.

A second feature of instruments is that they communicate information. Collecting and communicating information can be very costly. Thus, instruments are typically designed to gather information. On one side, the borrower will typically provide information to the financial firm. The firm typically has specialists which can use this information to design the appropriate financial instrument.

3.1.3 Underlying versus Derivative Instruments

There are two general classifications of instruments: underlying and derivative.

- Underlying Instruments: These instruments are used by savers or lenders to transfer resources directly to investors or borrowers. The standard example of these is stocks and bonds.

- Derivative Instruments: The value and payoff of the instruments are derived from behavior. Examples of derivatives include futures and options. The derivative specifies a payment between the buyer and seller. The payment is contingent on the price of the instrument.

3.1.4 A Primer for Valuing Financial Instruments

Here’s are first look as to why different instruments have different values. There are four basic properties which alter the value of a financial instrument:

1. Size: The larger the payment, the higher the value.

2. Timing: Economic Agents are impatient. So, the sooner the payments, the higher the value.

3. Likelihood: The more likely it is that payments will be made, the higher is the value of the associated instrument.

4. Circumstances: Payments that made when most needed are most valuable. Proof: We only buy insurance against bad events.

3.1.5 Examples of Financial Instruments

Let’s just take a look at some of the most common financial instruments:

Financial Instruments Used Primarily as Stores of Value

1. Bank Loans: The borrower obtains resources from the bank immediately in exchange for a set of future payments.
• Bonds: Similar to bank loans except that the borrower is typically and firm or government. The borrower issues a bond which is purchased by another party, the lender, for some price. The borrower used the cash to make purchases. The lender holds the bond which guarantees some future lump sum payment or a stream of future interest payments.

• Mortgages: Simply a loan to purchase real estate. In most mortgages the house serves as collateral. This means that if the borrower defaults, the lender gains ownership of the house. The use of collateral simply transfers risk from the lender to the borrower. Set up properly, the lender faces minimal risk.

• Stocks: The holder of a share owns a small piece of the firm and is entitled to a portion of the profits. Firms typically issue stock to raise funds.

Financial Instruments Used Primarily to Transfer Risk

• Insurance Contracts: The buyer of the contract makes premium payments to the other party under the condition that the other party must make payments under certain conditions.

• Futures Contracts: An agreement to trade an asset at some future date at some fixed price.

• Options: The holder receives the right to buy or sell a fixed amount of an asset at a predetermined price at specific date or during a specific period. It is important to realize that it is a choice to but or sell not a requirement.

3.2 Financial Markets

Financial markets are places where financial instruments are bought and sold. The markets relay information, shift risk, set prices, and help move resource to their most valued use. Smooth financial markets are key to an efficient economy. This section studies general aspects of financial markets.

3.2.1 The Role of Financial Markets

Even though there are hundreds of financial markets. The roles of each market will be at least one of three basic things with regards to the buying and/or selling of financial instruments:

1. Liquidity: Markets help to ensure that buyer and sellers have quick and cheap access to financial instruments. Agents will have the ability to quickly move in and out a financial instrument.

2. Information: Markets will pool and communicate information about the buyers and sellers of a financial instrument. This is one of the basics of supply and demand.
3. Risk Sharing: Markets allow individuals to share or pool risk across the entire market. Agents prefer stability and sharing risk is one way to help increase stability.

### 3.2.2 The Structure of Financial Markets

There are hundreds of financial markets that govern the supply and demand of financial instruments. Luckily there are some common ways to group markets according to certain properties: where instruments are traded, the way which instruments are traded, and the type of instrument.

#### Primary versus Secondary Markets

- **Primary Markets**: Financial markets where newly-issued assets are sold. IPOs and issuing of new debt.

- **Secondary Markets**: Financial markets where existing securities are traded. Most transactions on NYSE and other markets.

#### Centralized Exchanges versus Over-The-Counter Markets

- **Centralized Exchanges**: A secondary financial market where buyers and sellers of assets must meet in a central physical location to make trades. The NYSE and Chicago Board of Trade are examples of this.

- **Over-The-Counter (OTC) Markets**: A secondary financial market where buyers and sellers can meet electronically to make trades in several places. Examples of this include the NASDAQ and off track betting.

#### Debt and Equity versus Derivative Markets

- **Debt and Equity Markets**: Trades are made and result in immediate cash payments. Stocks and bonds of this type.

- **Derivative Markets**: Claims are made for transactions that will lead to future cash payments. Futures and options are examples of this.

### 3.2.3 Characteristics of a Well-Run Financial Market

Well-Run financial markets have three characteristics:

1. **Low Transactions Cost**: The trading of financial instruments is done quickly and cheaply. Today’s efficient markets perform millions if not billions of transactions in a single day.

2. **Full Information**: The markets must pool and provide correct information. Accurate information is key to an efficient market. If information is incorrect, agents may make incorrect decisions.
3. Protection: Any promises of payments or collection of debts must have legal backing. Without parties could simply walkout of arrangements. This is and information is why the stock market uses the SEC.

3.3 Financial Institutions

Financial Institutions are the firms which provide access to financial markets. These institutions serve as a middle man between savers and borrowers and are thus sometimes called financial intermediaries. This sections briefly discusses the role and structure of financial institutions.

3.3.1 The Role of Financial Institutions

The main purpose of a financial institution is to reduce transactions costs by specialization in some particular financial instrument. These firms also reduce information costs by having efficient methods of monitoring and screening potential borrowers. Financial institutions streamline many things which individual would find costly or impossible to do. Think about investing in the stock market without a brokerage firm...

3.3.2 The Structure of the Financial Industry

The structure of financial industry is summarized by breaking firms into two categories: depository and non-depository institutions. A depository institution takes in deposits and makes loans. These are more typically called banks. Non-depository institutions trade other financial instruments. These include insurance companies, securities firms, pension funds, and others. We can generally classify financial firms into six categories:

1. Depository Institutions: These firms take in deposits and make loans. These include commercial banks, credit unions, savings banks among others.

2. Insurance Companies: These firms accept premiums which are typically invested. In return, they promise to pay compensation to policyholders should a certain event occur. You name an event and you can probably buy insurance for it.

3. Pension Funds: These firms invest individual or group contributions into the financial market in order to provide retirement payments. These firms include companies like TIAA-CREF.

4. Securities Firms: These firms includes brokers, investment banks, and mutual fund companies. These firms act like middle men. They give individuals access to financial markets. The individual faced the risk of the investment.

5. Finance Companies: Use a pool of assets to make loans to customers. Unlike banks, these firms use financial debts to make loans not deposits.
6. Government-Sponsored Enterprises: Federal agencies which provide loans directly to farmers and home mortgagors. These firms include Freddie Mac and Fannie Mae. This segment of the market also covers Social Security and Medicare.

As we work our way through the course we will study each type of industry and how it relates to the financial market and how these firms may influence other aspects of the economy.

PART II: INTEREST RATES, FINANCIAL INSTRUMENTS, AND FINANCIAL MARKETS

4 Chapter 4: Future Value, Present Value, and Interest Rates

Why is it that nobody seems to like a banker or credit card company? Usually it is because they owe money to these people and have to pay interest payments on top of the principal they already owe. Most people fail to realize that there is a cost to loaning out money. Typically the person who loans out money is choosing to delay some form of consumption. Since people are impatient, delaying consumption is costly thus to get banks or firms to loan money they must be given interest. The goal of the interest is to help maintain the lender’s buying power over time. In order to for borrowers and lenders to make good financial decisions they must know how to calculate the value of things over time. The goal of this chapter is to learn some of these techniques. We will learn about the concepts of present and future value and how these concept tie in with interest rates and pricing assets.

4.1 Valuing Monetary Payments Now and in the Future

To compute values across time we need the tools of future value and present value. We will begin by learning future value.

4.1.1 Future Value and Compound Interest

Let’s start with the definition of future value:

**Definition 3 Future Value:** The value at some future date of an investment made today.

Suppose you invest $100 today and you know that the interest rate on this investment is 5% per year. What will be the value of this investment next year?
$105. Seems start forward enough, but how did we do this? Here is that formula for this example

\[ \text{Future Value} = \$100 + .05 \times \$100 = 1.05 \times \$100 = \$105 \]

You simply take the principal investment plus add on the interest payment for the year. Now let’s consider a little more complicated example. Now suppose you invest $100 at 5% per year and leave it in the bank for 2 years. What will be the future value of the investment in 2 years? This example is a little more complicated because of the second year. In the second year the investor earns interest not only on the $100 principal but also on the interest earned during the first year? So, during the first year you receive interest on $100 and at the end of the second year you earn interest on $105 which is made up of the $100 principal and the $5 earned during the first year. The interest on the interest is called compound interest. What is the future value of this investment after 2 years?

\[ \text{Future Value} = \$100 + (0.05 \times \$100) + (0.05 \times \$100) + (0.05 \times 5) = \$110.25 \]

Let’s do a little algebra to simplify this a little

\[
\begin{align*}
\text{FutureValue} & = \$100 + (0.05 \times \$100) + (0.05 \times \$100) + (0.05 \times 5) \\
& = \$100 + (0.05 \times \$100) + (0.05 \times \$100) + (0.05 \times 0.05 \times \$100) \\
& = \$100 \times (1 + 0.05 + 0.05 + 0.05 \times 0.05) \\
& = \$100 \times (1 + 2 \times 0.05 + 0.05^2) \\
& = \$100 \times (1.05)^2 \text{ (complete the square)} = \$110.25
\end{align*}
\]

Notice that a pattern is beginning to form. The future value of an investment is equal to the current value of the principal multiplied by one plus the interest rate raised to a power equal to the number of periods into the future we are measuring the value. More specifically

\[ \text{Future Value} = PV \times (1 + r)^n \]

where PV = principal, r = interest rate, n = number of periods into the future. So if I were to hold that $100 investment in the bank for 5 years the future value of the investment would be

\[ \text{Future Value} = \$100 \times (1 + .05)^5 = \$127.63 \]

Here are couple of important issues about using this formula. First the measurement of the interest rate and the time periods must be of the same scale. In this example the interest rate was in terms of years, and so was n.
4.1.2 Present Value

Another topic which is related to future value is the concept of present value. Present value basic does the reverse calculation of future value. This tool will help use value future payments in terms of today. Suppose you give some one a loan of $100 today. The borrower gives you two options of getting paid back $120 in 2 years or $150 in 4 years. Which one do you take? That’s what present value is used for.

The Definition Here is the definition of Present Value:

Definition 4 Present Value: The value today (in the present) of a payment that is promised in the future.

To understand this definition of present value let’s go bank to our original example of investing $100 now at 5% interest. We know that the future value of this investment is $105 next year. It make some sense to say that the value of $105 one year from now is $100. All we did was reverse that calculation. I this case

\[
\text{Present Value} = \frac{\text{Future Value}}{(1 + r)} = \frac{105}{1.05} = 100
\]

Present value tells use exact how much future payments are valued in today’s terms. Now suppose that we what to know that value of a payment of $110.25 in two years given the interest rate is 5%.

\[
\text{Present Value} = \frac{\text{Future Value}}{(1 + r)^2} = \frac{110.25}{1.05^2} = 100
\]

All we do is simply reverse the future value calculation. As far as what influences present value, the following three things increase the present value of a future payment:

1. A higher future value.
2. A shorter time until the payment
3. A lower interest rate, r.

I need to stress again, present value is a key concept in this course we will use this formula several times throughout the course, you must know how to do this!
How Present Value Changes  The following tables and graphs will show you how present value changes as we change certain characteristics of a future payment. The following graph shows how the present value of a $1000 investment changes over time where the interest rate is 5% per year.

Notice that present value decreases at a decreasing rate. At 15 years the present value of $1000 is less than $500 and by 50 years the present value is less than $100.

The next figure shows how the interest rate alters present value. The figure displays the same $1000 for three interest rates 2%, 5%, and 10%.
Notice how much the interest rate can change the present value of a payment. With 5% interest it took about 15 years for the present value of $1000 to fall to $500. At 10% interest, a $1000 investment falls to $500 in present value in a little over 7 years. On the flip side, with a 2% interest rate the present value takes 35 years to fall to $500. So small changes in interest rate can have a larger effect on present value.

The final figure in this sections shows how changes in the size of the initial investment influence present value. The figure displays the present value for a $1000 and a $2000 dollar investment at 5% interest.
There are two things to notice about the figure. First, a larger investment will always have a higher present value. Second, the two investment decrease at the same rate in percentage terms. To see this, notice when both investments drop to half of their initial value: at the same time.

### 4.1.3 Interest Rates and Discount Rates

It is important to make clear some terminology. The interest rate that is used in making present-value calculation is often called the discount rate. Taking present values is often called discounting or reducing future payments to their current value. Another term which also uses for the interest rate is yield. This term is generally used to describe the return on holding a bond. So, interest rate, discount rate, yield all essentially mean the same thing. They just differ in when they are generally used.

The concepts of an interest rate and a discount rate are important when thinking about decision making. Everyone makes the same basic decisions about their income: how much to consume and how much to save. One simple thing is true, people who are more patient tend to save more. These people tend to value the future more. This is the same as saying they discount the future less, or payments in the future have higher present values. Thus, these people will save in the presence of lower interest rates. All assets and financial markets offer interest rates for holding saving. If an interest rate exceeds a person’s discount rate, then it is likely that they will choose to participate in the market. Think about how you would react if the interest rate would increase from 1% to 5%. I bet you would put more money into saving. The opportunity costs of not saving have increased.
4.2 Applying Present Value

Since present value is such an important idea, it is important that we go through a few examples to show how to use this concept. Some these examples will also show us how easy it is to compute the present value of not only a single future payment, but also a stream of future payments by stringing together several present value computations.

4.2.1 Internal Rate of Return

One common use of present value is to help make investment decisions. Suppose we have the following example. You are a business owner deciding whether to buy a new machine. The seller of the machine says that it costs $100,000. We analyzing the usefulness of the machine you find that the machine will generate an extra $30,000 for the next 4 years. After 4 years the machine will be obsolete and can no longer be used. Should you buy the machine?

Answer: Maybe. If the business owner takes out a loan of $100,000 to cover the cost of the machine, will the $30,000 in extra revenues cover the loan payments? If the extra revenue does cover the loan payments with a little extra, then yes buying the machine is a good idea, otherwise he had better not buy it.

So, we need to figure out if the revenue stream from the machine is high enough to cover the expenses. To do this we need to calculate the internal rate of return on the machine.

Definition 5 Internal Rate of Return: The interest rate which equates the present value of an investment with its cost.

Let \( i \) be the internal rate of return on this machine. Given the definition of internal rate of return, how to calculate present value, and the 4 year life span of the machine we need to solve the following problem

\[
100,000 = \frac{30,000}{1+i} + \frac{30,000}{(1+i)^2} + \frac{30,000}{(1+i)^3} + \frac{30,000}{(1+i)^4}
\]

The easiest way to solve this problem is to have build a spreadsheet which simply calculates the right hand side of this for a spread of \( i \) and find the one closest. It turns out that if \( i = 0.07714 \). Both sides of the above equation equal $100,000. So the internal rate of return for this machine is 7.714%. This number is important because it tells the business owner about the costs he can afford to obtain the $100,000. If the owner can borrow the $100,000 for any interest rate under 7.7%, then the investment will pay for itself and should be made. This is always true, if the internal rate of return on an investment exceeds the cost of borrowing, then the investment should be made.

To show this suppose the business owner borrows the $100,000 and is charged a 7% on loan with constant yearly payments for 4 years. To find the owner’s yearly payments we simply apply the same present value formula only this time we know the interest rate is 7%, it is the payment we do not know. At since the bank was willing to offer the loan we know that the bank finds
the stream of loan payments equal to the present $100,000 (if they didn’t they wouldn’t have made the loan). So mathematically, to find the yearly payment we solve

\[
$100,000 = \frac{X}{(1 + .07)} + \frac{X}{(1 + .07)^2} + \frac{X}{(1 + .07)^3} + \frac{X}{(1 + .07)^4}
\]

where \(X\) represents the yearly payment.

Solving this is easier than you think, simply pull \(X\) out of all the numerators to get

\[
\begin{align*}
$100,000 &= \frac{X}{(1 + .07)} + \frac{X}{(1 + .07)^2} + \frac{X}{(1 + .07)^3} + \frac{X}{(1 + .07)^4} \\
&= X \left[ \frac{1}{1.07} + \frac{1}{1.07^2} + \frac{1}{1.07^3} + \frac{1}{1.07^4} \right] \\
&= X \times 3.387
\end{align*}
\]

So \(X = 29,524.65\).

Thus, every period this owner spends $29,524.65 on the machine which generates $30,000 each period. So his business receives a positive difference of $75.35 each period. YEAH for him!!

### 4.2.2 Bonds: The Basics

One of the basics of finance is to use present value calculation to compute the value of bonds. Let’s first define what we mean by a bond.

**Definition 6 Bond:** A promise to make a series of payments on specific future dates

Depending on the type of bond, the number of timing of the payments will change. We are going to begin by looking at some of the most common types of bonds. The first is called a coupon bond. Say a borrower wishes to borrow $100 by issuing a coupon bond. This is done by selling the bond to a lender who gives the borrower $100 in return for the bond. The borrower is required to make annual payments called coupon payments. These payments depend on the interest rate tied to these bonds called the coupon rate. Thus if this is 5% coupon bond, the borrower would be required to pay 5% of the total amount borrowed to the lender every period. Thus the lender would receive a yearly payment of $5 in this example. A bond will also specify when the initial principal is to be repaid. This is the maturity date of the bond.

So, how much should someone be will to pay for this kind of contract. The answer is the present value of the bond which is a sum of two values: the present value of the future principal payment and the present value of a stream of coupon payments.

For this example let’s suppose we have the opportunity to buy a $1000 coupon bond with a maturity of 30 years and an interest rate of 6%. 

20
Valuing the Principal Payment  Valuing the future principal payment is a straightforward application of our first calculations of present value where

\[ PV_F = \frac{\text{Face Value}}{(1 + i)^n} = \frac{\$1000}{(1 + .06)^{30}} = \$174.11 \]

So, the present value of this future principal payment is a small compared to the face value of the bond.

Valuing the Coupon Payments  The bulk of the value of holding a bond comes from the stream of interest payments over the life of the bond. Calculating the present value of this stream simply involves stringing together thirty payments which are proceeding further and further into the future. In this example we know that each period the borrower is responsible for paying 6% of the face value of the bond every period or $60 for 30 years. The formula for computing the present value of this stream of payments is

\[ PV_{CP} = \frac{\$60}{1.06^1} + \frac{\$60}{1.06^2} + \cdots + \frac{\$60}{1.06^{29}} + \frac{\$60}{1.06^{30}} = \]
\[ = \$56.60 + \$53.40 + \cdots + \$11.07 + \$10.45 = \$845.89 \]

Valuing the Coupon Payments plus Principal  To compute the total value of the bond we simply add together the value of the principal payment and the value of the coupon payments which in this case is $174.11+$845.89=$1000. The present value of the bond is equal to the face value of the bond, this will occur if the coupon rate equals the interest rate. This doesn’t have to be the case. The coupon rate (which is specified in the bond) can differ from the interest rate/discount rate. What if the interest rate is 5%? What is the present value of this bond.

\[ PV = \frac{\$60}{1.05^1} + \frac{\$60}{1.05^2} + \cdots + \frac{\$60}{1.05^{29}} + \frac{\$60}{1.05^{30}} + \frac{\$1000}{1.05^{30}} = \]
\[ = \$57.15 + \$54.42 + \cdots + \$14.58 + \$13.88 + \$231.38 = \$1153.73 \]

So if the interest rate is 5% a 6% coupon bond generates an extra $153.73 which means in this world I would be willing to pay up $1153.73 to hold this $1000 bond.

4.3 Real and Nominal Interest Rates

It is important to note that all of the interest rates used thus far are nominal interest rates. These are interest rates measured in terms of current dollars. These rates do not incorporate any effects that inflation may have on buying power. Since most borrowers and lenders are more concerned with the buying
power of their investment it is often more important to calculate the real interest rate which corrects for changes in buying power over time.

The relationship between the nominal and real interest rate is simply

\[ i = r + \pi \]

where \( i \) = nominal interest rate, \( r \) = real interest rate, \( \pi \) = expected inflation rate. Thus to calculate the real return we simply need to take the given nominal interest rates and subtract the inflation which is typically measured using some price index. If the expected inflation rate exceeds the nominal interest rate, the real interest rate will be negative, and investing would actually lead to decreasing buying power over time. If the real interest rate is positive, the investment will lead to increased buying power over time.

5 Chapter 5: Understanding Risk

The world is a risky place. Every day we make several economic and financial decisions that involve risk. Should I buy more insurance? Should I quit my job and look for a new one? Should I wait and buy gasoline at the next station because it may be cheaper? All of these decision are economic gambling. Not surprisingly many of the tools that we are going to use to analyze risk come from simple games of chance.

Typically agents have some notion about the amount of risk involved in a decision and incorporate this into their final choices. While we can not make the world risk-less may be we can make risk manageable.

Finally, we should not always think of risk as a negative. Without risk there would be no opportunity for huge success. Thus agents need to value possible losses against possible gains. Thus we find probability theory used throughout many financial markets. This theory will allow use to compute risk and prices of many assets. We will learn how to measure risk and how this risk changes the demand for certain financial instruments and the price associated with them.

5.1 Defining Risk

In normal context the definition of risk is the possibility of loss or injury. In economic decisions that involve risk are simply those whose outcomes are uncertain. These risk could be unexpected losses or gains. We are going to use the following definition for risk.

Definition 7 Risk: Measure of uncertainty about the future payoff to an investment, measured over some time horizon and relative to a benchmark.

This definition can be broken into size important parts which we will explain:

1. Measure: Risk is a measurement, it allows use to compare the riskiness of two investment quantitatively. Holding everything else constant, the riskier of two options should be less desirable.
2. Uncertainty about the future: The list of possible future payoffs are simply 
the outcomes of a random process and should be treated as such.

3. Future Payoff: Risk involves an element of time and although the exact 
outcome is unknown, we should have some sense of what is going to hap-
pen. The list of possible outcomes.

4. Investment: Risk can be measured on a single or group of financial instru-
ments.

5. Time Horizon: Every investment has a time horizon. In general holding 
investment over a short time horizon is less risky than holding over a long 
time horizon.

6. Relative to a Benchmark: If something is risky, it is risky compared to 
something else. Later we will discuss a few of the come benchmarks used 
to compare risk across investments.

Now we know what risk is. Let’s measure it.

5.2 Measuring Risk

In section we will about tools used to measure risk. To do this, will need to be 
comfortable with concepts used to talk about random events. Once we know 
this we will have a better understanding of terms like expected returns, expected 
inflation, and other expectations used throughout economics and finance.

5.2.1 Possibilities, Probabilities, and Expected Value

Probability theory states that before considering an uncertain event, we must 
first list all the possible outcomes and the probability associated with each pos-
sible outcome. Think about rolling a die. What are all the possible outcomes? 
1,2,3,4,5,6. Now, what is the chance of each outcome occurring? If the die is fair 
each of the six outcomes have a 1/6 chance of occurring. Thus the probability 
of any one outcome is 1/6.

Definition 8 Probability: Measure of the likelihood than an event will occur.

This measure is expressed as number between zero and one. If an event has 
zero probability, it has no chance of occurring. If the probability of an event is 
one, then it is certain that this event will occur.

Sometimes outcomes will be expressed in frequencies instead of probabilities. 
In our previous example the frequency that you will roll a 3 is 1 out of 6 rolls. 
Typically, we will find it helpful to summarize this into a table called a frequency
distribution. The following table is a frequency distribution of rolling a fair die.

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Probability</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1/6</td>
<td>1 dot</td>
</tr>
<tr>
<td>#2</td>
<td>1/6</td>
<td>2 dots</td>
</tr>
<tr>
<td>#3</td>
<td>1/6</td>
<td>3 dots</td>
</tr>
<tr>
<td>#4</td>
<td>1/6</td>
<td>4 dots</td>
</tr>
<tr>
<td>#5</td>
<td>1/6</td>
<td>5 dots</td>
</tr>
<tr>
<td>#6</td>
<td>1/6</td>
<td>6 dots</td>
</tr>
</tbody>
</table>

The previous table is indeed a frequency distribution because every possible (positive probability outcome) is listed. This can be checked by adding the probability of all outcomes together. You should get a total of one.

Let’s now work with a financial example. Suppose you are thinking about buying a stock that costs $1000. From research you know that there are three equally likely possibilities for this stock: it could rise to $1500, it could stay at $1000, or it could fall to $600. These three amounts are the possible payoffs for this investment. Let’s look at the frequency distribution for this investment.

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Probability</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1/3</td>
<td>$600</td>
</tr>
<tr>
<td>#2</td>
<td>1/3</td>
<td>$1000</td>
</tr>
<tr>
<td>#3</td>
<td>1/3</td>
<td>$1500</td>
</tr>
</tbody>
</table>

We now calculate what is called the expected value, mean, from this investment. This is very much like calculating the average payoff. The computation of an expected value is straightforward. For every possibility multiply the probability of an outcome by its payoff. Then add over all possibilities. For this example the expected value is calculated as

$$
\text{Expected Value} = \frac{1}{3} \times \$600 + \frac{1}{3} \times \$1000 + \frac{1}{3} \times \$1500 \\
= \$200 + \$333.33 + \$500 \\
= \$1033.33
$$

This a very useful number which can be a tricky to interpret at first. The expected value is the average payoff I would receive from making this investment of $1000 many, many times. Thus, on average if I spend a $1000 on this stock I should expect to receive $1033.33 on average. The extra $33.33 is called the expected return from this investment.

Now let’s consider another investment option for this $1000 investment. The frequency distribution is shown below:
<table>
<thead>
<tr>
<th>Possibility</th>
<th>Probability</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1/6</td>
<td>$200</td>
</tr>
<tr>
<td>#2</td>
<td>1/6</td>
<td>$600</td>
</tr>
<tr>
<td>#3</td>
<td>1/3</td>
<td>$1000</td>
</tr>
<tr>
<td>#4</td>
<td>1/6</td>
<td>$1500</td>
</tr>
<tr>
<td>#5</td>
<td>1/6</td>
<td>$1900</td>
</tr>
</tbody>
</table>

What is the expected value of this investment?

\[
\text{Expected Value} = \frac{1}{6} \times 200 + \frac{1}{6} \times 600 + \frac{1}{3} \times 1000 + \frac{1}{6} \times 1500 + \frac{1}{6} \times 1900
\]

\[
= 33.33 + 100 + 333.33 + 250 + 316.67
\]

\[
= \$1033.33
\]

It is exactly the same as the first option. Would the typical investor treat these investment options the same? Which one looks riskier? Just casually we see a higher top payment and lower bottom payment in the second option. So, the second choice looks riskier. We will now try to measure how much riskier the second option is when compared to the first.

### 5.2.2 Measures of Risk

Just as the previous example showed, we have some sense to gauge risk just by looking at the possibilities. The easiest way to measure the riskiness of a choice to look at it relative to something that has no risk. In our financial world, we will call a financial instrument that has not risk a risk-free asset. This asset has a known return which is the risk-free rate of return. The payoff from this type of instrument is guaranteed. For example is the risk-free rate of return is 3\% then a $1000 risk free investment would pay $1033.33 with certainty. If there was a chance that the payoff could deviate from $1033.33 then the investment is deemed risky.

In both of the previous options there was a possibility that the payoff could deviate from $1033.33, thus these are risky options. What caused this risk was the spread in the payoffs away from $1033.33? Also, it seems that the farther these payoffs are spread, the greater the risk. Thus, is seems we can measure risk by simply looking at how the possible payoffs are spread. We will now look at two such measures: the standard deviation of the investment and value at risk.

**Variance and Standard Deviation** Now for a little more stats review. The variance is defined as the probability-weighted average of the squared deviations of the possible outcomes from their expected values. First response to this definition is...HUH? Just think of variance as a measure of volatility in the payoffs.

To calculate the variance of an investment you do the following
1. Calculate the expected value of the investment
2. Subtract each possible payoff from the expected value
3. Square each result
4. Multiply each term by its probability
5. Add all the terms together.

In this order, for the example for the first option above, we would have

\[
\text{Variance} = \frac{1}{3} (600 - 1033.33)^2 + \frac{1}{3} (1000 - 1033.33)^2 + \frac{1}{3} (1500 - 1033.33)^2 \\
= \frac{1}{3} (-433.33)^2 + \frac{1}{3} (-33.33)^2 + \frac{1}{3} (466.67)^2 \\
= \frac{1}{3} (187774.88\text{dollars}^2) + \frac{1}{3} (1110.89\text{dollars}^2) + \frac{1}{3} (217780.88\text{dollars}^2) \\
= 62591.63\text{dollars}^2 + 370.30\text{dollars}^2 + 72593.63\text{dollars}^2 \\
= 135555.56\text{dollars}^2
\]

The standard deviation is the square root of the variance or

\[
\text{Standard Deviation} = \sqrt{135555.56\text{dollars}^2} = 368.18
\]

The standard deviation is a more useful number than the variance. The measure of the standard deviation is in the same units as the payoffs: dollars. Sometimes we will want to put the standard deviation in terms of the size of the initial investment which in this case is:

\[
\frac{368.18}{1000} = 36.82\%
\]

Given two investment options with the same expected value we will generally want to choose the option with the smallest standard deviation.

We can also compute the standard deviation of the two investment option. Doing so we find

\[
\text{Variance} = \frac{1}{6} (200 - 1033.33)^2 + \frac{1}{6} (600 - 1033.33)^2 + \frac{1}{3} (1000 - 1033.33)^2 + \frac{1}{6} (1500 - 1033.33)^2 + \frac{1}{6} (1900 - 1033.33)^2 \\
= \frac{1}{6} (-833.33)^2 + \frac{1}{6} (-433.33)^2 + \frac{1}{3} (-33.33)^2 + \frac{1}{6} (466.67)^2 + \frac{1}{6} (866.67)^2 \\
= $555.78
\]
If we put this in terms of the initial investment we find

\[
\frac{555.78}{1000} = 55.78\%
\]

The second option is indeed riskier.

**Value at Risk** The standard deviation is the standard approach to measuring risk, but is some cases we need to think about risk in a different way. In some situations we are less concerned about the spread in the possible payoffs, and more concerned about the lowest possible payoff, the worst case scenario. The measurement of risk in this case is called the value at risk (VaR).

Let’s consider the situation of a potential home buyer who is able to afford a monthly mortgage payment of $750 and not one cent more. You find a house to buy and a the bank is willing to lend you the last $100,000 to buy. You expect to complete the transactions and move within six months.

If the mortgage has an interest rate of 7% that would imply a monthly payment of $651 which is inside the household’s budget. Over the next six months however, interest rates may change and influence the size of the mortgage payment. To be insured against this the bank offers a fixed rate mortgage of 8%. The only alternative is to wait and see what happens in six months. What should they do?

We first need to know all the possible outcomes with there associated probabilities. Let’s assume the following distribution

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Interest Rate</th>
<th>Monthly Payment</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>10%</td>
<td>$846</td>
<td>0.25</td>
</tr>
<tr>
<td>#2</td>
<td>8%</td>
<td>$714</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>7%</td>
<td>$651</td>
<td>0.50</td>
</tr>
<tr>
<td>#4</td>
<td>6%</td>
<td>$589</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Where possibility #2 is only possible if the fixed rate mortgage is selected. Which way should we go?

We could calculate risk in the same manner as the previous example, but that does not get at the true risk involved in this investment. Suppose the interest rate does rise to 10% and you have a monthly payment of $846. You lose more than the extra $132 per month in mortgage payments. Since this exceed your limit of $750 you also lose the house.

In this situation we measure risk by the value of the largest loss. In this case it would be the house. In our previous example the value at risk would be the difference between the initial investment of $1000 and the value of the lowest payoff. In option 1 the value at risk was $400 and in option 2 the value at risk was $800.
5.3 Risk Aversion, the Risk Premium, and the Risk-Return Trade-Off

The discussion about risk and how agents make risky choices is somewhat simplified by the basic belief that most people are risk-averse (with regards to their finances). The simplest way to understand risk aversion is to think about a simple coin flipping game. Here is the setup. A coin is going to be flipped one time. If heads comes up you win $1000 and if tails comes up you will $0. The expected value of this game is $500. How much would you pay to play this game? If you are willing to pay $500 to play then you are risk neutral. The certain $500 which you have has the same value as a risky investment that on average would pay $500. The risk does not alter how you value the investment. Most people would not be willing to pay $500, we would pay something less. If you are in this area, you are risk averse. A risk averse person will always select a certain payoff over a risky investment with the same expected payoff.

Clearly, since people dislike risk, there is value to be gained by finding ways to avoid risk. This gives us insurance markets. A insurance contract absorbs our risks, and since this is valued by the customers we must give the insurance company a premium which is higher than what it expects to payout. The difference between the premium and expected payout is the risk premium of the contract. Generally, the riskier the contract/investment, the higher the risk premium. The is the most common explanation for why stocks pay higher returns than bonds. Stocks are riskier and this have a risk premium in their payoffs.

5.4 Sources of Risk: Idiosyncratic and Systematic Risk

Although we face many different forms of risk, we can generally put these risks in two categories: idiosyncratic and systematic. Idiosyncratic risks are those risks which affect a small number of people. Systematic risks are those that affect a large number of people or portion of the economy. Every stockholder faces these two risks everyday. Idiosyncratic risks are those that affect the specific firm that the shareholder has a stack in. These are things like only affect the specific company. Systematic risks are those that affect every share- holder who holds stocks in the entire industry. In economic circles we generally think of idiosyncratic shocks as microeconomic shocks and systematic shocks are macroeconomic shocks.

5.5 Reducing Risk through Diversification

The financial world is swamped with risk. So what can people do to prevent catastrophic losses like those seen during the run up of tech stocks of the 1990s. The solution to this problem is 400 years old "do not keep all you eggs in one basket".

Risk can reduced through a strategy called diversification which is where more than one type of risk is held at the same time. The holding of several
risky investment can reduce the overall riskiness of an entire portfolio. There are basically two ways to diversify risk: hedging and spreading.

5.5.1 Hedging Risk

Hedging is the strategy of reducing risk in a portfolio by making two investments which have opposite risk characteristics. When one investment typically does poorly, the other investment typically does well and vice versa.

Consider an example where an investor, who is looking to invest $100, faces risk from a potential change in the technology used to build hybrid cars. If the new technology is successful, companies that specialize in hybrid technology would have lower costs and higher profits. If the technology fails, future demand for oil will look higher and higher profits will be seen at oil companies. Knowing this, the investor decides to buy an equal number of shares in Honda and Texaco. Here is how the investor’s portfolio depending on the technology shock:

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Honda</th>
<th>Texaco</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Succeeds</td>
<td>$120</td>
<td>$100</td>
<td>0.50</td>
</tr>
<tr>
<td>Technology Fails</td>
<td>$100</td>
<td>$120</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Let’s compare three strategies this investor might take:

1. Invest only in Honda
2. Invest only in Texaco
3. Invest half in each

The following table shows the expected value and standard deviation of each strategy:

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Expected Value</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honda Only</td>
<td>120 ( \times .5 ) + 100 ( \times .5 ) = 110</td>
<td>10</td>
</tr>
<tr>
<td>Texaco Only</td>
<td>110</td>
<td>10</td>
</tr>
<tr>
<td>Split</td>
<td>110</td>
<td>0</td>
</tr>
</tbody>
</table>

Each strategy has the same expected payoff, the third is a perfect hedge, no matter what happens with the technology, the investment will pay $110.

5.5.2 Spreading Risk

The second diversification strategy is to spread risk. In this case you simply invest in several options which have payoffs which are unrelated to each other. Let’s go back to our investor looking to make a $100 investment. The investor is
looking at two unrelated stocks and what to know the best strategy to diversify.
Consider the following payoff structure

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Disney</th>
<th>Starbucks</th>
<th>Total Payoff</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>$60</td>
<td>$60</td>
<td>$120</td>
<td>0.25</td>
</tr>
<tr>
<td>#2</td>
<td>$60</td>
<td>$50</td>
<td>$110</td>
<td>0.25</td>
</tr>
<tr>
<td>#3</td>
<td>$50</td>
<td>$60</td>
<td>$110</td>
<td>0.25</td>
</tr>
<tr>
<td>#4</td>
<td>$50</td>
<td>$50</td>
<td>$100</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Once again let’s consider three strategies

1. Holding only Disney
2. Holding only Starbucks
3. Holding 50% in each.

We can compute the expected value and standard deviation of each of these cases.

For the Disney only case (remember the above table is share price at $100 you have enough for 1 share of each or 2 shares of one)

\[
\text{Expected Value} = \frac{1}{2}100 + \frac{1}{2}120 = 110
\]

and the standard deviation is

\[
\text{Standard Deviation} = \sqrt{\frac{1}{2}(100 - 110)^2 + \frac{1}{2}(120 - 110)^2} = $10
\]

The same would be true for the second strategy.
The third strategy would be computed as

\[
\text{Expected Value} = \frac{1}{4}120 + \frac{1}{4}110 + \frac{1}{4}110 + \frac{1}{4}100 = 110
\]

with a standard deviation of

\[
\text{Standard Deviation} = \sqrt{\frac{1}{4}(120 - 110)^2 + \frac{1}{2}(110 - 110)^2 + \frac{1}{4}(100 - 110)^2} = \sqrt{\frac{1}{4} * 100 + \frac{1}{4} * 100} = \sqrt{50} = $7.1
\]

So the third investment strategy produces the same expected payoff with less risk. Thus we are partially diversified.
6 Chapter 6: Bonds, Bond Prices, and the Determination of Interest Rates

This chapter covers the required basics to understand Bonds and the Bond Market. The easiest way to think about a bond is to treat it like an IOU. A bond simply is a contract which a borrower writes starting that in return for some amount of money from the lender, the borrower agrees to payment(s) of money at a future date(s). The most common users of bond financing are governments. The federal government has been using bonds since 1789 when the U.S. Treasury Department was formed. It should be noted that state and local governments as well as private industry use bonds.

To understand the financial system and particularly the bond market, we must learn three things. First, the relationship between bond prices and interest rates. Second, the supply and demand functions which construct the bond market. Finally, why bonds are a risky asset.

6.1 Bond Prices

One basic question about a bonds, is what is it’s price. How much would you be willing to pay to take on a bond? This amount depends mostly on the characteristics of the bond’s payouts. We generally see four basic types:

1. Zero-Coupon Bonds: These bonds promise a single future payout. The most common is U.S Treasury Bills

2. Fixed-Payment Loans: These are typical households loans like mortgages and student loans.

3. Coupon Bonds: These bonds make periodic interest payments and repay the principal at maturity. Common coupon bonds are U.S. Treasury Bonds and Corporate Bonds.

4. Consols: These are bonds which make periodic interest payments forever and never repay the interest. Not to many of these, they look like annuities.

We will look at the pricing of these types one at a time.

6.1.1 Zero Coupon Bonds

Treasury or T-Bills are the simplest form of a bond. They simply represent a promise by the U.S. Government to pay a fixed amount of money say $100 in the future. There are no coupon payments and thus the name zero coupon bonds or pur discount bonds. This type of bond will typically be priced below face value value. If a $100 T-bill sells for $96, the extra $4 is the interest which will be made for holding the bond.

The price of a T-bill is simply the present value of a single payment in the future:
Price of Zero Coupon Bond = \frac{\text{Face Value}}{(1 + i)^n}

where \( i \) is the interest rate and \( n \) is the number of periods until maturity. So if you know the interest rate is 4%, the price of a $100 1-year coupon bond would be

\[
\text{Price of 1-year $100 Zero Coupon Bond} = \frac{100}{(1 + .04)^1} = \$96.15
\]

The treasury department only issues T-bills with maturities of one year or less. The most common is the 6-month T-bill. In the same environment the price of a 6-month T-bill would be

\[
\text{Price of 6 month $100 Zero Coupon Bond} = \frac{100}{(1 + .04)^{\frac{1}{2}}} = \$98.06
\]

The price of the 6-month T-bill is higher than the one year bill.

### 6.1.2 Fixed-Payment Loans

Standard fixed payment loans are names as such because they promise to pay a fixed number of payments at regular intervals. These are amortized which simply means that the borrower is paying off both interest and principal in every payment. The pricing of these types of loans is another simple application of presents value which would look like:

\[
\text{Value of Fixed-Payment Loan} = \frac{\text{Fixed Payment}}{(1 + i)} + \frac{\text{Fixed Payment}}{(1 + i)^2} + \ldots + \frac{\text{Fixed Payment}}{(1 + i)^n}
= \frac{\text{Fixed Payment}}{i} \left( 1 - \frac{1}{(1 + i)^n} \right)
\]

where \( i \) and \( n \) take on the same definition as in the previous section.

So suppose we borrow $25,000 for college with an annual interest rate of 4% or a monthly interest rate of \((1.04^{\frac{1}{12}} - 1) = 0.0032\). This loans agreement calls for 120 monthly payments of $300. The value of this loans would be

\[
\text{Value} = \frac{300.00}{0.0032} \left( 1 - \frac{1}{(1 + 0.0032)^{120}} \right) = \$29,855
\]

### 6.1.3 Coupon Bonds

Coupon bonds were discussed in chapter 4. The price of a coupon bond is the summation of two present values. The present value of the stream of coupon
payments and the present value of the principal payment at maturity. Thus the price would be

\[ P_{CB} = \left[ \frac{\text{Coupon Payment}}{(1 + i)} + \frac{\text{Coupon Payment}}{(1 + i)^2} + \ldots + \frac{\text{Coupon Payment}}{(1 + i)^n} \right] + \frac{\text{Face Value}}{(1 + i)^n} \]

Since we have already discussed this let’s move on to the final type: consols.

6.1.4 Consols

This type of bond only pays periodic interest payments. These are simply coupon bonds that never mature. The price or value of these bonds is simply the value of this infinite stream of coupon payments. Which would look similar to the first part of the value of a coupon bond. In turns out that an infinite stream simplifies to the following

\[ P_{\text{Consol}} = \frac{\text{Coupon Payment}}{i} \]

So, the price of a consol at 5% interest with $20 coupon payment would be \( \frac{20}{0.05} = 100 \). If the interest rate were to fall, the price would rise to \( \frac{20}{0.04} = 125 \).

6.2 Bond Yields

Now that we know how to calculate the price of bonds given the interest rate, we need to learn how to move in the other direction. Given the price and other characteristics of the bond, we want to calculate the interest rate or the return to the bond given in the price. Typically, these interest rates are simply called yields. The yield of a bond can change depending on the how long an investor is looking to hold a bond. We will begin with the most straight forward yield calculation.

6.2.1 Yield to Maturity

The most useful measure of the return to a bond is calculate the yield to maturity which is simply the return an investor would get from holding a bond from today until the bond matures and the final principal is repaid. Suppose we are holding a $100 face value 5% coupon bond with one year to maturity. We know, given the characteristics of a coupon bond that the owner of the bond will receive an interest payment of $5 and the $100 principal payment in one year. So the price of this bond should be:

\[ \text{Price of Bond} = \frac{5}{(1 + i)} + \frac{100}{(1 + i)} \]

The value of \( i \) which solves this equation is called the yield to maturity. Thus, depending on the price of the bond, the yield to maturity may take on different values.
1. If the price equals $100, then the yield to maturity must equal the coupon rate.

2. If the price is above $100, then the yield to maturity will be below the coupon rate.

3. If the price is below $100, then the yield to maturity will be above the coupon rate.

The following table shows how yields to maturity and prices move in this example:

<table>
<thead>
<tr>
<th>Yield to Maturity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03</td>
<td>$101.94</td>
</tr>
<tr>
<td>0.04</td>
<td>$100.96</td>
</tr>
<tr>
<td>0.05</td>
<td>$100</td>
</tr>
<tr>
<td>0.06</td>
<td>$99.06</td>
</tr>
<tr>
<td>0.07</td>
<td>$98.13</td>
</tr>
</tbody>
</table>

The return to the bond depends on the price that you pay. If you pay $99.06 on a $100 bond you receive your return through two sources. First is this the interest payment that you get in one year. You also receive the increase in value from $99.06 to $100 which is called the capital gain. A capital gain is simply a change in the value of the actual asset. If the price were above $100 the investor would actual suffer a capital loss and the yield to maturity would be below the coupon rate.

6.2.2 Current Yield

The second measure of the return to a bond is called the current yield. The current yield is simply a measure of the current proceeds the investor receives for making a loan. In this case it is simply the coupon payment divided by the price paid.

\[
\text{Current Yield} = \frac{\text{Coupon Payment}}{\text{Price Paid}}
\]

This measure of the yield measure the return solely as a function of interest payments and ignores any capital gains or losses.

Going back to our 5 percent coupon bond we can calculate the current yield of this bond. If the price was $99, then the current yield would be

\[
\frac{5}{99} = 0.0505
\]

So the current yield would be 5.05 percent. If we calculate a variety of current
yields for given prices we find the following:

<table>
<thead>
<tr>
<th>Yield to Maturity</th>
<th>Price</th>
<th>Current Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03</td>
<td>$101.94</td>
<td>0.0490</td>
</tr>
<tr>
<td>0.04</td>
<td>$100.96</td>
<td>0.0495</td>
</tr>
<tr>
<td>0.05</td>
<td>$100</td>
<td>0.0500</td>
</tr>
<tr>
<td>0.06</td>
<td>$99.06</td>
<td>0.0505</td>
</tr>
<tr>
<td>0.07</td>
<td>$98.13</td>
<td>0.0509</td>
</tr>
</tbody>
</table>

Notice that a systematic pattern forms. Just as with the yield to maturity, if the price of the bond is greater than face value, the current yield is less than the coupon rate. If the price of the bond is less than face value, the current yield will exceed the coupon rate. However, since the current yield does not incorporate capital gains or loss the current yields are much less volatile than yields to maturity. The relationship between all of these bond characteristics is summarized in the following table

- Bond Price < Face Value  Coupon Rate < Current Yield < Yield to Maturity
- Bond Price = Face Value  Coupon Rate = Current Yield = Yield to Maturity
- Bond Price > Face Value  Coupon Rate > Current Yield > Yield to Maturity

### 6.2.3 Holding Period Returns

The final measure of returns on a bond is called a holding period return. Most bond holder will hold a bond until it matures, thus the relative return on a bond is simply a measure on how much the investors gains by buying the bond and selling at some point in the future.

Suppose you pay $100 for a 10 year 6% coupon bond with a face value of $100. The investment plan is to hold the bond for one year and then sell it. Remember, in one year you will be selling a 9-year coupon bond. Your return for this investment depends on how the interest rate has changed over the year. If the interest stays at 6% then the return is simply $\frac{6}{100} = 0.06$.

However, the interest rate changes, the price of all bonds moves. So, let’s say the interest rate, yield to maturity, falls from 6 to 5 percent. In this case the price of a 9-year bond would be

\[
\text{Price} = \frac{6}{1.05} + \frac{6}{1.05^2} + \ldots + \frac{6}{1.05^9} + \frac{100}{1.05^9} = \$107.11
\]

So you bought a 10 year bond at $100 and sold it as a 9-year bond for $107.11. What is your return on this investment? It has two parts: the $6 coupon payment and the $7.11 capital gain. So the holding period return in this case would be:

\[
\text{Holding Return} = \frac{\$6}{\$100} + \frac{\$107.11 - \$100}{\$100} = \frac{\$13.11}{\$100} = 13.11\%
\]
Clearly the return is depended on how the yield to maturity (bond price) changes over the holding period. If the yield to maturity were to rise to 7 percent the price of the 9-year bond would fall to $93.48. The holding return would be

\[
\text{Holding Return} = \frac{\$6}{\$100} + \frac{\$93.48 - \$100}{\$100} = \frac{-\$0.52}{\$100} = -0.52\%
\]

The coupon generated a 6% return however the price movement generated a 6.52 percent capital loss. In general the holding return is

\[
\text{Holding Return} = \frac{\text{Coupon Payment}}{\text{Price Paid}} + \frac{\text{Change in price of Bond}}{\text{Price Paid}}
\]

this return can be broken into two components

\[
\text{Holding Return} = \text{Current Yield} + \text{Capital Gain}
\]

There will be a capital gain or loss whenever there is a price change over the holding period. This should be the first time that we realize that there is risk associated with holding bonds. The longer the holding period the greater are the potential price movements. Thus, longer term bonds are generally more risky. Remember this when we talk about the yield curve in the next chapter.

### 6.3 The Bond Market and the Determination of Interest Rates

We now have a basic understanding the relationship between bond prices and interest rates. The next step in learning is trying to figure out where bond prices come from. The bond market functions like any other market you have studied in economics. The price of the good is determined by the crossing of supply and demand. In this section we will learn the basic of how supply and demand forces work in the bond market.

Given the environment I need to make a few choices on how to proceed with the analysis. First, the market is for the current existing stock of bonds. Second, we are going to setup the market in terms of bond prices to keep it similar to other applications of supply and demand. We could just as easily use interest rates or yields since knowing one is like knowing both. Finally, we need to realize that we are talking about the market for particular types of bonds. In most situation we will want to be clear about the type of bond and the investment horizon.

#### 6.3.1 Bond Supply, Bond Demand, and Equilibrium in the Bond Market

Put simply bond prices are determined from the supply and demand for bonds. The bond supply curve is a relationship between the price and quantity of bonds people are willing to sell. The higher the higher the price of the bond, all other thing equal, the larger will be the supply. This occurs many for two reasons.
1. From the investors point of view, the higher the price of the bond the more tempting it is to sell the bond.

2. From the companies seeking financing, the higher the price to sell the bond the better.

Put together these two things simply say that the supply curve should slope upward.

The bond demand curve is the relationship between the price and quantity of bonds investors what to buy. All other things equal, as the price falls, the reward for holding a bond goes up. The return for a bond goes up as the price of the bond goes down. Thus the demand curve for bonds is downward sloping.

Equilibrium is simply the point at which supply and demand are equal. At any other point, there will be market pressures on the price of bonds to move back towards equilibrium. If the bond price were to start out above equilibrium, supply would exceed demand. That means that there are bonds that are left unsold at the current. In order to sell these bonds the price must be reduced. This put downward pressure on the market price. If the price is below equilibrium, demand will exceed supply. Not all investors who desire to buy bonds can find them. Their reaction will be to start bidding up the price to get them and thus we have upward pressure on the market price.

We know have an understanding of equilibrium. The next step is to understand the typical forces which lead to changes in the bond market by changing either bond supply or bond demand and altering equilibrium.
6.3.2 Factors That Shift Bonds Supply

Changes in bond supply are typically induced by forces which influence the need for borrowing. We typically summarize this into three factors: changes in government borrowing, changes in business conditions, and changes in expected inflation. Other factors can lead to change in bond supply such as tax incentives for investment.

Changes in Government Borrowing The government is a HUGE borrower. Thus any increase in the government’s borrowing needs will increase the quantity of bonds outstanding and shifts the supply of bonds to the right. This would thus lead to an increase in the equilibrium quantity of bonds and a reduced equilibrium price of bonds.

Changes in General Business Conditions In the upswings of business cycles, firm are generally in health financial shape and looking to invest and expand. Much of this investment is made through borrowing. So, we actually be more borrowing in good time than in bad. So as business conditions improve, the bond supply curve shifts to the right.

Changes in Expected Inflation Bond issuers general worry about the real cost of borrowing. That is they remove inflation when measuring how costly it is to borrow. For example, if the nominal interest rate is 6% and the inflation rate is 4%. The real interest rate is 2%, this would be the real cost to borrowing. Any increase in the expected inflation rate would reduce the real interest rate and the cost of borrowing. So, an increase in the expected inflation rate spurs borrowing and shifts the bond supply curve to the right.

6.3.3 Factors that Shift Bond Demand

We now want to discuss shifts in the demand for bonds. Six factors shift the demand for bonds at a given price: wealth, expected inflation, the expected return of other assets, expected interest rates, risk, and the liquidity of bonds.

Wealth The more the economy grows the wealthier the people become. As wealth grows investment grows in all assets. Thus, and increase in wealth shifts the demand for bonds to the right and leads to a higher equilibrium quantity and price of bonds. This affect this generally procyclical as wealth rises in good times and falls during recessions.

Expected Inflation Changes in expected inflations will influence investors’ willingness to buy bonds with fixed-dollar payments. A decline in expected inflation means that any future payments will have a higher value than originally thought. Thus the bond becomes more attractive. Thus a fall in expected inflation will increase bond demand and shift it to the right.
Expected Returns and Expected Interest Rates  An investor’s willingness to hold any asset is dependent on the value of alternative investments whether it be stocks or other financial instruments. If the return on bonds rise relative to other options, the demand for bonds will increase and shift to the right. Thus, we can already see how many people believe that there is some tie between bond and stock prices.

Similar arguments hold if there are changes in expected interest rates. When expected interest rates fall, expected bond prices are expected to rise. This leads to an expectation of capital gains and makes bonds look more attractive. Thus, a fall in expected interest rates shifts bond demand to the right.

Risk Relative to Alternatives  As we saw in previous chapters. The expected return to an investment is not the only variable which drives an investor’s decision to hold and investment. The riskiness of the investment is also important. Generally, investors are risk averse. Thus, holding other things constant, as the riskiness of bonds falls relative to other investments, the demand for bonds will increase and shift to the right.

Liquidity Relative to Alternatives  A highly liquid asset has value in that it is easy to convert to other forms particularly consumption. Investors like liquidity. So, if the liquidity of bonds increases relative to other assets, the demand for bonds will shift to the right.

6.3.4 Understanding Changes in Equilibrium Bond Prices and Interest Rates

It is important to briefly summarize these shocks. Note that expected inflation affects both bond supply and bond demand. An increase in expected inflation increases bond supply, but reduces bond demand.

Also note that business condition affect both supply and demand. A recession reduced business investment and borrowing which reduces the supply of bonds and the loss of wealth generated by the recession also leads to a reduction in bond demand.

In summary, some economic situations lead to multiple shocks and can influence both sides of the market.

6.4 Why Bonds are Risky

Before moving any further one thing need to be made clear: Bonds are not a riskless investment. There are substantial risks to holding bonds these risks come from either broken promises or unexpected changes in the economy. We generally place bond risk in the places: default risk, inflation risk, and interest-rate risk.
6.4.1 Default Risk

Bonds are simply a promise for future payments, unfortunately as the saying goes "promises are made to be broken". Any bond has a chance of going into default where the issuer of the bond does not make the promised payment. Generally the threat of default is not an issue when taking about U.S. Treasury bonds. Corporate bonds are a different story. There is always a chance a business will fold, and if that occurs, any bond holder would receive nothing. How does this risk affect the return of bonds?

Simple, risk requires compensation, thus this is one reason why the return to bonds exceed the risk-free rate. Generally, the higher the default rate the higher the return (yield) for the bond. Suppose we know that the risk-free interest rate is 5% and you wish to buy a $100 face value 1 year 5% coupon bond from a company. If the bond is held until maturity in a risk free environment the price of the bond would be

\[ P_{\text{RiskFree}} = \frac{5}{1.05} + \frac{100}{1.05} = 100 \]

Now suppose that there is a 10% chance that the business will default on the bond and leave you with nothing. If that were the case, the payoff profile for this bond would look like.

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Payoff</th>
<th>Probability</th>
<th>Payoff*Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Payment</td>
<td>$105</td>
<td>0.90</td>
<td>$94.50</td>
</tr>
<tr>
<td>Default</td>
<td>$0</td>
<td>0.10</td>
<td>$0</td>
</tr>
</tbody>
</table>

Thus the expected value of the bond would be $94.50. This is one year coupon bond, so any payments will be made one year into the future. So the present value of this bond is

\[ PV = \frac{94.50}{1.05} = 90 \]

So this bond would see for $90. What is the yield to maturity on this bond? The promised yield is calculated as

\[ \text{Yield to Maturity} = \frac{\text{Payoff}}{\text{Price}} = \frac{105}{90} - 1 = 0.1667 \]

So the yield of the bond is 16.67% with default and 5% without. This assumes that the investors are risk neutral. If we make investors risk averse, the price would have to be below $90 and the yield greater than 16.67%.

6.4.2 Inflation Risk

Generally, bond payments are promised in fixed amounts. That is, a $100, one-year 5% coupon bond is going to pay $105 in one year. This amount is a fixed dollar amount no matter what happens over the life of the bond. Given that this
$105 is a fixed amount, your value of the bond is subject to risk from inflation. This bond is written in with a 5\% nominal interest rate. What investor are about is the real return to assets? So whether inflation is 2\% or 6\% is a very important issue for bond holders. In the first case the real return to the bond would be 3\%, in the second case the real return is -1\%. So, level of inflation is important for the real return to a bond. If the inflation rate rises during the life of the bond, the real return would fall. The added uncertainty of inflation adds more risk to holding bonds.

6.4.3 Interest-Rate Risk

The final source of bond risk is interest rate risk. Treasury Bonds generally assume that you know what the inflation rate is and there is no default risk. The only risk you have from holding a U.S. Treasury Bond comes from changes in the interest rate. Remember the interest rate and bond prices are related to each other. If the interest rate rises during the life of the bond, the price of the bond will fall, and so will your yield. Also, the longer the term of the bond, the greater is the risk from interest rate changes.

To summarize, riskiness of a bond investment comes from three sources:

- Default Risk: The issuer may not repay the promised payments
- Inflation Risk: Inflation may be higher than expected and cut into returns
- Interest Rate Risk: Interest rate may rise over the holding period and lead to capital losses

7 Chapter 7: The Risk and Term Structure of Interest Rates

Due to the wide variety of risk and longevity of bonds around the world and the sheer magnitude of money involved it is important to understand the differences among the many types of bonds that are sold and traded in the financial market. We will see that bonds differ in two aspects: the identity of the issuer (and the risk associated) and the time to maturity. This chapter will examine how each of these affects the price of a bond and then use our knowledge to interpret shocks in a broad variety of bond prices.

7.1 Ratings and the Risk Structure of Interest Rates

Default is the first important risk that is priced into bond. It will be the first thing a potential bond holder will look at. The risk varies greatly across different types of bonds. This idea is so important that a standardized grading system has been established to measure the default risk of bonds.
7.1.1 Bond Ratings

The best known bond rating system has been developed by Moody’s and Standard and Poor’s. Companies who have good credit (low debt levels, high profits, and lots of cash) are given high bond ratings. A high ratings tells potential bond holders that there is very little threat of default. The following table reports both the Moody’s and Standard and Poor’s bond rating with associated interpretations.

<table>
<thead>
<tr>
<th>General Grade</th>
<th>Moody’s</th>
<th>S&amp;P’s</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment</td>
<td>Aaa</td>
<td>AAA</td>
<td>Best quality, smallest risk of default. Stable.</td>
</tr>
<tr>
<td></td>
<td>Aa</td>
<td>AA</td>
<td>High quality. Slight default risk.</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>A</td>
<td>High quality but risk associated with economic conditions</td>
</tr>
<tr>
<td>Speculative</td>
<td>Ba</td>
<td>BB</td>
<td>Speculative (future returns) not well protected</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>B</td>
<td>Able to pay now but at risk to default in future</td>
</tr>
<tr>
<td>Highly Speculative</td>
<td>Caa</td>
<td>CCC</td>
<td>Poor quality, clear danger of default</td>
</tr>
<tr>
<td></td>
<td>Ca</td>
<td>CC</td>
<td>Highly speculative often in default</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>C</td>
<td>Lowest rating, poor prospects or repayment</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td></td>
<td>In default</td>
</tr>
</tbody>
</table>

Investment grade bonds have a very low risk of default. The US government and a few private firms have a AAA rating. Several other companies have bonds with ratings of AA and A. (www.investinginbonds.com)

The group of ratings is for speculative bonds. These bonds have higher risk of default. These are bonds with S&P ratings or BB and B. Some retail companies are moderately developed countries have bonds in these categories. The final grade is for highly speculative bonds. These bond have little prospect of repayment. Bonds offered by Enron would be of this type.

Speculative bonds are often referred to as junk bonds or really as high yield bond. Why? High risk involves high returns. So, if a junk bond does actually pan out, the holder typically get a high return. Junk bonds usually fall into two categories. In the first case, a highly dependable issuer has simply fallen on hard times. These are called fallen angels. In the second case, we typically have very little information about the issuer.

Bond ratings are continuously updated a some bonds change ratings often from 1997 till 2002 WorldCom bonds went from junk, Ba, to investment grade, A, and back again. In May 2001, WorldCom issued $11.8 billion in 10 year bonds which one year later were trading for $0.44 on the dollar. In a given year, 5 to 7 percent of all bonds will be downgraded from an investment to a speculative rating. Roughly the same amount receive upgradings from speculative to investment.
7.1.2 Commercial Paper Ratings

Commercial Paper is just a short-term bond over less than 270 days with most being within 5 to 45 days. These bonds are simply short term uncollateralized loans. In 2004 there was over $1.4 trillion of outstanding commercial paper. Because there is no collateral behind these bonds, only the most stable companies and governments can issue commercial paper. Commercial paper is rated in a similar fashion to bonds with the differences in ratings due mostly to default risk and the identity of the issuer.

7.1.3 The Impact of Ratings on Yields

Bond ratings reflect default risk. The higher the rating, the lower the risk. On the flip side, the lower the rating, the lower the price, and thus the higher the yield. Higher risk is simply a decrease in the demand for bonds which leads to a lower price. The figure out how default risk influences bond prices. We simply measure the spread over Treasuries. This measure simply uses US Treasury prices as a benchmark and then uses the prices on all other bonds which are identical except for the issuers credit rating. This produces a spread of prices which allows us to break the yield of a bond into two components.

\[
\text{Bond Yield} = \text{US Treasury Yield} + \text{Default Risk Premium}
\]

This formula makes a simple predictions. First, as the rating of a bond goes down, the default premium should go up, or the difference in returns from a bond to US Treasury should grow. Second, if the yield of US Treasury Bonds changes, all other bond yields should change in a similar fashion. The following
As can be seen in the above figure there is a clear and constant gap in the yields across these types of bonds. The risk premium is fairly fixed over time. This pattern would be true for any maturity bond. Generally the gap gets larger with longer maturity bonds. Why does this make sense? The high yields of lower grade bonds do attract some investors, Michael Milkin, the king of junk bonds, is just one example.

### 7.2 Differences in Tax Status and Municipal Bonds

Default risk is no the only factor that affects the return on a bond. The next important things is taxes. Just as with other assets, bond holders must pay federal income taxes on interest from privately issued bonds and US Treasury bonds. On the other hand coupon payments from state and local governments are not federally taxed. The general rule is that interest from bonds issued from one government are not tax from other governments. This is greatly alter the actual yield of a bond. Now the bondholder need to look at after-tax yields to determine which bond generates the greatest return.
For example suppose you have the option of a 6% percent yield on a federal bond which faces a 30% income tax and a 4.5% state municipal bond. Which one generates a higher after-tax yield. The after-tax yield of the federal bond is calculated as

\[
\text{After Tax Yield} = \text{Bond Yield} \times (1 - \text{Tax Rate})
\]

\[
= 0.06 \times (1 - 0.30) = 0.042
\]

So after taxes, the state level bond actually generate as higher yield.

### 7.3 Term Structure of Interest Rates

The tax status and default risk of a bond are not the only factors the affect its yield. The maturity length of the bond influences the yield. The key is to think about a long term bond like a sequence of short term bonds. The yield of the long term bonds depends on the future returns of future short term bonds. To find this we need a framework for studying future interest rates.

The relationship among bonds with the same risk characteristic and different maturities is called the term structure of interest rates. A plot of the term structure, with the yield to maturity on the vertical axis and time to maturity on the horizontal axis is called the yield curve.

![Yield Curve Diagram](image)

If we were to draw the yield curve from a year ago it would look similar to the graph above. We would only see small variations in the curvature of the
yield curve particularly on the lower part of the curve. What does this mean?

1. Interest rates of different maturities tend to move together.
2. Yields on short-term bonds are more volatile than yields on long term bonds.
3. Long term yields tend to be higher than short term yields.

Why do we find these differences in yields? The two explanations are the expectations hypothesis and the liquidity premium theory.

### 7.3.1 The Expectations Hypothesis

The first theory of the term structure to interest rates is called the expectations hypothesis. If we generalize all yields into two components: a risk-free rate and a risk premium. The expectations hypothesis centers on the first component.

We begin with the observation that the risk free rate can be computed assuming that there is no uncertainty about the future. That is we know the yield of a risk free bond today and in the future. The yield of a 10 year note and holding a sequence of 10 1 year notes would be equal. Certainty in the future implies that bonds of different maturities would be perfect substitutes for each other.

Now, how does this work? If bonds of different maturities are perfect substitutes for each other, then we can construct investment strategies that must have the same yield over the holding period. Let’s take an investor with a two year time horizon. Two possible strategies are available to this investor:

1. Invest in a two-year bond and hold it to maturity. The interest rate on this bond will be denoted $i_{2t}$. Investing a dollar in this bond will generate a yield of $(1 + i_{2t})(1 + i_{2t})$ in two years.

2. Invest in two one-year bonds, one today and one in one year. The bond today has an interest rate of $i_{1t}$ and the bond next year has an interest rate of $i_{t+1}^r$.

The superscript denotes that this is an expected interest rate that we do not know today. A dollar invested in this strategy is expected to generate a yield of $(1 + i_{1t})(1 + i_{t+1}^r)$ in two years.

In the expectations hypothesis, these two strategies should generate equal yields. Thus

$$(1 + i_{2t})(1 + i_{2t}) = (1 + i_{1t})(1 + i_{t+1}^r)$$

Use an approximation and simplifying we find

$$i_{2t} = \frac{i_{1t} + i_{t+1}^r}{2}$$
For a three year horizon we would have

\[ i_{3t} = \frac{i_{1t} + i_{2t+1} + i_{3t+2}}{3} \]

so on and so forth. Thus the yield to long maturity bonds is just an average of a sequence of short maturity bonds with a holding period equal to that of the maturity of the long-term bond. Does the expectations hypothesis generate a realistic yield curve?

1. Long-term bond rates are all averages of expected future short term rates. Thus, interest rate of different maturities will move together.

2. Short term rates will be more volatile than long term rates. A single short term rate moving will have limited impact on the average of a sequence of short term rates.

3. The expectations hypothesis does not generate the typical upward sloping yield curve unless future interest rates are expected to rise. This is contrary to the fact that we have seen a general downward trend in interest rates for 20 years and we still have an upward sloping yield curve.

So, the expectations hypothesis gets 2 out of 3 by simply ignoring risk and treating bonds like substitutes. Maybe we need risk to get the three characteristic of yields. We typically consider long term bonds more risky than short term bonds. We need to add risk to the expectations hypothesis. This moves us to the liquidity premium theory.

7.3.2 The Liquidity Premium Theory

The expectations hypothesis fails to account for the slope of the yield. So what does? The answer is risk. The upward slope of the yield curve is a result of the fact that long-term bonds are riskier than short-term bonds. These long term bonds face the same default risk as short term bonds, but also face greater amounts of risk from inflation and interest rate changes.

Inflation and interest rate changes are things which generally occur gradually, thus a simple fact is that the longer the maturity, the more likely it is that inflation will change and interest could rise to induce potential capital losses. The increased risk associated with long term bonds implies that bondholder need to be given higher yields to hold them.

We can now think of a bond yield having two components: a risk-free part and risk premium. The expectations hypothesis can explain the risk-free portion. The risks associated with inflation and interest rate risk account for the risk premium. Together they form the liquidity premium theory of the term structure of interest rates.

We begin by simply adding a risk premium term to the expectations hypothesis. Suppose we are calculating the yield for a three year bond. Thus would
be

\[ i_{3t} = r_{p3} + \frac{i_{1t} + i_{1t+1} + i_{1t+2}}{3} \]

where \( r_{p3} \) represents the risk premium associated with a 3 year bond. The longer the maturity of the bond the greater is the risk premium and thus the yield of the bond. By including a risk premium we are able to generate the third characteristic of bond yields which says that long-term yields are greater than short-term yields.

### 7.4 The Information Content of Interest Rates

This section covers the information which can be obtain from interest rates and how this information helps account for overall economic conditions. Risk spreads typically generate particular types of information and the term structure generates others.

#### 7.4.1 Information in the Risk Structure of Interest Rates

When the economy goes into a downturn, the financial situation of firms worsens. This increases the likelihood that they will not be able to meet finance obligations. The immediate response would be to raise the risk premium on private bonds. (This is not generally true for government bonds which are very stable.) Of course, this premium will vary depending on characteristics of the individual firm. The increase in the risk premium will increase the yields or lower the price of private bonds and thus increase the spread between these bonds and US Treasury bonds. Generally a growing risk spread indicates reduction in future GDP growth. Since this information is reported daily instead of quarterly like GDP. We can use a immediate changes in the risk structure as signals to future changes in GDP growth.

#### 7.4.2 Information in the Term Structure of Interest Rates

In terms of the term structure of interest rates, it is the slope of the yield curve which best relays information about the overall economy. According to our theories, the yield curve should be sloping upward. Note that the statement does not say always, it says should. Every once in a while short-term rates can exceed long term rates. In this case, we actually have a downward sloping or inverted yield curve. How can this happen, only if we expect a fall in short term interest rates. This is signalling information about the goals of monetary policy. The federal reserve uses short term rates to influence economic behavior. If we see high short term rates, this implies tight monetary policy which is trying to slow economic growth and inflation.

Empirical data indicates that the slope of the yield curve is a good indicator of future GDP growth. The typical approach is to calculate the term spread which is simply the difference in yield between the 10 year and 3 month bond.
If the term spread is negative, that would imply high short term rates. The typical result is that a drop in the term spread today implies lower GDP growth in one year.

8 Stocks, Stock Markets, and Market Efficiency

Stocks and stock markets are a prominent feature of the financial and economic world. Stocks are a financial instrument that investors use to hold or increase wealth with returns. Stocks also protect investors against other financial risks in their lives. Thus, we are buying a risky asset to help mitigate other risks. For firms, stocks are just another way to obtain financing.

Stocks and stock markets also serve a signals to the overall health of a market based economy. Stock price inform potential investors about the value or the issuing company and help allocate resources to high valued companies thus helping to maintain an efficient economy.

Contrary to what most people believe, stock prices tend to rise steadily and slowly over time, it is just those occasional market collapses that people tend to remember (Great Depression, October 1987, January 2000-September 2001). In this chapter, we are going to learn a little about stock markets. We are going to see how stock fluctuation influence households and the economy as a whole. How let us begin simply by learning about stocks themselves.

8.1 The Essential Characteristics of Common Stock

Stocks, (common stock, equity) are shares in a firm’s ownership. A firm that is issuing stock is simply selling part of the company so that the stock buyers can become partial owners of the firm. Most stocks have similar characteristics. First, they typically come in small denominations, which allows investors to buy as much of the firm as they want. Second, shares are transferable which simply means that stock holders are free to sell their stock to others. Most stocks today take on values of less than $100 and most large corporations issue stock that includes many, many shares.

Until recently, stock holders would actually receive certificates for their shares of stock. Today most stock certificates are held electronically by the investors’ broker. This prevents theft of shares and reduces the costs to trading shares.

Owners of stocks are given certain rights. First, the stockholder is entitled to the profits of the company. Stock holders are know as residual claimants which simply means that they are entitle to profits, only after all other creditors have been paid. The stock holders get the leftovers which in many cases is not much.

Fortunately for stock holders, they are owners who face only limited liability which means that even if the firm goes bankrupt the stock holders only lose their initial investment and are not responsible for any additional costs. The lack of full liability makes investing is stock more attractive. In this case the liability for the company’s losses is limited to zero.
Share holders are also entitled to voting at a firm’s annual meeting. A shareholder’s number of votes is typically proportional to the number shares he/she owns. These meeting are arranged so that the stock holders can elect the board of directors today investing in stocks is a very popular. Roughly half of all US households hold some form of stock either directly or indirectly through mutual funds or retirement accounts.

8.2 Measuring the Level of the Stock Market

It is easy enough to see that when stock values rise our wealth goes up, and when stock values fall our wealth level goes down. These changes in wealth influence our consumption and savings decisions. This same idea holds for the entire economy which is simple a sum of all these individual households. This means that stock value fluctuations can have effects on the entire economy. Thus, we need to understand the dynamics of stock price changes. From a macroeconomic perspective we need to be able to measure the level of stock prices changes at a market level. The measure of the value of an entire stock market is measured with a stock-market index.

The idea of a stock market index is similar to other indexes in economics like price indexes and measures of real GDP. An index simple gives us a measure of scale which allows up to calculate percentage changes. Indexes are pure numbers they are not measure in the same terms as what they are measuring. The CPI is simply a number, it is not a price.

Stock market indexes function in the same way. They simply give use a measure to determine how stock value are moving up or down. If the Dow Jones Industrial Average is 10,000, that does not reflect any information. However, a change from 10,000 to 11,000 indicates that stock prices rose by 10 percent. We now know how much the value of the average stock has changed and can compute how much wealth has changed.

Flipping through financial newspapers and on-line resources we can find hundreds of stock-market indexes. We now want to simply describe some of the most well-known indexes.

8.2.1 The Dow Jones Industrial Average

The first and still best known stock market index is the Dow Jones Industrial Average (DJIA). This index was created in 1884 and began as the average price of 11 stocks. Today, the index is based on the stock prices of 30 of largest companies in the United States. The DJIA measures the value of buying a single share of each of the stocks in the index (at the time the index was started). The calculated average is a little more complicated than simply adding up the value of all 30 stocks and dividing by 30.

The DJIA is a price-weighted index. This simple gives higher weight to higher priced stock. Suppose we have an index of only two companies with share prices of $50 and $100 each giving a total value of $150. Now consider a 15% rise in the price of the first stock. That would raise the total value of both

50
stocks by $7.50 to $157.50. A 15% rise in the value of the second stock would raise the index by $15 to $165. So the DJIA is more sensitive to changes in the value of high priced stock.

The actual computation of the DJIA today is simply to sum the value of all thirty stock and then divided through by a divisor which is used to take into account stock splits and index changes which do happen. On October 11th 2005, the total value of all 30 stocks was 1280.94. The divisor was 0.1249 which generates

\[
DJIA = \frac{1280.94}{0.1249} = 10255
\]

It is also important to note that the make up of the thirty companies in the index does change. In the beginning the index included mostly heavy industry companies like railroads and steel manufactures. Today, the make of the companies is more diverse including Wal-Mart, Microsoft and Home Depot. General Electric is the only original company still in the index. To get more info about the DJIA check out [www.djindexes.com](http://www.djindexes.com).

### 8.2.2 The Standard and Poor’s 500 Index

The Standard and Poor’s 500 Index differs from the DJIA in two ways. First, the index covers much larger number of companies (500). Second, the value of the index is calculating using a different weighting scheme. The level of the index is based on the value of the 500 largest companies in the United States. In this index a company’s stock price is weighted according to its total market value. Thus, the S&P 500 is a value weighted index. Thus, the most important stocks in this index come from the companies with the largest value not the highest stock price.

Going back to our previous example If the firm with a stock price of $100 had 10 million shares outstanding. It total market value, or market capitalization would be $100*10 million = $1 billion. If the firm with a stock price of $50 had 100 million shares outstanding its total market value would be $5 billion. So, together the two companies are worth $6 billion.

No suppose stock prices change. If the $100 stock rose 15% to $115. The value of that firm would rise to $1.15 billion and the total value of the two firms would rise to $6.15 billion which would be a 2.5% increase in total value. If the second firm had its stock price rise 15%, the value of the second firm would rise to $5.75 billion which would increase the total value of the two firms to $6.75 billion. This represents an increase of 12.5% over the initial $6 billion. So, clearly the larger valued firm influences the value-weighted average more than the small firm.

### 8.2.3 Other U.S. Stock Market Indexes

Besides these two indexes there are other important measuring including the NASDAQ composite index and the Wilshire 5000. The NASDAQ average is
a value-weighted index of over 5000 companies traded in the over-the-counter stock market. This index is made up of mostly smaller young companies. The Wilshire 5000 is the most broadly based index in use. It covers all publicly traded stocks in the United States, including all the stocks on the NYSE, the American Stock Exchange, and the Nasdaq. The index is a value weighted average of over 6500 stocks and is the best measure of overall market wealth.

8.2.4 World Stock Indexes

Every major country in the world has a stock market and they all have indexes. Most of them are value weighted like the S&P 500. These indexes can be easily found in financial news sources. It is important to recognize that straight comparisons across indexes are not useful. We must compare the percentage changes in these indexes to gauge information about how well a country’s stock market is performing relative to other countries.

8.3 Valuing Stocks

There are several schools of thought about how stocks are valued. Some people believe that stock price changes can be predicted by looking at how prices have changed in the past. These type of people are called chartists. Others base prices on a perception of investor psychology and behaviors. These type of people are called behavioralists. Still others hold the belief that the value of stocks is based on the financial health of the company who issues the stock. Thus, the fundamental value of a stock is based on the timing and uncertainty of the future returns from the company. All three schools of thought have some merit and probably contribute to the total value of stock. In this class, we are going to stick will basic fundamentals of valuing stocks which is closest to building the fundamental value of stocks.

8.3.1 Fundamental Value and the Dividend-Discount Model

Like other financial instruments, a stock is a promise to make payments in the future under certain conditions. With stocks these future payments are called dividends. If the firm who issues the stock is sold, the owners receive their appropriate portion of the purchase price.

Let’s begin thinking of an investor who plans to buy stock today and sell it in one year. Our understanding of present value tells us that the price the stock today should equal the present value of payments the investor will receive from holding the stock. This is equal to the selling price of the stock in one year’s time plus the dividend payment. We can express the current price of a stock as

\[ P_{today} = \frac{Dividend_{tomorrow}}{(1+r)} + \frac{P_{tomorrow}}{(1+r)} \]

where \( r \) is the interest rate used to compute present value.
If the investor plans on holding the stock for two years the price computation would change to

$$P_{today} = \frac{Dividend_{tomorrow}}{(1+r)} + \frac{Dividend_{t+2}}{(1+r)^2} + \frac{P_{t+2}}{(1+r)^2}$$

for a three year pattern we would have

$$P_{today} = \frac{Dividend_{t+1}}{(1+r)} + \frac{Dividend_{t+2}}{(1+r)^2} + \frac{Dividend_{t+3}}{(1+r)^3} + \frac{P_{t+3}}{(1+r)^3}$$

This pattern would continue as we continue to add to the length of the holding period. That is the price of a stock is simply the present value sum of all dividend payments plus the present value of the price of the stock when sold.

What about companies that do not pay dividends? The answer is to estimate when they will begin to pay dividends and use the same present value calculations. Just plug in zero for the dividend for any period where dividend payments will not be made.

Looking back at the previous example and equation we see that this is only a useful expression if we know something about the future path of dividend payments. One common strategy is to use past changes in dividend payments to forecast future changes. To proceed, suppose we see that the dividend payments have been growing at a constant $g$ percent annually. We will use this pattern to forecast future dividend growth and simply assume that the dividend next year will be the dividend today multiplied by $(1 + g)$.

$$Dividend_{t+1} = Dividend_{today}(1 + g)$$

As long as the growth rate of dividends is constant, all we need to do is multiply by $(1 + g)$ to compute future dividends. So doing this substitute we find that the price of a stock today that is held for three years with dividends growing at rate $g$ would be

$$P_{today} = \frac{Dividend_{t+1}}{(1+r)} + \frac{Dividend_{t+2}}{(1+r)^2} + \frac{Dividend_{t+3}}{(1+r)^3} + \frac{P_{t+3}}{(1+r)^3}$$

$$= \frac{(1+g)Dividend_{t}}{(1+r)} + \frac{(1+g)^2Dividend_{t}}{(1+r)^2} + \frac{(1+g)^3Dividend_{t+3}}{(1+r)^3} + \frac{P_{t+3}}{(1+r)^3}$$

Still we can’t compute the price of a stock today without some proxy for the price at the end of the holding period. We solve this problem by simply assuming that the company will pay dividends forever. Mathematically this simply makes the present value of the selling price zero and the price of a stock is simply the present value sum of all future dividends. If we use a growth rate of $g$. The price of the stock becomes

$$P_{today} = \frac{D_t}{(r-g)}$$

53
This relationship is called the dividend-discount model. This is a very simple approach to building the fundamental value of a stock. This gives us very simple rules for when we should expect high stocks prices: when dividends are large, when interest rates are low and when the growth rate of future dividends is high.

It is important to realize that this model only builds a fundamental value of a stock, other things may influence the true value of a stock. The biggest thing is risk. Prices for most stocks change frequently thus make the returns from stock holding volatile and risky. Let’s briefly discuss why stocks are risky.

### 8.3.2 Why Stocks are Risky

Stockholders are the owners of the firm and are entitled to the firm’s profits after all financial obligations including bondholders. In effect the stockholders have bought the firm by putting up some of their own wealth and borrowing the rest. This borrowing creates leverage and leverage brings risk. A simple example will make this point clearer.

Imagine a firm wants to buy a $1000 machine and can finance this purchase by using stocks or bonds. If the interest rate is 10%, each $100 borrowed to finance the purchase will bring an obligation of $10 in interest per period. Also assume that in good years the firm earns $160 and in bad years they earn $80. Good years and bad years occur with the same probability of 50%. The following table shows how the stock returns for this firm vary as the level of debt changes. The more debt, the more leverage and the greater the owners’ risk.

<table>
<thead>
<tr>
<th>% Equity</th>
<th>% Debt</th>
<th>Interest</th>
<th>Equity Payment</th>
<th>Equity Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>0%</td>
<td>0</td>
<td>$80 $160</td>
<td>8% 16% 12% 4%</td>
</tr>
<tr>
<td>50%</td>
<td>50%</td>
<td>$50</td>
<td>$30 $110</td>
<td>6% 22% 14% 8%</td>
</tr>
<tr>
<td>30%</td>
<td>70%</td>
<td>$70</td>
<td>$10 $90</td>
<td>3.33% 30% 16.67% 13.33%</td>
</tr>
<tr>
<td>20%</td>
<td>80%</td>
<td>$80</td>
<td>$0 $80</td>
<td>0 40% 20% 20%</td>
</tr>
</tbody>
</table>

As the proportion financed by equity falls, the expected return from equity rises, by so does the risk.

Let’s review how these calculations were made. Suppose the firm uses 50% equity and 50% debt financing for the $1000. With $500 in debt the firm is liable for $50 in interest payments and thus is we are in a bad year stockholders would only get $80-$50 = $30 in dividends. If we are in a good year stockholders would receive $160-$50 = $110. The returns can be turned into percentages off of the initial investment of $500 in stock. Thus we get $30$500 = 0.06 in a bad year and $110$500 = 0.22 in a good year. Since these payouts are equally likely we find that the expected return is

\[ E_{\text{return}} = 0.5 \times 0.06 + 0.5 \times 0.22 = 0.14 \]
and the standard deviation of payouts becomes

\[ SD = \sqrt{(0.06 - 0.14)^2 \times 0.5 + (0.22 - 0.14)^2 \times 0.5} = 0.08 \]

What happens if this firm goes to 90% debt financing? Potential bankruptcy. With $900 in debt the company would be liable for $90 in interest. In a bad year the firm only generates $80, leaving the firm $10 in the red, and since stockholders can not be asked for this $10 the firm goes bankrupt.

Stocks are risky because they make stockholders residual claimants. Because they are the final people to get paid they are never sure if there will be enough to go around and receive any return. This risk is not generally faced by bondholders who are paid first.

### 8.3.3 Risk and the Value of Stocks

Because of the risk associated with stocks, stockholders require compensation. The greater the risk, the higher the compensation. This implies that investors have to balance the risk of a stock with the potential greater return from the stock. It is important to include ideas about risk into our valuation of stocks which includes compensation for a stock’s risk.

The idea goes as follows. Buying a stock today for a price \( P_t \) entitles the investor to a dividend, \( D_{t+1} \), plus the proceeds from the sale of the stock at the end of the holding period, (let’s say one year), \( P_{t+1} \). The return from holding the stock would be the present value of the dividend payment and the difference in the price all divided by the initial price of the stock:

\[ \text{Return} = \frac{D_{t+1}}{P_t} + \frac{P_{t+1} + P_t}{P_t} \]

Since the price, \( P_{t+1} \), is unknown and volatile, the returns from stocks are risky. Thus, the stockholder is going to need to be compensated a risk premium. The total return required from a stock can be broken into two parts: a risk-free rate and a risk premium (often called the equity risk premium). The risk-free rate is estimated as the interest rate of US Treasuries. Thus to the stock return is

\[ i = rf + rp \]

where \( i \) is the total stock return, \( rf \) is the risk-free rate, and \( rp \) is the risk premium. From our understanding of the fundamental value of a stock we know that

\[ P_t = \frac{D_t}{(i - g)} \]

where \( g \) is the growth rate of dividends, \( D_t \) is the current dividend payment, and \( P_t \) is the price of the stock. Combining these two ideas we have

\[ P_t = \frac{D_t}{rf + rp - g} \]
We see that the higher is the risk premium needed to hold a stock, the lower is the price of the stock. So we now have a fourth condition of high stock prices, the risk premium is low.

8.3.4 The Theory of Efficient Markets

Why do stock prices change so frequently? One explanation starts in a similar fashion as the dividend-discount model and is based on the fundamental value of a stock. When fundamentals change, so must the price.

These ideas generates what is know as the theory of efficient markets. Prices of financial instruments, including stocks, reflect all available information. As a result markets will adjust immediately to any changes in information even if it is not immediately clear what information just changed.

This theory basically says that stock prices are unpredictable. If you could predict a future stock price rise, you would immediately buy as many shares as possible. Your action would increase the demand for the stock, and drive the price up today. So, thinking that prices will rise tomorrow, will action raise prices today. When markets are efficient, the current trading price of a stock reflects all available information.

If this theory is correct, no one can consistently beat the market average return. So what about market managers who claim that they can consistently generate returns in excess of market indexes. (Empirical evidence actually shows that these funds generate returns below the market average.) How can managers consistently beat the market.

1. They have private information which is illegal
2. They are taking on added risk which has yet come to bite them
3. They are lucky
4. Markets are not efficient

It just happens to be the case that in a market with so many players there will always be a few big winners, and unfortunately most of the time it is brought on by luck.

8.4 Investing in Stocks for the Long Run

Stocks appear to be risky, but many people hold a large portion of their assets in the stock market. Why? Most of the risk in holding stocks is generated in the short-run. The yearly return on a stock or even a market index can be quite volatile. For example the return on the S&P 500 has fluctuated between +50% down -40% over any one year. However, over the life time of the market the average return is 8.5% per year. As the length of a period is stretched out past a year the return on stocks smooths out and becomes much less volatile. Actually, when looking over 30 year periods the average return for stocks has roughly the same volatility as the return on bonds with a higher expected value.
Stocks actually look less risky than bonds. Investor just need to look past the short term market fluctuations and see stocks as a long run investment. The following figure compares the 1 year and annualized 10 year returns on the S&P 500 stock index since 1960. You can see that the 10 year return is much stabler than the one year return.

8.5 The Stock Market’s Role in the Economy

The stock market plays a large role in today’s economy. Stock prices tell us the value of companies. This price guides the allocation of resources which in an efficient market should flow to the most valued use. High priced stocks are the ones investors desire and have an easier time getting the resources they need. As long as stocks accurately reflect fundamental values, the resource allocation mechanism works well.

However, it does not always appear that stock prices are reacting to fundamentals. It can appear that at times the behaviorist beliefs that investor psychology can influence the prices of stocks. In some cases it may appear that investors become overly excited about the prospects of particular stocks and the price rises regardless of what the fundamentals may say. This can create what are called bubbles which are persistent gaps between the actual price of an asset
and the price brought about through fundamentals. If true, the danger of any bubble would be a burst which would result in an immediate correction of the price back to its fundamental levels.

Stockholders are not the only ones who feel the effects of potential bubbles, the issuing firms can also be influenced by bubbles. If a firm’s stock prices rises substantial, borrowing will become very easy to obtain. The company can sell shares to finance business opportunities. Thus the firm may actually overinvest and find themselves in financial crisis. Also, there is a crowding out effect that some firms who should have been able to get more financing could not because the other firm has already been allocated the resources. In the world of bubbles, resources may not get allocated to their most efficient use.

Bubbles can also influence consumer behavior. When stock prices rise, the wealth of investors rises and they to over borrow and consume and save too little. When the bubble bursts, wealth will fall and some consumers may not be able to meet financial obligations. If the bubbles influences too many consumers, the stock market could destabilize the real economy.

9 Chapter 9: Derivatives: Futures, Options and Swaps

Not being covered

10 Chapter 10: Foreign Exchange

Every year, trading goods and services between countries is becoming easier. We seem to be moving towards a global economy. Nearly one-quarter or all the goods produced in the world are produced for an international exchange. International transactions are not limited solely to the trading of goods and services. Households, companies, and governments also invest in other countries. Since the volume of international transactions has grown to such levels it is important for us to understand exchange rates.

Whenever you buy a good that was produced overseas, someone somewhere has had to exchange dollars for the currency used where ever the item was produced. This is true even if you are not directly buying from a foreign firm. If you buy a TV in Target that we made in Japan. Someone had to convert dollars into yen to purchase the good. It could of been Target or the company which agrees to deliver TVs to Target.

Changes in the rates at which we can convert currency can have huge effects on our abilities to exchange goods between countries. In the late 1990s the Korean won went through a dramatic change in its exchange rate in October of 1997 every one US dollar could be exchanged for 900 won (the currency of Korea). By January of 1998, the exchange rate had changed so that every one US dollar could purchase 1900 won. As a result the prices of many Korean imports fell substantially and US made exports to Korea got very expensive.
In this chapter we want to learn about foreign exchange. Specifically, how are exchange rates determined and what can account for the fluctuations we see in these exchange rates.

10.1 Foreign Exchange Basics

If you have ever traveled overseas one question always comes up. How much should I take because I am not sure how it’s going to cost to pay for things. Why does this question come up? It is because you already know that you will be paying for things in foreign currency and generally we find it difficult to price goods in that currency. How do we deal with this? Exchange rates. This rate tells us how to convert units of one currency into units of another currency.

10.1.1 The Nominal Exchange Rate

Exchanging dollars for a foreign currency is like any other economic transaction, you are using your dollars to buy something. In this case you are using your dollars to buy money to spend in other countries. The price paid for the foreign currency is called the nominal exchange rate or sometimes just called the exchange rate. The nominal exchange rate is the rate at which one can exchange the currency of one country for the currency of another country. Currently, the reported dollar-euro exchange rate is about 0.84. That means every $1 US will buy 0.84 euros. So if you travel to Europe now you would be paying $100 for 84 euros. This exchange rate is dynamic with changes occurring daily. The following figures display the nominal exchange rate of some major currency against the US dollar.
This figure displays the nominal exchange rate between the Japanese Yen and the US Dollars. We can see just how much exchange rates can change over time. The rate of Yen per dollar has been falling over the long-run. In 1971, one US dollar could buy 350 Yen. Thirty years later, the same dollar could purchase only 100 Yen. The dollar has lost purchasing power, or has depreciated. At the same time the Yen is gaining purchasing power or appreciating. In 1971 one Yen could purchase only $\frac{1}{350}$ of a dollar and thirty years later the same one Yen could purchase $\frac{1}{100}$. The following figure displays the exchange rate between the
Canadian and US dollars.

Contrary to the previous picture, the exchange rate is relatively constant over the 30 plus year time horizon. If anything the US dollar is appreciating over the time horizon. Now, one US dollar can purchase about 1.2 Canadian dollars. Notice that in the previous two graphs, that in the short term the exchange rate has movement. We can see little ripples in the graph. The following figure
displays the relationship between the Chinese Yuan and the US dollar.

In this figure nearly all of the ripples are out of the graph. Why? China is a centralized economy in that the exchange rate is set by the government. The only movements we see in the exchange rate are from control reevaluations which are dictated as government policy.

The final figure is displays two exchange rates: The Euro to US Dollar and
the US Dollar to Euro exchange rates.

This figure display one fact: exchange rate are just ratios and it does not matter which way you express this ratio. The darker line show the US dollar to Euro exchange rate which measures how many US Dollars you can purchase with one Euro and the lighter line measures how many Euro you can buy for one US dollar. Since these exchange ratio are simply inversely related as one goes up, the other must go down. To avoid confusion on which way the exchange rate is being expressed, you should always write out the currency units in the exchange rate.

10.1.2 The Real Exchange Rate

While you may be interested in knowing that you can buy 0.83 Euros for one US dollar when packing for your trip. What you really need to know is how can you buy for a Euro. This is one thing a nominal exchange rate can not measure. To get at a measure of the buying power of foreign currency, we need to calculate the real exchange rate of the currency. This is the rate at which one can exchange the goods and services in one country for the goods and services from another country. Generally we will measure the cost of buying a bundle of goods in one country relative to buying the same bundle of goods in another country.

Suppose you know that a cup of Starbucks Coffee in the US costs $1.80. The same cup of coffee costs 1.6 Euros. Also suppose that the nominal exchange rate
is 1 Euro buys 1.2 US Dollars. This means that to buy the cup of coffee in Europe
I would have to spend

\[1.6\text{Euro} \times 1.20\frac{\text{\$}}{\text{Euro}} = \text{\$1.92}\]

to buy the same cup of coffee in Europe. The coffee in Europe is actually \$0.12
more expensive than in the US. This is enough information to calculate the real
exchange rate between Europe and the US.

\[
\text{Real Exchange Rate} = \frac{\text{Cost of Buying Domestically}}{\text{Price of Coffee in US Dollars in the US}} = \frac{\text{Cost of Buying in Foreign Country}}{\text{Price of Coffee converted into US Dollars in other country}} = \frac{\text{\$1.80}}{\text{\$1.92}} = 0.9375
\]

This is the real exchange rate between these two countries. At these prices 1
cup of coffee in the US buy 0.9375 cups of coffee in Europe. This ratio clearly
measures the differences in buying power across countries. Notice that the
calculation of the real exchange rate cancels out all units of measure. The real
exchange rate should be a plain number. If the units do not cancel out, you are
probably using the inverse of the nominal exchange rate that you need.

In this situation the real exchange rate was less than one, in some situations the real exchange rate will be greater than one. Here are the basic rules
associated with the value of the real exchange rate

1. Real Exchange Rate less than one: Goods in the Domestic country are
   relatively cheaper than the same goods in the Foreign country

2. Real Exchange Rate equals one: Goods in both country relatively the
   same price.

3. Real Exchange Rate greater than one: Goods in the Domestic country are
   relatively more expensive than the same goods in the Foreign country.

When the real exchange rate rises, goods, particularly exports, in the do-
mestic country look more expensive. At the same time the goods, particularly
imports, of the foreign country look less expensive. The opposite is true if the
real exchange rate falls.

10.1.3 Foreign Exchange Markets

As was stated earlier, foreign exchange is a huge and growing part of the global
economy. In any one business day, well over \$1 trillion of foreign currency
in foreign exchange markets. This means that in we should expect over \$300
trillion in foreign exchange transaction in any one year. This is 8 times world GDP of about $36 trillion and about 25 times the size of US GDP.

Another interesting feature is that liquidity of the US dollars induces agents to use it in roughly 90 percent of transactions. Many times people use US dollars as a middle man in an exchange between two foreign countries. Suppose that an agent in Thailand, currency in baht, and an agent in Japan wish to make a transaction which buy a good from Japan. This is going to involving converting baht into yen. This can be done in two steps. First, convert the baht to US Dollars, and then convert these dollars into yen.

10.2 Exchange Rates in the Long Run

The next question to address is how are exchange rates determined. The answer is that is depends on the timeframe we are looking at. Let’s begin by looking at exchange rates in the long run.

10.2.1 The Law of One Price

The starting point of any discussion about long run exchange rates has to begin with the idea of the law of one price. The law of one price is based on the idea of arbitrage and states that identical products should sell for the same price. If two goods are perfectly identical, they should sell for exactly the same price regardless of where they are sold. If not there is an arbitrage condition where everyone would simply buy the goods from the cheaper place. This desire would drive the demand for the cheap good up, or demand for the expensive good down. Thus, the price of cheaper goods would rise and the price of expensive goods would fall. This would always occur as long as the prices were out of balance in the two locations.

So do the same goods cost the same in different places? Generally, no. Transportation costs, tariffs, and other costs simply associated with trading goods can cause the law of one price to fail. Sometimes goods just are not tradeable. Cars in other countries have their steering wheels on the right side of the car, electric appliances have different voltages, etc. Sometimes, especially with services, we can not take advantage of arbitrage possibilities.

10.2.2 Purchasing Power Parity

So if the law of one prices fails so often, why do we still talk about it? Because it does help us understand the behavior of exchange rates in the long run. To see why this helps we need to extend our example from a single good to a basket of commodities. The result is the theory of purchasing power parity. This means that one unit of domestic currency will buy the same basket of goods and services anywhere in the world.

This ideas as a straightforward implication.

Dollar Price of basket of goods in US = Dollar price of basket of goods in Foreign Country
Rearranging this we get

\[
\frac{\text{Dollar Price of basket of goods in US}}{\text{Dollar Price of basket of goods in Foreign Country}} = 1
\]

Well, this is simply the real exchange rate between these two countries. So, one implication of purchasing power parity is that the real exchange rate should be equal to one.

These may seem strange, but remember this discussion is about exchange rates over the long run. On any given day purchasing power parity is going to fail, but over the long term exchange rate do move and so maybe this concept can help us understand these movements. To see this idea helps, let’s right out the real exchange rate again.

\[
\frac{\text{Dollar Price of basket of goods in US}}{\text{(Foreign Currency Price of Basket of Goods) } \times \text{(Dollars per Foreign Currency)}} = 1
\]

Rearranging term again we have

\[
\frac{\text{Dollar Price of basket of goods in US}}{\text{Foreign Currency Price of Basket of Goods}} = \text{Dollars per Foreign Currency}
\]

Purchasing power parity implies that when the price change in one country but do not change in the other, the exchange rate should change as well. When prices rise is a country that is called inflation, and so if prices are rising at different rates across countries, we get movements in exchange rates. If inflation is high in the US and low elsewhere, this idea says that we should expect the US dollar to depreciate. It takes more dollars to buy the same amount of foreign currency. The empirical evidence does support this idea if we make sure to look over the long term. High inflation countries tend to have depreciating currencies and vice versa.

### 10.3 Exchange Rates in the Short Run

While the idea of purchasing power parity can help us understand long run changes in nominal exchange rates, it has little if any ability to help understand the changes in exchange rates that we see on a daily, weekly, monthly, or even yearly time frame. How do we account for this volatility? We use the framework of a market for currencies and it is changes in the demand and supply in this market which generates the fluctuations in the exchange rate that we see. It is important to realize that since this is now a short run analysis nominal and real exchange rate differences are the same. There is insufficient time for the price level to change.

#### 10.3.1 The Supply of Dollars

When dealing with a market for currency we need to pick a home country and stick to that one. Since we are in the United States, for this part of the analysis
we will choose the United States as the home country. That means that the
currency is US dollars. When it deal with exchange rates we will be referring
to the number of units of foreign currency, say Euros, it takes to purchase one
US dollar.

Who are the suppliers of dollars to the currency market? Anyone who is
currently holding dollars. For the most part the suppliers are the citizens of the
United States. There are two reason when some who is holding dollars will want
to convert them into foreign currency

1. to purchase goods and service oversees who prices are set in terms of the
   foreign currency
2. to invest in foreign assets which are measured in terms of the foreign
   currency

The following figure displays the supply of dollars in the dollar-euro market.
Just like all other supply curves the curve is upward sloping. The higher is the
price of dollars, the greater is the supply. Why? Basically we know that if the
dollar has a high value, foreign goods and assets will look relatively cheap and
holding more dollars means we can buy more cheap goods. So consumers will
be more like to go buy foreign goods and assets which will put more dollars on
the market.

\[ 10.3.2 \quad \text{The Demand for Dollars} \]

Foreigners who want to make purchases of American goods, services, and assets
need dollars to do so. The lower the exchange rate is for dollars, the fewer
euros the foreigners will need to purchase a dollar. Thus the American goods look cheaper. Since the goods look cheaper there will be a higher demand for these goods and thus a greater need to change euros into dollars. Thus, as the exchange rate falls, quantity of dollars demanded will rise. This creates a demand curve for dollars which is downward sloping.

10.3.3 Equilibrium in the Market for Dollars

The equilibrium exchange rate, \( P^* \) on the figure, equates the supply and demand for dollars. So, the current exchange rate is determined by the market forces of demand and supply. If there are shocks in the world which influence the supply and/or the demand for dollars, we will see a change in the equilibrium exchange rate for dollars.

10.3.4 Shifts in the Supply of and Demand for Dollars

Shifts in the supply or demand for dollars will move the equilibrium exchange rate. We will start by discussing shifts in the supply of dollars. Anything that increases the desire to import goods and services or an increase in the preference for foreign goods will increase the supply of dollars. These shocks will shift supply to the right and lead to a fall in the exchange rate and a depreciation of the dollar. Remember the supply of dollars is use to purchase foreign goods and assets. So there will be several different types of shocks all of which lead to a change in the supply for dollars

1. Increase in the supply of dollars for the purchase of foreign goods

   (a) An increase in preferences for foreign goods and services.
   (b) An increase in US real GDP and income,

2. Increase in the supply of dollars for the purchase of foreign assets

   (a) An increase in the real interest rate on foreign bonds.
   (b) An increase in US wealth
   (c) A decrease in the riskiness of foreign investments relative to US investments
   (d) An expected depreciation of the dollar

To talk about shifts in the demand for dollars we simply need to go down the same list of item and look at these shocks from the perspective of foreigners.

1. Increase in the demand of dollars from foreigners for the purchase of domestic goods

   (a) An increase in foreigners’ preferences for domestic goods and services.
   (b) An increase in real GDP and income overseas
2. Increase in the demand of dollars from foreigners for the purchase of domestic assets
   (a) An increase in the real interest rate on domestic bonds.
   (b) An increase in overseas wealth
   (c) A decrease in the riskiness of domestic investments relative to overseas investments
   (d) An expected appreciation of the dollar

10.3.5 Explaining Exchange Rate Movements

The supply and demand framework helps to explain short-run movements in the exchange rate. Between January 1999 and October 2000 we saw a 30 percent appreciation of the dollar relative to the euro. This framework generates the conclusion that this change was drive by either a decrease in the supply of dollars by Americans, or an increase in the demand for dollars from Europeans. We need to look at the empirical evidence to determine which seems right.

Over this time we see an increase in American purchases of European goods, so this means that this time saw an increase in the supply of dollar, so this can not be the cause. It must be something about the demand for dollars. Over the same time period, 1999 represented the peak of the dot-com era which brought in tons of foreign investors brought on by the high returns of the US stock market. As results we saw a huge increase in the demand for dollars and thus we have to shock responsible for the appreciation of the dollar.

10.4 Government Policy and Foreign Exchange Intervention

As countries increase there uses of imports and exports, the importance of the exchange rate grows. Currency appreciation drives up the prices of the domestic goods relative to goods around the world. This will depress exports and hurt domestic companies that either sell or rely on exports. These business will often use political pressure to have policies that depreciated the currency or in some manner increase the relative price of imports.

Throughout the world governments have reacted in a variety of ways to this political pressure. Some countries, like China, adopt a fixed exchange rate policy and directly set the exchange rate. Some countries rely on tariffs which increase the relative prices of imports. Other countries which use a floating exchange rate will sometime engage in foreign exchange intervention. This is where the government get directly involved with the foreign exchange market by either buying or selling currency in an attempt to mimic supply or demand shocks and drive the exchange rate in a particular direction. Out of all countries Japan is probably the country that uses intervention the most. Although, they have had mixed results at best in influencing the value of the yen.
11 Chapter 11: The Economics of Financial Intermediation

The efficiency of an economy is tied to the effectiveness of its financial intermediation. A financial intermediary is a firm whose assets and liabilities are mainly financial instruments. The goal of financial intermediation is pool resources from savers and lend them to people and firms who need to borrow. These institutions also gather and relay information about the financial conditions of firms and individuals. This information helps to intermediary guide resources to their most valued use.

As stated earlier, a healthy economy has well-run financial intermediation. If intermediation fails the economy can falter. Many people believe that it was the failure of the banking sector in the 1930s that help to bring about the Great Depression. Similar arguments exist for the Asian crisis of the late 1990s.

So, in theory the market system may as simple as supply and demand. In reality, the system is chaotic. The flow of information through a market system, which drives where resources get allocated, is particularly vulnerable to problems. This chapter will discuss the role of financial intermediation and also some of the information problems faced by these institutions.

11.1 The Role of Financial Intermediaries

Financial intermediation is a huge part of the market economy. In terms of size the activity associated with indirect finance through intermediation can and does exceed GDP. Why do we rely on intermediation so much? The answer comes down to information. Think about a simple auction on eBay, who is a financial intermediary. This online auction house provides a market mechanism that always anyone to sell almost anything.

In any one year eBay sells millions of different items to millions of different people, but notice that there are no financial products listed. You can purchase collectibles, but you can not take out a loan. Nowhere will you find a person’s car loan or mortgage.

So, why don’t you see mortgages listed on eBay? First thing, the average home in Baltimore is over $200,000 which means you would have to list a $200,000 mortgage. There are not too many individuals who could finance such a venture. You break the $200,000 in small pieces, but the logistics of breaking up the mortgage and having to ensure that everyone was paid on-time would make this possibility extremely costly. Second, as a buyer on eBay you would know nothing about the borrower’s financial obligations. Can this person pay back the loan? Are they really using this to buy a house? There is an endless number of questions which come about in this transaction.

Financial intermediaries exist so that individuals do not have to face all of these questions. These institutions exist to reduce the transaction and information costs associated by borrowing and lending. Financial intermediaries perform five basic functions:
1. Pooling of resources from small savers
2. Providing safekeeping and services and access to the payments system
3. Supplying liquidity
4. Providing methods of diversification to reduce risk
5. Collecting and processing information to reduce information costs.

The first four functions focus on reducing transactions costs and the fifth function deals with reducing information costs. Let’s take an more in-depth look at these five functions.

11.1.1 Pooling Savings

The most obvious function of a financial intermediary is to pool resources of a large number of small savers. By pooling these resources the banks can then make large loans to other people or firms. It is very unlikely that one person could finance a $200,000 mortgage or a multi-million dollar investment. However, a bank will pool together the asset of several individuals to accomplish this goal. To be effective, financial intermediaries need to attract a LARGE number of savers. This is generally accomplished by banks who make savers feel secure in the fact that their assets are safe.

11.1.2 Safekeeping, Payments System Access, and Accounting

This security is the second function of a financial intermediary. Banks used to construct large, heavy safes which looked imposing. This safekeeping of valuables and assets is just one of several services provided by intermediaries. Banks provide services that give savers quick access to their assets through things like ATMs, credit and debt card, checks, and monthly statements. Bank are extreme efficient at financial transactions greatly reducing their costs. Many banks also provide bookkeeping and accounting services. They help customers maintain their finances and plan for the future.

11.1.3 Providing Liquidity

Financial intermediaries also provide liquidity to their customers. Liquidity is simply the ease at which assets can be turned into a means of payments and thus consumption. Banks allow their depositors to quickly and easily turn their deposits into money quickly and easily whenever needed. Borrowers also benefit from easier liquidity. They can make loans which require repayment in a extended fashion. Imagine trying to buy a house or car without a loan. Intermediaries specialize their balance sheet so that they can make sizeable quick withdraws for customers.
11.1.4 Diversifying Risk

Banks mitigate several types of risk. First, they take deposits from many people and make thousands of loans with these deposits. Thus, each depositor faces only a small amount of the risk associated with loans that would go default. No one depositor losses all there assets when a bank loan goes unpaid. Banks also provide a low-cost way for depositors to diversify their investments. Mutual-fund companies off small investors a way to purchase a diversified portfolio of several different stocks.

11.1.5 Collecting and Processing Information

One of the biggest problems that savers face is whom to lend their assets too. How do they figure out which borrowers are financial and secure and trustworthy? The fact is that the borrowers could lie about their true state and the lender has little ability to verify the truth. Finding out the truth can be a costly venture and because of this we can see information asymmetry which is when the borrowers have information that the lenders do not.

By collecting and processing information, financial intermediaries reduce the problems associated with asymmetric information. Loan applicants are carefully screened. They monitor loans for timely payments. These information problems have huge implications on the financial systems. We need to study what these problems are and there implications.

11.2 Information Asymmetries and Information Costs

Information is a central element to efficient markets. When the costs of obtaining information are too high, some potentially beneficial transactions do not take place and markets tend to stall. The issue is that information costs are all over financial markets which makes them sometimes some of the worst functioning markets. In most all transactions, the issuer of a financial instruments, borrowers, know some information which the buyer, saver, does not know. This is a situation know as asymmetric information.

There are two information problems which form obstacles two smooth running financial markets. The first problem is called adverse selection. This problem arises before the transaction ever occurs. Simple fact is that lenders need to know how to differentiate between good risks and bad risks. Unfortunately for them, that is information only the borrower has. The second type of information problem is called moral hazard. This problem occurs after the transaction has taken place. Lenders need to find a way to tell whether borrowers will use the proceeds of a loan as they claim they will. We should look at some examples of these problems and their implications.

11.2.1 Adverse Selection

Let’s begin our study of asymmetric information with the most famous situation: The Lemon’s Problem.

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Used Cars and the Market for Lemons The 2001 Nobel Prize in Economics was awarded to George Akerlof, Michael Spence, and Joseph Stiglitz for "their analysis of markets with asymmetric information". Akerlof's contribution came from a 1970 paper titled "The Market for Lemons" in which he explained why the market for used cars, some of which are "lemons", does not function well.

Suppose two cars are for sale, both of the same make and model. One is in good shape and was owned by a previous owner who maintained a good maintenance record and drove very little. The second car was owned by someone who sparingly changed the oil and loved to drive in the fast lane. The owners of the cars know whether their own car is in good repair, but the buyer does not.

Let's say the potential buyer is will to pay $15,000 for a well-maintained car and $7,500 for a lemon. The first car owner knows the car is in good shape and won't sell it for less than $12,500. The other owner knows that the car is in poor shape and would be willing to sell for as little as $6,000. Without knowing anything else about the car, the risk-neutral buyer would only be willing to pay the expected, average, price for these cars which would be $11,250. That is less than the first owner is willing to sell for, thus the only car we can buy is the lemon. In this type of world no one with an above average car would ever put their car on the market. Thus, the market is full of lemons.

Due to this asymmetric information, several entities exist that help solve this problem. Consumer reports can be established about the sellers of used cars. Many people now offer warranties on used cars and buyers can use mechanics to help verify the true state of the car. As a result we should find the prices for good and bad used vehicles closer to their true value.

Adverse Selection in Financial Markets When it comes to financial markets, this adverse selection problem exists just as it exists with used cars. Potential borrowers know more about the projects they wish to finance than potential lenders. In the same way that adverse selection can drive out the good cars this situation can drive good stocks and bonds out of the financial market.

Think about two firms, one with good prospects and one with bad prospects. As a potential stock buyer, since you can not tell which firm is which, you would only be willing to pay the average stock price as a risk neutral investor. The stock of the good company would be undervalued. Since managers of this company know that their stock would be undervalued, they would never both issuing it in the first place. That leaves only the firm with bad prospects in the market. This would be known by investors and the market would have a hard time getting started.

The same thing can happen in the bond market. Remember that risk requires compensation and if you can not tell the high risk bonds from the low risk bonds, the lender will demand the average premium on all bonds. This drives companies with good credit out of the market unwilling to pay the inflated interest rate. Since lender are not interested in buying debt from bad companies, the market would not function.
11.2.2 Solving the Adverse Selection Problem

The adverse selection problem creates situations where good companies will pass
on potentially valuable investments. Since these investments are lost, the best
companies are not necessarily the ones that grow as rapidly as they should. At
the same time, poorer companies may take on investments which they should
not be doing. So, it is important to identify the good companies from the bad
companies. How does financial intermediation try and solve this problem?

There are two basic methods for solving problems of adverse selection. First,
create more information for the investors. Second, provide guarantees in the
form of contracts that can be written such that the owners of the firms face the
same risks as the investors. Let’s talk about these solution mechanisms.

Disclosure of Information The most straightforward fix to adverse selection
is to create more information. This can be done by government regulation or
through other market forces. Most publicly traded companies are required to
release tons of information through requirements set up by the Securities and
Exchange Commission (SEC). Public companies are also required to release
information which can influence the wealth of the company and any information
that we be given to professional stock analysts.

Even with these requirements, some companies have managed to get around
the system. Current history generate a famous list: Enron and WorldCom.
With mis-accounting these companies were able to effectively disguise the true
financial health of these companies and falsely drive up the apparent worth and
thus stock price of the companies. These examples have created new accounting
regulations geared at closing these loop holes.

Collateral and Net Worth Another solution for adverse selection is to write
contracts so that lenders are compensated even if the borrower defaults on the
loan. If the lender is guaranteed a payment, some bad credit risks no longer
look so bad.

There are two ways to ensure that a borrower is likely to repay a lender:
collateral and net worth. Collateral is something of value pledged by a borrower
to the lender in the event of default on a loan. This collateral is said to secure
the loan. In many situations, the collateral for the loan is simply the good that
is being purchased by the borrower. For example: a house is collateral for a
mortgage and the car is collateral for an auto loan. In this adverse selection is
not much of a problem. In either case the lender gets paid and the borrower only
gets a payoff if they meet their financial obligations. Loans without collateral,
unsecured loans, generally have higher interest rates. The lender is taking on
more risk and must be compensated.

Net worth is an owner’s stake in a firm. Under many cases, new worth serves
like collateral. If a firm defaults on a loan, the lender can make a claim on the
net worth of the firm. Of course if the firm has no or negative net worth, the
lender would receive nothing, but in general the lender would still get some form
of a payoff. In this case the lender still faces risk from changes in the value of
the firm.

11.2.3 Moral Hazard: Problem and Solutions

Thus comes from a simple belief in insurance markets. An insurance policy
changes the behavior of the person who is insured. A fire insurance policy
written for more than the value of the home can entice a person to commit
arson, automobile insurance encourages reckless driving, and flood insurance
encourages building on coastlines and lake fronts. The example go on an on.
Moral hazard problem can arise in situations where we cannot observe people’s
actions and thus cannot judge whether an outcome is intentional or simply luck.

In a financial situation, a borrower knows more about how the borrowed
funds will be used than the lender. The lender does not see the true effort put
into a project, or the true risk associated with a given project. Moral hazard
problems effect both stock and bond financing and make is difficult for many
firms to obtain either type of financing. Let’s look at how moral hazard effects
both stock and bond financing and how we can solve this problem in both
situations.

Moral Hazard in Equity Financing As a stockholder, how do you know
that the company that issued the stock is using the funds in a way that is best
for the future of the company and, more importantly to you, a higher future
stock price. The answer is that it is not general going to use the funds in
the best manner. The managers of the company have different objectives than
the stockholders. The managers are going to run the company that is most
advantageous to them. The separation between management and ownership
creates a principal-agent problem. The luxuries of being a manager generally
come at the expense of the stockholders.

Solving the Moral Hazard Problem in Equity Financing Solutions to
moral hazard are difficult. Information about the quality of management could
be helpful if the owners have the ability to fire managers, but this is not generally
the case. Many companies want managers to put a substantial amount of their
wealth into the company. This would make the manager a stockholder and line
up the objectives of the two parties. However, this only works if the manager
has the means to buy a substantial amount of the company.

Many other companies use a stock option which is tied in with the salary
of a manager. The manager get a large bonus if the stock price rises past a
certain level. This works as long as accounting services are well regulated and
of the strongest quality. In this scenario, the is an incentive for managers to
misrepresent the financial health of the company in order to inflate the stock
price. Still it is the generally accepted practice of making managers part owners
of the company that seems best at solving the moral hazard problem.
Moral Hazard in Debt Finance  Since there are severe moral hazard problems in equity financing, investors may want to think about debt financing. However, debt financing still has problems. Then general problem comes in that managers will have an incentive to take on too much risk with projects. Remember owners are entitled to all profits beyond the payments required to cover the debt. So if the manager takes on a risky venture and it succeeds, the bond holders get their same interest payment and the owners receive a huge bonus. If the project fails the company goes bankrupt and the managers receive no bonus and the bond holders loss all of their investment.

Solving the Moral Hazard Problem in Debt Finance  A good contract can limit the effects of moral hazard on debt financing. The contract can stipulate limits too the amount of risk the company can take on. This can be done by limiting what good and services can be purchased with borrowed funds. Many loans stipulate what can an cannot be done with the funds. This is why car loans require the borrower to purchase full insurance coverage, or why students who take out student loans are required to be enrolled in a certain number of credit hours. The lender wants to make sure the funds are being used in the proper manner.

11.3  Financial Intermediaries and Information Costs

Information costs make direct finance expensive and thus difficult to obtain. This generates the role of indirect financing and financial intermediation. Much of the information collected by intermediaries is used to reduce information costs and the effects of adverse selection and moral hazard. To reduce adverse selection, potential borrowers are typically carefully screened. To minimum moral hazard, all borrowers are carefully monitored and the penalties are imposed on borrowers who violate their financial obligation. Let’s take a look at how banks reduce information costs.

11.3.1  Screening and Certifying to Reduce Adverse Selection

Before getting any type of loan, a potential borrower must fill out an application. Typically this application will require information, like a social security number, which can be used to gather your credit history and credit score. This credit score tells a lender how likely you are to repay a loan. The higher the score the more likely you are to pay back the loan. Once this information is verified, a borrower with a higher credit score will have access to larger and/or lower interest rates.

Banks also use other types of information beyond your loan application. Many banks look at patterns in your checking or debit card accounts. They can learn a great deal about your habits and gauge certain types of risks for the bank. To put is bluntly, banks gathered tons of information, have specialist who can interpret this information, and can effectively minimize adverse selection problems.
11.3.2 Monitoring to Reduce Moral Hazard

To minimize moral hazard problems, banks also use specialists monitor individuals who take out loans and firms who issue stocks and/or bonds. Many times the bank will actually take part in the same investment strategy of the borrowing firm, (or use a venture capital firm to do the same thing). In this way the bank can more closely monitor the activities of the firm and monitor where it is that they use their borrowed funds.

Finally it should be noted that the market system itself can help to limit moral hazard problems. If a firm is mismanaged and the stock price falls, a new company can take-over and remove the managers. Because of this, it is generally in the interest of the managers to satisfy the desires of the stockholders of their company.

12 Chapter 12: Depository Institutions: Banks and Bank Management

Bank, or what we will call depository institutions, are the most obvious financial intermediaries. These firms accept deposits from savers and make loans to borrowers. What distinguishes banks from non-depository institutions is their primary source of funds, their liabilities. These firms include commercial banks, savings and loans, credit unions, and other banking institutions.

Banking is a business which provides it’s customers a variety of services. First, they provide accounting and record-keeping services. Second, they provide access to the payments system allowing customers to turn their assets into means of payments. Third, they pool the resources of several savers together in order to provide loans to borrowers. Finally, they provide diversification services which allow customers to invest their assets in a diversified portfolio which the bank buys and sells in the financial market.

As a business a bank strives to profit from each of these services. Our goal for this chapter is to see how banks accomplish this goal. We will examine the business of banking and see where banks get their funds and what they do with them. We will also examine the risks involved in banking and how banks attempt to manage this risk.

12.1 The Balance Sheet of Commercial Banks

Given the general size of these institutions we will focus most of our discussion about one type of bank: a commercial bank. These institutions were designed to provide banking services to businesses. These banks allow firms to make deposits and draw from them quickly. Most commercial banks offer accounts to individuals, but the bulk of the activity still goes through the commercial sector. We will start our examination of banking by looking at the balance sheets of the banks. A balance sheet is simply a list of assets broken into two categories: the sources of funds (liabilities) and the uses of funds (assets). A bank’s balance
sheet must state that

\[
\text{Total Bank Assets} = \text{Total Bank Liabilities} + \text{Bank Capital}
\]

Banks obtain their funds through the deposits of their customers and borrowing from other financial institutions and through financial markets. These funds are then used to make loans, purchase securities, and hold cash. The difference between assets and liabilities is considered the bank’s net worth. The profit for a bank comes from the service fees it charges as well as the interest rate differential between what is pays its liabilities and what it charges its assets. Let’s look at these things in more detail starting with a bank’s assets.

12.1.1 Assets: Uses of Funds

The asset side of a bank’s balance sheet summarizes what a bank does with the funds they collect. We generally break the uses into four categories: cash, securities, loans, and all other assets. In general about one-fourth of a bank’s assets is held in securities, another 65 percent are held as loan, and the last 10 percent is held as cash and other assets. These other assets include building owned by the bank and item repossessed from defaulted loans. At any one time the total assets of banks is roughly 2/3 of nominal GDP.

**Cash Items** Cash assets are of three types. The first and largest portion of cash assets are called reserves. Banks hold reserves because regulations require them to do so and because it an appropriate business practice. Reserves include the cash inside a bank’s vault and their deposits with the Federal Reserve. Cash is obviously held in a bank because their customers need to make cash withdrawals.

The remaining cash items include checks received by the bank that have yet to be cleared by the issuing bank. Example a paycheck. It takes time for your bank to retrieve the funds from your employer’s bank. Also, some banks do hold deposit accounts at other banks. They keep them as sort of for emergency cash on hand.

It should be noted that since banks receive no interest from cash and it is expensive to hold, they will try an minimize their cash assets.

**Securities** The second largest part of a bank’s assets are it’s securities. US banks hold a substantial amount of bonds (not allowed to hold stock). The bonding of banks is mostly US Treasuries while the remaining come from state and local bonds. These bond can be quickly sold and turned into cash just in case the bank needs extra cash. Sometimes these bonds are called secondary reserves. Over time, we have seen the importance of securities fall in bank portfolios.

**Loans** Loans are the primary source of assets for banks. Loans typically account for roughly 2/3 of a bank’s total assets. These loans are broken into
a total of five categories: business loans (also called commercial and industrial
loans), real estate loans, consumer loans, interbank loans, and other types.
These loans are generally very liquid and are sometimes traded between banks.
This is especially true for mortgages and auto loans.

The primary difference between different types of banks is centered around
the different types of loans the bank uses for its assets. Commercial banks
specialize in commercial loans, savings and loans specialize in mortgages, and
credit unions specialize in consumer loans. Over time we have seen commercial
banks become more active in the mortgage market as the market for mortgage
backed securities has developed.

12.1.2 Liabilities: Sources of Funds

To finance its operations, a bank needs funds. These funds are gathered from	hree place: deposits of customers, bank charges, and borrowing from financial
markets. To bring about sufficient deposits, bank typically offer their customers
a variety of option in term of types of deposit accounts. There are basically two
general types of deposit accounts: transaction and non-transaction accounts.
Transaction accounts, also called checkable accounts, make up a small, roughly
10 percent, of a bank’s total funds. Non-transaction accounts make up 60 per-
cent of total liabilities which the final 20 percent coming about through borrow-
ing in finance markets.

Checkable Deposits  Checkable deposits are simple accounts which bank cus-
tomers are allowed to write checks and use this account as a means of payment.
Over time the percent of liabilities tied to checkable accounts has been decreas-
ing. These accounts typically pay little or no interest, so customers usually
strive to keep their checkable deposits low, and invest their remaining assets in
accounts which have a high return.

Nontransaction Deposits  Non-transaction deposits include standard sav-
ings accounts and time deposits which are simple CDs with fixed maturity. Cer-
tificates of deposit (CD) generally come broken into small CDs (under $100,000)
and large CDs (at or over $100,000). Large CDs can be bought and sold like
several other financial instruments on the financial market. When a bank needs
funds, one of the first steps is to issue larger CDs.

Borrowings  The final portion of bank funds comes from borrowing in the
financial market. Today, borrowing accounts for over 20 percent of a bank’s
liabilities. Banks typically preform this borrowing in three ways. First, the
bank could borrow the funds directly from the Federal Reserve in what is called
discount loan. We will talk more about this later even though banks do little
of this type of borrowing.

The second type of borrowing is between banks. At any one time, some
banks will have extra cash on hand (excess reserves) which they can supply to
the market. On the other side, some bank need cash and will borrowing the excess reserves of the other bank. This borrowing is done in the federal funds market. Loan do no have collateral so the two banks involved in any transaction mush trust each other.

The final type of borrowing works through repurchase agreements. This is typical a short-term collateralized loan where securities are exchanged for cash. In this transaction, it is understood that it will be reversed at some future date. When I say short-term I mean it, most of these loans are overnight. The following table summarizes the bank balances sheet of US commercial banks.

<table>
<thead>
<tr>
<th>Assets</th>
<th>Total(billions)</th>
<th>Percent of Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cash Items</strong></td>
<td>321.6</td>
<td>4.1</td>
</tr>
<tr>
<td>Securities</td>
<td>1893.5</td>
<td>23.9</td>
</tr>
<tr>
<td>US Government</td>
<td>1170.1</td>
<td>14.8</td>
</tr>
<tr>
<td>State and Local Governments</td>
<td>722.8</td>
<td>9.1</td>
</tr>
<tr>
<td><strong>Loans</strong></td>
<td>5044.6</td>
<td>63.7</td>
</tr>
<tr>
<td>Commerical and Industrial</td>
<td>887.1</td>
<td>11.2</td>
</tr>
<tr>
<td>Real Estate</td>
<td>2411.6</td>
<td>30.5</td>
</tr>
<tr>
<td>Consumer</td>
<td>672.3</td>
<td>8.5</td>
</tr>
<tr>
<td>Interbank</td>
<td>364.7</td>
<td>4.6</td>
</tr>
<tr>
<td>Other</td>
<td>708.9</td>
<td>9.0</td>
</tr>
<tr>
<td><strong>Other Assets</strong></td>
<td>655.1</td>
<td>8.3</td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td>7914.8</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liabilities</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Checkable Deposits</strong></td>
<td>645.0</td>
<td>8.9</td>
</tr>
<tr>
<td><strong>Nontransaction Deposits</strong></td>
<td>4487.7</td>
<td>62.3</td>
</tr>
<tr>
<td>Saving Deposits and Time Deposits</td>
<td>3340.9</td>
<td>46.3</td>
</tr>
<tr>
<td>Large Time Deposits</td>
<td>1146.8</td>
<td>15.9</td>
</tr>
<tr>
<td><strong>Borrowings</strong></td>
<td>1589.0</td>
<td>22.0</td>
</tr>
<tr>
<td>From US Banks</td>
<td>459.1</td>
<td>6.4</td>
</tr>
<tr>
<td>For Foreign Banks</td>
<td>1129.9</td>
<td>15.7</td>
</tr>
<tr>
<td><strong>Other Liabilities</strong></td>
<td>487.4</td>
<td>6.8</td>
</tr>
<tr>
<td><strong>Total Liabilities</strong></td>
<td>7209.1</td>
<td></td>
</tr>
</tbody>
</table>

**Assets-Liabilities = Net Worth** 705.7

**12.1.3 Bank Capital and Profitability**

Remember a banks net worth is also called bank capital. If a bank was sold and all of its assets were used to payoff outstanding liabilities, this bank capital is what would be left over. Thus bank capital is the bank owners stake in the company. Capital is the protection banks have against a sudden drop in the value of their assets.
The loan loss reserves are an important part of bank capital. These reserves represent an amount of money set aside to deal with the losses associated with defaulted loans. If a loan goes into default, the bank will eventually write off the loan and remove is from the balance sheet by simply deducting this loan from bank capita. According to the previous table there was about $7.2 trillion in liabilities to purchase $7.9 trillion in assets. That leaves on $700 billion in bank capital. So in terms of debt to equity. We find that the banking sector has a roughly 10 to 1 debt to equity ratio. This implies that there is a substantial amount of leverage in the system.

There are several measures of the profitability of a bank. The first is called the return on assets (ROA). The return on assets equals the bank’s net after tax profit divided by the total assets of the bank

$$ROA = \frac{\text{Net After Tax Profit}}{\text{Total Bank Assets}}$$

This calculation measures how efficiently a bank is using its assets. However, if there is an outside investor looking at the bank the return on assets is less important than the return on owning the bank. The bank’s return to the owner is measured by the return on equity (ROE). This return is calculated as net after tax profits divided by bank capital.

Not too surprising, just as with other equity investment, the return is related to the amount of leverage (borrowing) in the bank. On common measure of leverage is the ratio of bank assets to bank capital. Using this idea we can tie together the ROA and the ROE. Specifically,

$$ROA \times \frac{\text{Bank Assets}}{\text{Bank Capital}} = \frac{\text{Net After Tax Profit}}{\text{Total Bank Assets}} \times \frac{\text{Bank Assets}}{\text{Bank Capital}}$$

$$= \frac{\text{Net After Tax Profit}}{\text{Bank Capital}}$$

$$= ROE$$

The typical US bank has a ROA of 1.2% with a ROE that is between 12 and 14 percent higher than that. Currently, the ROE tends to be larger for bigger banks and this could explain the tendency bank mergers to make even bigger banks.

Another measure of bank profitability is to measure the net interest income of the bank. A banks deposits and borrowing create interest expenses that must be paid by the bank. Loan and securities create interest income that flows into the bank. The difference between the two is net interest income. This is typically expressed as a percentage of total assets called the net interest margin. This is the interest rate spread associated with the bank which is simply the weighted average of the interest rate received on assets and the interest rate paid on liabilities. A well-run bank will have a relatively high net interest margin and high interest income. This also gives us an insight into the future profits of the bank give the time associated with loans being repaid.
12.1.4 Off-Balance Sheet Activities

Banks also conduct other types of business which do not appear on their balance sheet. Many of these are fee based services where the bank is reducing transactions or information costs for other parties. Sometimes firms and banks make loan commitments where is exchange for a bank fee, the bank agrees to give a firm a loan as a sign of credit worthiness. This agreement is no where on the balance sheet and is not until the loan is actually utilized that is does appear on the bank’s balance sheet. Sometimes these loan commitments are never actually exercised they simply show that the firm has solid credit.

Letters of credit are another popular off-balance sheet activity. These letters guarantee that a customer is going to make a payment. The bank is absorbing the risk of the customers default on the payment, and as compensation the bank receives a fee. This letter of credit activity is associated with commercial and government bank customers. Because these off-balance sheet activities generally imply added risk to the bank, these types of transactions are careful monitored. The financial does not want bank to take on too much risk that is hard to track.

12.2 Bank Risk: Where It Comes from and What to Do about It

The banking industry is a risky business because of the high leverage associated with banks and the type of business they are conducting. Throughout the several types of services a bank offers, it is exposed to several different types of risks. Among these include the risk that loans will not be repaid, customers will suddenly withdraw tons of cash, the interest rate changes, and the securities market behaves poorly. Each of these types of risk are typically categorized as one of the following: liquidity risk, credit risk, interest-rate risk, and trading risk. Let’s looks at these risks more closely.

12.2.1 Liquidity Risk

All banks face the risk that their customers will want to cash out their deposits. This is called liquidity risk. Banks face liquidity risk on both sides of their balance sheet. The threat of sudden deposit withdraws is a liabilities side liquidity risk. The asset side of liquidity risk comes most from the off-balance sheet activities. Whenever a bank makes a loan commitment, it needs to make sure that the cash for the commit is ready and available for withdraw.

If a bank cannot meet the funds requested by its customers, it runs the risk of bank failure. Because of this threat, bank managers are constantly trying to manage liquidity risk. Let’s look at an example of managing liquidity risk. The following is an example of a simple bank’s balance. Remember the two sides of
the balance sheet must always be equal.

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserves</td>
<td>Deposits</td>
</tr>
<tr>
<td>$15 million</td>
<td>$100 million</td>
</tr>
<tr>
<td>Loans</td>
<td>Borrowed Funds</td>
</tr>
<tr>
<td>$100 million</td>
<td>$30 million</td>
</tr>
<tr>
<td>Securities</td>
<td>Bank Capital</td>
</tr>
<tr>
<td>$35 million</td>
<td>$20 million</td>
</tr>
</tbody>
</table>

The bank’s assets include $15 million in reserves. Banking regulations require that a bank hold a portion of their assets either as cash or non-interest deposits at the Federal Reserve. That required portion is typically measured as a percentage of deposits. Let’s assume the require reserves are 10% of deposits. For this bank with $100 million in deposits the require reserves are $10 million. This bank has $5 million in excess reserves.

Now let’s look at liquidity risk. What happens if a customer comes up at withdraws $5 million? Not much. since the bank has $5 million in excess reserves, the cash can simply be withdrawn and the reserve are still above the required ratio. Why liquidity risk is an issue is because banks do not like holding excess reserves. This is simply cash which is earning no interest for the bank. Banks typically find ways to keep excess reserves as low as possible. So, let’s suppose that bank’s balance sheet looks like the following before the $5 million withdraw.

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserves</td>
<td>Deposits</td>
</tr>
<tr>
<td>$10 million</td>
<td>$100 million</td>
</tr>
<tr>
<td>Loans</td>
<td>Borrowed Funds</td>
</tr>
<tr>
<td>$100 million</td>
<td>$30 million</td>
</tr>
<tr>
<td>Securities</td>
<td>Bank Capital</td>
</tr>
<tr>
<td>$40 million</td>
<td>$20 million</td>
</tr>
</tbody>
</table>

In this case, reserves held by the bank match the required reserves of 10%. Now suppose a customer comes in to withdraw $5 million. What does the bank do? They can not simply give out the cash and note adjust their portfolio. There reserve are now down to $5 million which is less than 10% of the remaining $95 million in deposits still at the bank. This means that bank is required to hold $9.5 million in reserves, they need to generate $4.5 million more in reserves. The quickest way to do this is to sell securities and use the generated cash for reserves.

A second option is for the bank to sell some of its loans to another bank and take the cash for reserves. This is a little more difficult in that only some types of loans can be sold and finding a buyer can be difficult from time to time. Another possibility is not to renew some outstanding loans that are up for renewal. The additional reserves can also be made by adjusting a bank’s liabilities. The bank could borrow funds from another bank and put the cash into reserves or attract new deposits putting all the funds into reserves. Today’s bankers prefer liability adjustments to solving reserve shortfalls. This allow reserves to be adjust without selling bank assets and making the bank effectively smaller.
12.2.2 Credit Risk

Banks also face the risk that some borrowers will not repay their loans, and no matter how creditworthy their customer are, there will always be some risk of default. This is called a bank’s credit risk. To manage this risk, banks use a variety of options. First, banks tend to stay well-diversified by using several different types of loans. They also specialize in credit risk analysis to help identify the most creditworthy loan applicants before give out a loan. The most difficult aspect of lending is problems of asymmetric information. Because of adverse selection, it is typically the most risky projects that will seek out a bank loan. Also, there is an incentive to take on too much risk once they receive the loan, thus we also have a moral hazard problem. Banks attempt to control these problems with careful screen and the use of collateralized loans. This limits the downside risk for the bank.

12.2.3 Interest-Rate Risk

Sometimes the liabilities and the assets of a bank do not match. This is mainly because there is a tendency for bank liabilities to be short-term and bank assets to be long-term. This mismatch in timing creates interest-rate risk. When the interest rate rises, banks face the risk that the value of their assets will fall more than the value of their liabilities. Think about taking out a mortgage at your bank where you have a saving account. When the interest rate rises, your payments on the mortgage (assuming a fixed-rate mortgage) do not change, but the interest paid on your savings account tends to rise. This kind of shock places a squeeze on the interest gap. Thus, this interest hike cuts into the interest income and thus the profit of the bank. To manage this risk, bank will typically try and restructure their assets into long term securities or make more loan based on an adjustable interest rate. The problem with adjustable rate loans is that although interest-rate risk falls, credit risk rises because so customers will be unable to make the larger payments under a higher interest rate. Knowing this, most banks use asset restructuring to get the assets and liabilities on an equal path of sensitivity relative to the interest rate. Besides restructuring assets, banks also use derivatives, interest rate swaps to manage interest-rate risk. This involves trading a fixed interest rate payment for a floating interest rate payment.

12.2.4 Trading Risk

It used to be standard practice that banks took in deposits and made loans which were held by the bank until completely repaid. Today banks are active traders of securities, derivatives, and loans. Banks use their capital in these markets to generate mor profits. However, trading financial instruments is risky. Sometimes price of an instrument can change and this type of risk is called trading risk.

Some large banks have lost billions of dollars because of trading risk. This risk is substantial for banks because of a moral hazard problem in that traders have incentives to take on more risky trades in an attempt to generate large
profits for the bank (salary package could be tied to this). The trader typically does no face any downside risk to their salary while the bank must pay for any losses. The type strategy to mitigate this risk is careful monitoring of traders and putting a limit on the amount of risk they may engage in.

12.2.5 Other Risks

Beyond liquidity, credit, interest-rate, and trading risks, banks face a number of different other risks. A bank that operates internationally will face foreign exchange risk. This comes about by holding assets in one currency and liabilities in another. A US bank that holds US dollar denominated liabilities may purchase bonds issued in Japan which are denominated in yen. When the exchange-rate between the dollar and the yen moves, the value of the liabilities is effective changed. To avoid this risk, banks typically try to match the denomination of their liabilities and assets.

Sovereign risk comes about through the possibility that some foreign borrowers may not repay their loans because their government will not allow them to. This happens when the foreign country has difficulty in raised US dollar denominated funds. Banks have very little they can do in the face of sovereign risk. The best strategies are to keep well diversified across countries, or refuse to do business in countries where is appears sovereign risk can be expected.

The final type of risk faced by banks is called operational risk. These are simply the risks associated with the day-to-day running of the bank. These things include computer failures, building fires, and events like 9/11 where some banks were forced to close their doors. The control of operational risk is one of the main objectives of a bank manager. In general, these other risks are relatively small compared to those discussed early in this section of the chapter.

The following table summarized bank risks and typical bank responses.

<table>
<thead>
<tr>
<th>Type of Risk</th>
<th>Source of Risk</th>
<th>Recommended Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquidity Risk</td>
<td>Sudden Deposit Withdraws</td>
<td>Hold sufficient cash</td>
</tr>
<tr>
<td>Credit Risk</td>
<td>Default by Borrowers</td>
<td>Manage assets-sell securities or loans</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manage liabilities- attract deposits</td>
</tr>
<tr>
<td>Interest Rate Risk</td>
<td>Mismatch in Maturity between</td>
<td>Diversify</td>
</tr>
<tr>
<td></td>
<td>Assets and Liabilities</td>
<td>Better screening</td>
</tr>
<tr>
<td>Trading Risk</td>
<td>Trading losses</td>
<td>Monitor Moral Hazard Problems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use derivatives, interest rate swaps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monitor Traders, risk management</td>
</tr>
</tbody>
</table>

13 Chapter 13: Financial Industry Structure

Note to be covered
14  Chapter 14: Regulating the Financial System

Everyday it seems as if some country is going through a financial crisis. Over the past 25 years, 93 countries have experienced a total of 117 systemwide and 51 smaller financial disruptions. These 94 countries span the entire global geographically and economically. When a financial crisis occurs, some sort of government intervention takes place. Often times the government takes on the liabilities of the financial system so that the individual depositors do not lose their money. These interventions have positive and negative effects and are quite costly. The Argentina crisis of the early 80s and the Indonesia crisis of the late 90s both cost those countries about 55% of their national GDP.

As a result of financial crisis countries typically suffer in terms of their economic growth. There is a strong negative correlation between the size of a financial crisis and the economic growth of a country. The larger the financial crisis, the lower the growth. Why is growth lower? Typically this is a result of a misallocation of capital that is disproportionately diverted to bailing out failed banks. These funds could have been better utilized in expands the best firms and banks. Instead the money is used to support the inefficient banks. Thus, the potential and future growth of a country can be reduced by a capital misallocation.

Financial crisis are common mainly because these systems are naturally fragile. However, a smoothly running financial system is a cornerstone of an efficient economy. The government knows this fact and as a result the financial sector is subject to many rules and regulations. Banks are constantly working to satisfy government oversight.

This chapter will broaden our understanding of regulations in the financial system by looking into three things. First, we will study the reasons of why the financial system is so fragile. Second, we will look into some of the standard safety nets which the government imposes to help the stability of the financial system. Finally, we will study the regulatory environment surrounding banks.

14.1  The Sources and Consequences of Runs, Panics, and Crises

A market economy is a land of opportunity. Every individual has an opportunity to succeed and unfortunately to fail. More small business fail than you may believe. Only one in ten small businesses survive three years. Everyday new businesses open and unpopular ones close. Banks are just another type of business with the same inherit risk. We really would not want an economy where only one in ten banks lasted only three years. The failure of bank is much more devastating than the failure of a retail store. When the retail store closes, individuals only lose a place to shop. When a bank fails, individuals can lose their deposits and thus there ability to make purchases and pay bills. This is while many government regulations are designed to safeguard banks.

The fragile financial state of a bank comes from the goal of providing liquidity to depositors. Any customer can walk into a bank and ask for their deposits to
be turned into cash. If a bank does not have the ability to offer this liquidity is fails. Banks not only provide immediate liquidity, they also provide this liquidity on a first-come first-serve basis. This can have important implications on the potential actions of depositors.

Suppose some depositors lose confidence is a bank’s ability to meet their withdrawal requests. This could result in a hearing that one of the bank’s largest loans goes into default. If this is the case, a bank’s assets no longer covers its liabilities. This makes the bank look insolvent. There will be a growing fear that the bank may run out of cash and close. Because of the first-come first-serve promise, depositors will rush to the bank to convert their deposits into cash before other customers arrive. Such a bank run can lead to a bank failure.

What really matters during a bank run is whether a bank is solvent, it is whether or not the bank is liquid. Solvency mean that a bank’s assets exceeds its liabilities. Liquidity refers to the bank’s ability with sufficient reserves to meet the withdrawal demands of its depositors. A typical event would be that rumors of a bank’s insolvency leads to a bank run with makes bank illiquid.

When a bank fails, depositors can lose some or all of their deposits. Governments will typically try to step in and insure depositors against these losses. This reaction comes from a concern that a single-bank failure could turn into a systemwide bank panic. Asymmetric information is the main reason we see bank runs turn into bank panics. Depositors at a bank are like the buyers in the used-car market. They can not tell the difference between a good bank and a bad bank. So when one bank gets into trouble, depositors at other banks begin to wonder about the stability of their own bank. If enough customers lose faith in their own bank, you could have other profitable banks fail as well and we know have a snowball effect.

It should be noted that bank runs and panics can come as a result of rumors. However, most historical events point to these events coming from real economic shocks. The financial health of a bank is highly procyclical. Remember a bank’s assets are made up of mostly outstanding loans and securities. In an economic downturn asset prices typically fall so this portion of bank assets loses some value. At the same time, firm’s typically have more difficulty in paying their financial obligations and thus the default rate on loans is typically higher. Of all eleven business cycles that occurred between 1870 and 1913, 7 or them were accompanied by massive bank failures. The great depression in the 1930 also saw several bank fail. Bank panics are typically the result of real events.

14.2 The Government Safety Net

There are three way the government gets involved in the financial system:

1. To protect investors.

2. To protect bank customers from monopolistic exploitation.

3. To ensure the stability of the financial system.
The government needs to take on the obligation of protecting the small investor. These investors are unable to judge the soundness of their financial institutions. The market can only do some much to ensure that competition controls the activities of financial institutions. The government uses its rules and regulation as protection for the small investor.

In a related issue, the main reason why financial institution tend to have market power is because of the tendency for these markets to look like oligopolies. These markets have a small number or large firms which control most of the market. Because monopolies are typically inefficient, the government tends to step in to prevent these firms from getting too large.

Finally, as stated before, the financial system tends to be fragile because of liquidity risk and asymmetric information problems. A financial firm tends to collapse much quicker than a industrial firm which tends to lose its customers gradually.

The government typically uses a combination of rules, regulations, and monitoring to accomplish these three goals. This section will discuss some of the standard government strategies. This discussion will begin by look at the unique role of the cornerstone of the financial system: depository institutions (banks).

14.2.1 The Unique Role of Depository Institutions

Banks tends to receive a disproportionate amount of the government’s attention. This is because of the huge economic importance of banks and the unique problems they face. If the banking system were to suddenly fail, most households would lose access to the payments systems and we would no longer be able to make purchases or pay bills. This would cause the economy and probably the country to collapse. Other financial institutions like insurance companies do not face this burden. Bank are also very fragile, they always face the possibility of a bank run.

The fragile nature of banks is really important considering the fact that banks are typically financially tied together through their balance sheets. The average banks keeps 4.5% of its assets in the form of interbank loans. If a bank fails, it would default on its loans at other banks putting them in financial distress. All of this issue make the banking sector a unique feature in the economy.

14.2.2 The Government as Lender of Last Resort

The best way to stop a bank failure from turning into a bank panic is to make sure that solvent banks can meet the withdraw demands of their customers. The typical government response to this idea is to behave as the lender of last resort. Basically the government would lend liquidity to banks who needed it. The solvent banks who need cash would simply borrow as much case from the government as needed. In return the bank would use its bank capital as collateral for the loans and a high interest rate would be charged to motive the
bank to keep sufficient reserves in the future. This strategy has been successful in mitigating some bank runs.

However, the lender of last resort is not a guaranteed fix. Sometime banks just simply to not take advantage of this opportunity. Another issue is that the government has its own asymmetric information problem. It has a hard time determining which banks are solvent and insolvent. The government only wants to give loans to solvent institutions which are simply illiquid and their shortage of reserves appears to be a temporary phenomena. Since government officials will also be anxious to keep the crisis from getting any worse, they will typically be generous with the lending requirements for banks. The problem is that bank managers know this and some will take advantage of the situation. The government looks like it will bail out a bank no matter why it is having trouble. This creates incentives for managers to take a highly risky position in the bank. Thus the asymmetric information creates a moral hazard problem for bank managers which will tend to be too risky.

14.2.3 Government Deposit Insurance

In response to the inability of the Federal Reserve to slow the bank panics of the 1930s, Congress instituted deposit insurance. The Federal Deposit Insurance Company (FDIC) guarantees that a depositor will receive the full amount of their deposits up to some maximum amount even if a bank fails.

Here is how this insurance works. When a bank fails, the FDIC resolves this by either closing the bank or finding someone to buy the bank. The first approach is called the payoff method. The FDIC simply takes on the responsibility of the bank and pays off all the deposits. The FDIC will then attempt to sell off the banks assets in hopes to recover some of these costs. Under this approach, some depositors will still lose some of their deposits, anyone with over $100,000.

Another approach is called the purchase-and-assumption method. In this method, the FDIC finds another firm that is willing to take over the failed bank. Since the failed bank is insolvent, has negative bank capital, the FDIC will typically pay the purchasing firm a fee for taking over the bank. Unlike the first approach, depositors are completely protected from losing their deposits. The only thing that will happen is that the bank may close one day and open the next day under a new name.

14.2.4 Problems Created by the Government Safety Net

The first problem of deposit insurance is that the protected depositors have no incentive to monitor the behavior of their banks. Knowing this, bank managers take on riskier asset positions. Thus, the deposit insurance creates its own moral hazard problem. We have seen this behavior by looking at balance sheets over time. The proportion of bank capital has fallen significantly over time. More and more bank assets are tied into securities markets which are more risky than simply holding the assets in the bank.
This is not the only issue. Government officials tend to pay attention to the largest banks first and tend to gear their regulations to help protect those banks. Thus, there is a belief in a too-big-to-fail policy that has the negative effect of limiting competition in the banking sector. Once again these large banks know that the government will bail them out first and this gives managers another incentive to take on risk. Thus it simply make the moral hazard worse at large banks.

14.3 Regulation and Supervision of the Financial System

Governments use a mix of three general strategies to help ensure that the risks created by the government safety net stay limited:

1. Regulation: Establish a set of specific rules for bank managers to follow.

2. Supervision: Provide oversight of financial institutions.

3. Examination: Uses specialists who examine bank records to provide information on the bank’s operations.

The goal of government intervention is not to eliminate all risks. That is actually one of the purposes for financial institutions. The goal of government interventions is to limit the effects that bank failure has on the public. The first regulation is that any potential bank manager is carefully screened. All new banks go through a thorough filter. Once a bank has been opened, it is given a long list of regulations which restrict the assets that the bank may hold, require the bank to hold a minimum level of capital, and makes public information about the bank’s balance sheet.

Not only does the government give out regulations, it also is in charge of enforcing them. Thus banks are under constant monitoring from government supervisors. They monitor, inspect, and examine banks and make sure they are complying to all the stated regulations.

These supervisors come from several different agencies which include: the U.S. Treasury, the Federal Reserve, the FDIC, and state banking authorities. The bank has some control on the make-up of its supervisors. It can choose to be a national or a state bank. It can also choose to be part of the Federal Reserve System or not. There are situations where bank managers do threaten the switch if they do not like what the supervisors say. Given all of this we can actually think of banking regulation as a competitive market.

This competitive regulatory market has two main implications. First, regulators have incentives to innovate and improve the quality of the regulations they write. Second, manager unfortunately have an incentive to search out the most lenient regulator.

14.3.1 Restrictions on Competition

Another goal of government policy has been to keep banks from growing too big and gathering substantial market power. These banks would then place a serious
strain on the financial system if one fails and without competition they could take advantage of their customers. While many regulations have become more lenient there are still limits on bank size. All bank merger require government permission. For a merger to be approved, two things must not happen. First, the merged banks can not have a monopoly over any geographical area. Second, small bank customers can not be exploited by a larger bank.

At the same time, the government also worries about banks becoming too competitive. In this situation the profits margins for banks become very small and they are at greater risk for failure. To try and generate some extra profits some bank managers will take on riskier asset positions.

The government addresses this moral hazard problem in two ways. First, restrictions on competition. Second, banks are prohibited from buying certain securities and types of loans.

14.3.2 Asset Holding Restrictions and Minimum Capital Requirements

The easiest way to prevent bank managers from taking on too much risk is to restrict the banks’ balance sheets. The two most common restrictions are:

1. Restrictions on types of assets the bank can hold
   (a) Commercial banks can not hold common stock.
   (b) All bonds must be of investment grade.
   (c) No one account can make up more than 25 of bank capital.
   (d) Federal Reserves requires no one interbank loan make up more than 25 percent of bank capital

2. Requirements to maintain a minimum level of bank capital.
   (a) The ratio of capital to assets must be maintained above a certain level.
   (b) The amount of bank capital must be proportional to the riskiness of the bank’s operations.

14.3.3 Disclosure Requirements

Banks must disclosure many types of information. All of these things are meant to keep problems of asymmetric information under control.

1. All cost of products need to be reported to customers in a standardized way. (Cross bank comparisons)

2. Report balance sheet to the financial markets.

3. A fees must be reported.
This freedom of information allows depositors, regulators, and other financial institutions to quickly gauge the quality of a bank’s balance sheet. This allows customers to easily shop among banks and regulators to quickly penalize banks that are taking on too much risk.

14.3.4 Supervision and Examination

The enforcement of banking regulations is done through supervision which relies on some monitoring and some inspecting. All banks must file quarterly reports called call reports which give detailed information about the entire financial operations of the bank. Experts then take these reports and analyze them. They will be looking for banks which appear to be falling apart.

Some on-site examination are also performed. All FDIC institutions are examined once a year. These examinations are unannounced and get into every aspect of the bank. At the largest institutions, examinations are performed continuously.

The most important part of the examination looks into past-due loans. Bank managers are reluctant to write-off bad defaulted loans which are taken off of bank capital. Part of an examination is done to make sure that defaulted loans are properly measured in a bank’s balance sheet.

14.3.5 The Challenge to Regulators and Supervisors

Regulators and supervisor face many challenges when looking into the operations of bank. Given the international nature and technological innovations in the banking sector, it becomes tough to define an on-site examination. Another difficulty is the growth in the number of financial instruments. Since we can buy assets for almost any kind of risk, it becomes difficult to decipher a bank’s balance sheet which could be loaded with complex financial assets. Thus, determining a bank’s financial health is not always clear.

Deregulations at the federal level have also made supervision more difficult. Banks are now allowed to have branches all over the country. Also functional restrictions for certain types of banks have become fuzzy. There are now organizations like Citigroup who perform all the functions of a typical commercial bank plus offer insurance and securities like nondepository institutions.

To resolve some of these issues regulators are trying to cooperate more. Each type of financial regulator needs to communicate with other types in order to gauge the overall health of these complex financial institutions.

15 Chapter 15: Central Banks in the World Today

Every six weeks, sometimes in an emergency, the financial markets are watching the Federal Open Market Committee of the Federal Reserve. This group announces policy towards interest rates. Depending on the announcement, the
market immediately incorporates this information and usually believes that the policy is used to stabilize financial markets.

The Federal Reserve (Fed) is the central bank of the United States. The main objective of the Fed is to work to make sure that the financial system functions smoothly and the average person can carry on their business without worry. The United States Fed is not the only central bank. Today their are over 170 central banks in the world in nearly every country. For example, in 1990 the 15 Soviet republics became independent. Within a year 12 of them had central banks and by 1993 all 15 did.

Despite the relative importance of the central bank. Many people do not understand the organization and function of a central bank. The goal of this chapter is to cover some of the basics.

15.1 The Basics: How Central Banks Originated and Their Role Today

The central bank started out as the government’s bank. Over the years, the role of the central bank has evolved and added several other functions. Today’s central bank not only serves as the government’s bank, but also provides many services to the financial sector. It is know more of a banker’s bank. Let’s look into how this comes about.

15.1.1 The Government’s Bank

Just like every other economic agent in the economy, the government has financial needs. To solve these needs, government form central banks. Central banks in some form have been around since the 1600s. It was not until the 20th century that central banks became the norm. The US Federal Reserve was not established until 1914. As the importance of the government and the financial system grew, the need for a central bank grew as well.

As the government’s bank the central bank maintains an important monopoly in the issuing of currency. The central bank creates money. In the US, the Federal Reserve has the sole legal authority to print and issue dollar bills. With this ability comes the power to control the availability of money and credit in the economy. Most central banks go about controlling these by adjusting short-term interest rates. This activity by the central bank is called monetary policy. Today, the central bank uses its policies to stabilize economic growth and inflation. An expansionary policy, with low interest rates, raise both growth and inflation over the short-run. A restrictive policy keeps interests rates high with low growth and inflation. Will will discuss this in more detail in a later chapter.

The most important reason why governments want control over their currency is their need to control inflation. A high rate of money growth coincides with high inflation. Giving the power to print currency to someone else can be dangerous. Printing money can be profitable and thus there are incentives to print tons of money. Since the government is not a profit maximizing agency, this incentive is controlled. Countries are reluctant to give away their monetary
control. However, it is sometimes done. The European Union is an example where several countries are unified under one monetary agency. There are strict controls in place to keep inflation low and keep the risk associated with misused monetary policy low.

15.1.2 The Banker’s Bank

Government backing and large gold reserves made early central banks the most reliable banks in the economy. The notes issued by these banks were deemed more secure than those of smaller banks. This makes it easier for customers to turn their deposits into cash and make exchanges. This safety lead to many smaller banks to adopt the notes of the central bank.

The central bank provides many important services for the financial sector. These include:

1. Providing loans in times of financial distress.
2. Management of the payments system
3. Overseeing commercial banks and the financial system as a whole

First, the power of printing currency enable the central bank to be able to make loans when everyone else can not. In this regard the central bank can protect other banks from the effects of bank runs which increases the stability of the financial system. The central bank is the ”lender of last resort”.

Secondly, the central bank maintains a secure and efficient payments system. People need to make transactions which involve the transfer of funds between agents and banks. There is a need to keep this system as cheap and reliable as possible. Since banks keep reserves at the central bank, the central bank is a nature place for any interbank payments to take place. In 2003, the average amount of daily transactions that flowed through the federal reserve was $3 trillion.

Finally, we have seen the information problems that are inherit to the financial system. There is a need for an agency with can oversee the entire financial system, the central bank serves this role. Government are the only agents that are not subject to many of the incentive problems in the financial system.

Given all of this, there are still problems that surround central banks. First, they are under extreme political pressure and under extreme pressure to be competent. Any give to either pressure can lead to substantial problems for the economy.

On a final note we should be clear on what the central bank does not control:

1. Securities markets, though it does monitoring and participates.
2. The central bank does not control the government’s budget. This is fiscal policy which is generally separate form monetary policy.
3. The central bank does not have to directly answer to the government. The role of the central bank to the government is just like the role between an individual and their bank.
15.2 Stability: The Primary Objective of All Central Banks

As a government agency, many people often question the role of the central bank. In this case it is clear what role the central bank plays. In most cases, the financial system is stable, but there are episodes of volatility where the entire system can collapse. Even though the effectiveness of monetary policy can be debated, the general goal of monetary policy is stability in the financial system and the economy as a whole.

Central bankers work to reduce volatility by pursuing five specific objectives:

1. Low and stable inflation
2. High and stable real growth, together with high employment
3. Stable financial markets
4. Stable interest rates
5. A stable exchange rate.

It is important to realize that individual agents can do little to minimize economy wide risks. Instability in any macroeconomic variable generates risks for individuals inside the economy. The job of the federal reserve is to attempt to limit these risks. It should be known that it is likely impossible to achieve all five objectives at the same time. Many times the federal reserve must make trade-off decision between two alternatives. Let’s look at each of these objectives.

15.2.1 Low, Stable Inflation

It is widely believed that uncontrolled inflation stagnates an economy. This is why many central banks make their primary job the maintenance of price stability. That is, they strive to eliminate inflation. The main reason for eliminating inflation is standards. A pound should be a pound, a cup should be a cup, and finally it is believed that a dollar should be a dollar. The purchasing power of a unit of currency should remain stable over time. Maintaining price stability enhances the usefulness of money as a unit of account and a store of value.

Prices are an important piece of information in a market. So when prices are stable, information is easier to process and making transactions costs lower. This allows more mutually beneficial trades to be completed. When prices are moving, information is difficult to decipher. Does the price rise mean that demand rose, or is it simply a rise in the general price level of the economy? For an efficient economy, we need to know the difference.

Low inflation also brings about stable inflation. In general as inflation gets higher, it becomes more volatile which can prove bad for an economy. In some rare cases we can even see hyperinflation where prices double in a matter of months.

So, it seems clear that inflation needs to be low. How low? The answer is not clear. Zero seems to be too low. To maintain an inflation rate of zero
comes close to having a situation of deflation, where prices are actually falling. How could this be bad? Try repaying your existing debts in a world where your income and wages are actually falling. Tied to this, employers feel restricted in a world of zero inflation. Labor prices are generally downwardly rigid. So that even if prices for their goods were falling, they would be unable to reduce wages to keep the same profits. The only possibly would be to fire workers. Given these issues, it is generally believed that low positive inflation is desired.

15.2.2 High, Stable Real Growth

Another objective of monetary policy is to promote high stable growth by mitigating economic fluctuations associated with business cycles. Monetary policy attempts to control cycles by adjusting interest rates. The idea is that there is some long-run substantial level of production called potential output that depends on the productive resources of the economy. Growth in productive inputs leads to growth in potential output which is what is called substantial growth. The United States the average growth rate is about 3 percent. Over the short-run, growth can deviate from this trend. In recessions, the economy slows, unemployment increases and monetary policy responds by lowering interest rates.

When times are real good, the economy grows quickly and tends to overheat. These high growth spurts are followed by downturns. Because of these downturns, monetary policy will take a stance that keeps the economy from growing too quickly. So in an upswing, the central bank will raise interest rates to slow the growth.

The level of growth is not the only thing that matters. Stability matters. These are economic fluctuations are systemwide risks which are hard for agents to diversify away from. Risk and uncertainty make planning more difficult and thus could influence investment decisions. So, the central bank promotes stability to make future planning easier.

15.2.3 Financial System Stability

The Federal Reserves was initial established to stop the financial panics during the late 19th and early 20th centuries. The Fed has served as overseer of the financial system for years. Today, the central bank can use its policies and large reserves to help mitigate several types of risks that make the financial system volatile. An efficient economy is dependent on an efficient financial system. This allows for easier flows of payments between parties reducing costs and promoting more beneficial trades. A financial system collapse is just another systematic risk that the central bank is designed to control.

15.2.4 Interest-Rate and Exchange-Rate Stability

There are two more objectives that most central banks deal with: interest rate and exchange rate stability. These goals are usually secondary, but still important enough to briefly discuss.
It is clear why interest rate volatility is a problem. Every financial exchange involves a borrower and lender. Interest rate volatility makes the repayment of these transactions hard to measure and forecast. If interest rates fall too much after the transaction, the initial lender is going to receive much smaller interest payments than expected. If the interest rate rises too much the borrower pays out much more than expected. Both parties generally want stable interest rates.

Finally, central banks prefer stable exchange rates. Variable exchange rates make the revenues from foreign sales and the cost of purchasing imported goods hard to predict. For many of the same reasons that borrowers and lenders prefer interest rate stability. The same can be said about the exchange rate and two parties taking part in an international exchange. This is much more of an issue for developing economies where much more of their economy is tied into the international sector.

15.3 Meeting the Challenge: Creating a Successful Central Bank

The 1990s were a unique time for the global economy. Several countries went through a phase of low inflation, high growth, and with more stability than in the 1980s. The belief is that with the introduction of the internet, cell phone, and other technology. The level of sustainable growth actually got higher in the 1990s. Because of this monetary policy makers could keep interest rates low without a large threat from inflation. Also many central banks were reorganized. The Federal Reserve started to make its policies open in February of 1994. A regular announcement explaining the interest rate adjustments became an official part of the Fed in 2002. Some people believe that some of the economic performance of the 1990s can be tied back to the restructuring of the central bank.

Today there is a belief in what constitutes the best way to design a central bank and what to tell monetary policy makers to do. To be successful a central bank must:

1. Be independent of political pressure
2. Make decisions by committee
3. Be accountable to the public and transparent in communicating its policy actions
4. Operate within an explicit framework that clearly states its goals and the trade-offs among them

15.3.1 The Need for Independence

The idea of monetary independence is a fairly new idea since the central bank is actually a government agency. Independence from political pressure comes from two components. First, monetary policy makers must be free to control their
own budgets. If politician control the budget of the central bank, they have the power to get monetary policy to yield to their wishes. Second, the bank’s policies must not be reversible by anyone outside of the central bank. This is true about most of the central banks today. In the US the Federal Open Market Committee decisions can not be overturned by the President or Congress.

Why is this important? Mainly because the decision by the Fed may take years to work completely through the economy. Politician are not generally this patient, they want to simply get past the next election. Thus it is in the interest of politician to find short term gains that make voters happy for the next election. This can compromise the Fed’s objective of stability. This would lead to interest rates that were too low, leading to unsustainable growth and high inflation.

15.3.2 Decision Making by Committee

Monetary policy recommendations are made after careful consideration of significant amounts of information. The scope of the information is so vast, that it seems illogical to leave this decision to one person. So, many central banks make policy decisions by committee. Pooling of knowledge and experience reduces the risk that policy will be controlled by any one person’s beliefs. In the Federal Reserve, monetary policy is made by the Federal Open Market Committee.

15.3.3 The Need for Accountability and Transparency

The one downfall of monetary independence is that it is not democratic. Monetary policy makers do not answer to voters like politician do. So, how do we have faith that the central bankers are engaging in activities that are appropriate? To establish trust, central bankers did two things. First, they established a set of explicit goals which they were trying to achieve. Second, they would frequently report, to the public, their progress towards meeting their goals. This gives the central bank two things: accountability and transparency.

How banks go about assuring accountability and transparency differs from country to country. Some banks uses specific targets from inflation rates. Other simply state more broad things like ”price stability”. There is also many differences in how banks communicate their policies to the public. Most announce policy changes immediately. Some just give more details than others. In the US, the typical policy statement is only a few sentences long. In Europe there is a full-blown press conference where policy makers will answer questions. It is debatable how much information is needed to make a central bank transparent.

15.3.4 The Policy Framework, Policy Trade-Off, and Credibility

The final piece of an efficient central bank is a clear policy framework. That is policymakers must clearly state their policy goals and the trade-offs among them. So, even though the Fed typically only release a couple of statements about its policy. This statement usually contains two important elements. First,
it clearly states the policy itself. Second, the statement usually reports the most important issue that lead to the policy and why other potential trade-offs did not cause a different decision. In 1998, the Federal Reserve faced a trade-off between inflation and growth. In October the FOMC decided to lower interest rates to spur growth. The policy statement was ”further easing of the stance monetary policy was judged to be warranted to sustain economic growth in the context of contained inflation”. The FOMC was trying to calm inflation fears by showing the public that they are aware of potential inflation, but that economic growth was the current driving issue in the economy. These kind of statements, although short, clearly show the Fed’s policy framework and give policymakers credibility.

Credibility is huge for any policy maker. A policy is only effective if the people trust it. Many financial crises can be built off of rumors rather than facts. In the previous statement the was meant to break a commonly held belief that one of the root causes of inflation is expected inflation.

15.4 Fitting Everything Together: Central Banks and Fiscal Policy

In order for countries to join the European Union, they must meet a set of conditions. Two of the toughest conditions are an annual government deficit of 3 percent of GDP and total government debt not to exceed 60 percent of GDP. Both of these conditions are tied to a country’s fiscal policy. So, in order to join in on a monetary arrangement the fiscal policy makers must be well-behaved. Why are these conditions included into a monetary arrangement. They are included because although fiscal and monetary policies generally have the same goals, conflicts can arise between them.

The main reason why we have a conflict is tied to why fiscal policy relies some much on debt. Politician think of mostly short-run effects. To buy more things, politician typically do not wait for the money to be collected through taxes, they will borrow to get the goods they want to make voters happy and get re-elected. The government can borrow by selling bonds to the central bank that they will buy if no one else does. Thus, fiscal policy is mimizign the effects of a monetary expansion policy which should spur growth and possibly inflation.

If at the same time, the central bank is engaging in an active policy, the fiscal policy can either cancel out or amplify the intended effects. The government borrowing can indirectly lead to higher inflation, so to control for this, the EU requires governments to have low amounts of borrowing. Monetary policy can only maintain low inflation if the government maintains controlled amounts of borrowing. So, although independent, effective monetary policy relies on responsible fiscal policy. The next chapter will get into more details about the organization of the typical central bank.
Chapter 16: The Structure of Central Banks: The Federal Reserve and the European Central Bank

In the early 1900s, the US found itself in a severe financial crisis. In 1907 roughly 2/3 of all banks found themselves temporarily unable to redeem deposits into cash. This was believed to been a result of a simply fact that the US banking system was not up to date. At that time European countries has already started to use central banks, the US had not. So the US considered their options for a few years, and in 1913, Congress passed the Federal Reserve Act which created the U.S. Federal Reserve System. Over time as the bank’s knowledge of how policy affected the economy grew, so did the importance of the Federal Reserve. Today, the fed is a key component of low inflation and high sustainable growth.

While the use of central banks is much older in Europe, the 20th century was marked by high inflation, volatile interest rates, and unstable exchange rates. Europe has been through long periods of stagnant growth and inflation and bad monetary policy are typically blamed. Thus, a consensus was built around the idea that to promote stability in the region their needed to be closer ties between the countries. The best way to achieve this was by unifying under one currency and a single central bank. The result we find is the currency, the euro, and a central bank called the European Central Bank (ECB).

The Federal Reserve and ECB represent the two most prominent central banks in the world. This chapter is meant to give some insight into the organizations of both central banks.

16.1 The Structure of the Federal Reserve System

The Federal Reserve Act established an agency which is composed of three overlapping branches. There is an executive branch called the Board of Governors. There is a collection of 12 Federal Reserve Banks spread across the country. Finally, there is a legislative committee called the Federal Open Market Committee. In addition, there are several other advisor committees that make recommendations to the Board of Governors and Regional Banks. The fourth branch which lies outside of the Federal Reserve is the collection of private commercial banks which are members of the Federal Reserve System. This is a complex organization with power that is diffused across many places. The diffusion is intentional to keep one party from controlling too much.

All national banks in the U.S. (those chartered through the federal government) are required to belong to the Federal Reserve System. State bank have the option to choose to become members of the system. Any bank which is a member of the Federal Reserve System must hold non-interest bearing reserve deposits at the Fed.
16.1.1 The Federal Reserve Banks

Two blocks from where the World Trade Center towers once stood is the Federal Reserve Bank of New York. This bank is one of the 12 regional banks which together with their branches form the center of the Federal Reserve System. These banks are spread across the country servicing different regions. The regions were determined back in 1914 and this is why you may think that the regions are vastly different in size. The 12 regional banks are:

1. Boston
2. New York
3. Philadelphia
4. Cleveland
5. Richmond: This bank serves Baltimore region
6. Atlanta
7. Chicago
8. St. Louis
9. Minneapolis
10. Kansas City
11. Dallas
12. San Francisco

The choice of location for the banks was driven by the population density of 1914 and politics of the time. The Speaker or the House was from Missouri so as a results we have two banks in Missouri. All are very similar in operation. Each covers at least a part of multiple states (so that no bank can give in to the political pressure of a state) and each has a cash vault that holds reserves. The New York branch has the only gold vault which contains 10% of all gold ever mined!!

The structure of each branch is part public and part private. These are federally charted banks that are private, non-profit organizations that are owned by the commercial banks of their region. They are overseen by the Board of Governors and a board of directors. The board of directors at each bank is partly appointed by the government and partly by the private sector. Given this, the directors can be a mixed variety of private bank managers, federal employees, and academic economists. Every bank appoints a bank president that serves a five-year term and is appointed by the board of directors and approved by the Board of Governors.

The day-to-day business of a bank serves both roles as the government’s bank and a banker’s bank. These duties include:
1. Duties as the government’s bank

(a) Issue new currency and destroy old currency.
(b) Maintain the U.S. Treasury’s account by paying checks, and processing payments.
(c) Manage the U.S. Treasury’s borrowing. This includes issuing and redeeming U.S. Treasury bonds, bills, and notes. (The bank is a bank and just does what it is told by the U.S. Treasury).

2. Duties as the banker’s bank

(a) Hold deposits for the banks in their districts.
(b) Operate and ensure the integrity of system for clearing checks and payments.
(c) Make discount loans available to commercial banks in their district.
(d) Supervise and regulate financial institutions and evaluate bank mergers.
(e) Collect and make available data on business conditions.

In addition the Bank of New York takes on some other important responsibilities.

1. Provides services to foreign bank with accounts in the U.S.
2. Point for open market operations where the Federal Reserve actively engages in the financial markets.

The Banks also play an important role in monetary policy as it is people (the presidents) of these banks that make up the Board of Governors who enact Fed policy through the Federal Open Market Committee.

16.1.2 The Board of Governors

The headquarters of the Federal Reserve is located in Washington DC at 20th and C street. The seven members of the board are appointed by the President and serve 14 year terms. The terms are staggered so that a new member is appointed every two years. This combined with the long terms minimizes the effect any one president can have on the composition of the board. To ensure geographical diversity, no two board members can come from the same Federal Reserve region.

Together with their large staff, the Board of Governors performs the following duties:

1. Analyzes domestic and international economic and financial conditions.
2. Administers consumer credit laws.
3. Supervises and regulates the regional Reserve Banks, this includes their budgets
4. Sets the reserve requirement.
5. Approves bank merger applications
6. With the Regional Banks, helps to regulate and supervise the banking sector.
7. Collects and publishes data on the Federal Reserve System’s activities and the economy.

16.1.3 The Federal Open Market Committee

When most people think about the Federal Reserve, they think about the power to set interest rates. So, most of the attention on the Fed is certain on the Federal Open Market Committee (FOMC) who sets interest rates to control the availability of money and credit in the economy. The FOMC was founded in 1936 and is made up of 12 voting members. These members consist of the 7 Board of Governors, the president of the Federal Reserve Bank of New York, and four other Bank presidents. The chair of the Board of Governors is also the chairman of the FOMC. This currently Alan Greenspan.

The FOMC could try and control and interest rate, but they focus their attention on the federal funds rate. This is the interest rate that is charged by banks for overnight loans to other banks (the funds come from the excess reserves of banks at the Fed). It is important to realize that this is a nominal rate which includes an inflation premium, but since inflation does not tend to change quickly, the FOMC in effect controls a real interest rate. It is the real interest rate that drive economic decisions about saving/consumption and investment. In effect the FOMC could have influence on real economic growth.

The FOMC meets eight times a year (roughly every six weeks) in the Board Room at the Federal Reserve headquarters in Washington D.C. Occasionally, if a crisis hits, the FOMC can have an emergency meeting.

At a meeting, the primary purpose is to decide on a target interest rate and produce a policy directive. The FOMC does not directly engage in the actions that are needed to implement a target, they just announce what the target should be. This job falls to the Federal Reserve Bank of New York who then engages in the buying and selling of U.S. Treasuries in an attempt to drive interest rates to the desired target rate.

To get a better understanding of how the FOMC works, it is important to see what information the members of the committee use to make their decisions. Before every meeting members are given three important documents: the beige book, the green book, and the blue book. The beige book is a compilation about current business activity and is published two weeks before the meeting. The green book consists of a collect of Fed forecasts for the next couple of years. Just before the meeting members are given the blue book which discussion current
financial markets and policy options. The green and blue books are treated as secret and not released until five years after the FOMC meeting.

An FOMC meeting goes through three parts: reports by the staff, statements of the members, and comments by the chair. Here’s the order of things:

1. The system open market account manager reports on financial markets and actions taken to maintain the target rate.
2. The director of the Division of Research and Statistics at the Board presents the staff’s forecast
3. One at a time, committee members (including all bank presidents) discuss the economic outlook, including specific regional information.
4. The director of monetary affairs, who is also the secretary of the FOMC, describes the two or three policy options from the blue book. One option is always to maintain the current interest rate.
5. Again committee members discuss the policy options. Chair goes first often recommending an action. The remaining members quickly discuss this and decide to agree or disagree with the recommendation.
6. A vote is taken, with the chair voting first.

Soon after the meeting a policy directive is made public.

16.2 Assessing the Federal Reserve System’s Structure

In this last chapter we established some basics on what makes an efficient central bank: independence from political influence, make decisions by committee, have accountability and transparency, and state their objectives clearly. Let’s see how close the Federal Reserve System comes in these categories:

16.2.1 Independence from Political Influence

To meet independence a central banks need three basic things: budgetary independence, irreversible decisions, and long terms. The Federal Reserve meets these three conditions. The budget is independent from the President of Congress. The Fed generates income comes from securities it holds and fees it charges to banks from things like check clearing and other services. The Federal Reserve, being non-profit, actually returns 95% of its income to the US Treasury.

Once the FOMC makes an interest rate change, no one, other than the FOMC can reverse that decision. Finally, governors have terms which last 14 years. This is substantially longer than any politician’s term. Only a supreme court justice could have a single term longer than a Fed governor.

The Fed does occasionally come under political attack, but does attacks have very little teeth.
16.2.2 Decision Making by Committee

The FED makes decisions through committee. The important monetary policy
decisions are made through the FOMC. No one person controls all of the power.

16.2.3 Accountability and Transparency

The FOMC does release quite a bit of information to the public. Prior to each
meeting, the beige book is made available publicly. Immediately after every
meeting, the announced policy directive is also released to the public. About
six weeks after a FOMC meeting, the minutes for that meeting are released.
Five years after a FOMC the green and blue books and word for work minutes
of meetings are released. Twice a year the Fed makes a Monetary Policy report
to Congress which includes forecasts for the next two years. This report is
accompanied by the fed chair’s appearance before Congress. Members of the
FOMC, including the chair, make frequent speeches which are generally quickly
released to the public.

The only obvious information missing from the situation deals with the re-
lease of a policy directive. There is no press conference and the directive is
usually very short and vague. Generally, the objectives of the fed are left vague
as well.

16.2.4 Policy Framework

Congress has set the Fed’s objectives: "The Board of Governors of the Federal
Reserve System and the Federal Open Market Committee shall maintain long
run growth of the monetary and credit aggregates commensurate with the econ-
omy’s long run potential to increase production, so as to promote effectively the
goals of maximum employment, stable prices, and moderate long-term interest
rates.”

This statement is vague and there is some disagreement into whether or not a
vague statement is preferred or not. In some sense the Fed can hide more things
with a vague statement. At the same time, a very specific objective would not
allow the Fed to be a dynamic policymaker. This is an area of constant debate,
how specific should objectives be.

16.3 The European Central Bank

Back in 1995 every European country used their own currency to make pay-
ments. An every country also had their own central bank to control the mon-
etary policy of their country. On January 1, 1999 the majority of Western
European countries adopted a common currency. Today most of Europe use
the same currency, the euro, to make payments, and the monetary policy is the
job of a single central bank called the European Central Bank. By 2004, the
euro was the official currency of 12 countries.

The agreement to form the European Union was formalized in the Treaty of
Maastricht which was signed in 1991. This treaty did much of what the Federal
Reserve chartered did in the US in 1914. The European System of Central Banks was formed. This consists of the ECB in Frankfurt Germany and the National Central Banks in 25 countries of which 12 participate in the monetary union. Let’s look closer at the organization of the European Central Bank.

16.3.1 Organizational Structure

The Eurosystem mirrors the Federal Reserve System. There is the same basic three branches of the agency. There is a six member Executive Board of the ECB which is similar to the Board of Governors. The second branch is the National Central Banks which look more like the Regional Banks in the Federal Reserve System. Finally, there is the Governing Council which formulates monetary policy in a similar fashion as the FOMC.

The Executive board has a president whose powers are similar to that of the Fed chairman’s. The ECB and the National Central Banks together preform the traditional operations of a central bank with the National Central Banks serving like the Regional Banks in the U.S.

There are several differences between the Fed and the ECB.

1. The ECB does not supervise and regulate financial institutions.

2. The implementation of monetary policy, the buying and selling of securities, takes place at all National Central Banks and is not centralized like in the U.S. (New York Fed).

3. The ECB’s budget is controlled by the National Central Banks, not the other way around.

Just like the Fed, the ECB focus is on money and credit availability. The Governing Council is composed of six members of the Executive Board and all 12 National Central Bank presidents. Unlike the FOMC, during meetings only the 18 members of the council are in the room. Decisions are made by consensus and not by votes.

There are a number of things which do help promote the ECB’s independence. They include:

1. Eight terms for the Executive Board members.

2. National Central Bank governors have terms of five years.

3. The ECBs financial interests must remain separate from any political organization

4. The Governing Council can not take instructions from any government, so policy is irreversible.

The provisions keep the ECB very independent for the governments of the represented countries.
16.3.2 Accountability and Transparency

The ECB, like the Federal Reserve, releases a large amount of information to the public in paper and on its Website. Some of this information includes a weekly balance sheet, a monthly statement, an analysis of current economic conditions, biannual forecasts of inflation and growth, research reports, and an annual report. In addition, the president of the ECB appears before the European Parliament four times a year and answers questions. The biggest difference between the Fed and ECB in this area is in the release of the policy directive after every meeting.

Following each meeting of the Governing Council, the president and vice-president of the ECB hold a news conference in Frankfurt. The president reads a several page statement announcing the policy directive with a brief report on the state of the European economy. They will also answer questions from the audience. This seems like a much more transparent policy attitude. However, the minutes of a Governing Council’s meeting won’t be released for twenty years.

Is this an efficient approach? That is still open to debate. The length and complexity of the released policy directive usually presents multiple opinions and can leave a more conflicting result than the simple short statements released by the Fed that seem much more unified. Second, time is still an issue with the ECB. It has only been around for a few years, it is going to take some time for policymakers to learn how their policy influence the European economy as a whole. Thus, the ECB is still gaining accountability.

16.3.3 The Price Stability Objective and Monetary Policy Strategy

The treaty of Maastricht states the policy objective of the ECB. It states that the primary objective of the European System of Central Banks (ESCB) shall be to maintain price stability. Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the European Community”, including the objective of sustainable and noninflationary growth. Like the Fed, this statement of purpose is vague. However, this policy does seem to be a little more geared toward controlling inflation. As a result, the Governing Council has developed to mandates. First, there is a numeric definition of what it means to have price stability. Second, the Council announces its intentions to focus of board-based assessment of the outlook for future prices.

Right now definition of stable prices is an inflation rate of 2 percent over the entire euro area. This inflation is pretty calculated as a weighted average of the average inflation rate in each country weighted by the size of a country’s economy.

The fact that the relative size of an economy controls the ECB’s policy has made some of the smaller countries feel less significant. Pretty much as long as inflation is controlled in Germany, Italy, and France, the European inflation rate will be low. High inflation in a few small countries will have minimal impact on the inflation rate of the entire community. There is still a question of how this influences the smaller economies.
All in all though the ECB seems to be meeting its objectives. The objectives set forth in the Treaty are effective in keeping disciplined monetary policy that helps all of the euro area.

17 Chapter 17: The Central Bank Balance Sheet and the Money Supply Process

At its most fundamental level, the Federal Reserve is just another bank. It goes through many of the same motions: granting loans and exchange in the securities market. It is the central bank’s size and ability to issue currency which separates its from the rest of the banking system. Because of it’s ability to inject or have ready to inject massive liquidity, the Federal Reserve stabilizes the entire system from collapse. The most recent example of this would have been in the hours following the attacks on September 11th 2001. In a matter of hours, the Federal Reserve announced it was open and ready for business and had granted loans to stressed financial institutions. The actions of the Federal Reserve stabilized the financial system. This is exactly opposite of what happened in the 1930s where the actions of the Fed appear to magnify the effects which generated the Great Depression. The Fed’s failure to a timely response generated a system-wide shortage of cash and several banks failed. History here and around the global has been marked by situations where the actions of a central bank seem to help a situation, while in others it seems to hurt. In this chapter, we will attempt to understand a little bit about why this is the case.

We need to understand how the central bank interacts with the financial system. What is it that the central bank buys and sells? What are its assets and liabilities? In general, how is the balance sheet of the central bank tied to the financial sector?

17.1 The Central Banks’s Balance Sheet

Just like any other bank, the central bank has a balance sheet. The Federal Reserve publishes its balance sheet weekly. The publication is crucial to the transparency of the Federal Reserve. We will study the basics of what is reported in a central bank’s balance sheet. The following table summarizes the major components of the balance sheet.

<table>
<thead>
<tr>
<th>Role</th>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government’s Bank</td>
<td>Securities</td>
<td>Currency</td>
</tr>
<tr>
<td></td>
<td>Foreign exchange reserves</td>
<td>Government’s Liabilities</td>
</tr>
<tr>
<td>Banker’s Bank</td>
<td>Loans</td>
<td>Commerical Bank Reserves</td>
</tr>
</tbody>
</table>

The top row of the table shows the assets and liabilities the central bank holds in its role as the government’s bank, and the bottom row summarizes its role as the banker’s bank.
17.1.1 Assets

The assets of a central bank come from three basic things: securities, foreign exchange reserves, and liabilities it holds at the banker’s bank. Let’s look at each of these in more detail:

1. Securities are the primary portion of a central bank’s assets. The Federal Reserve holds nearly $700 billion worth of U.S. Treasury securities. The total amount held by the central bank can fluctuate by buying and selling securities through open market operations. The central bank has the sole authority in determining how the bank conducts its open market operations.

2. Foreign Exchange Reserves are the bank’s and government’s balances held in foreign currency. These are held in the form of bonds issued by overseas governments. These are the instruments used when a central bank goes through foreign exchange interventions. These actions are meant to change the value of certain currencies. The total size of foreign exchange reserves held by the Fed is around $40 billion.

3. Loans are the asset which the central bank extends to the commercial banks. In general, the Federal Reserve makes two kinds of loans: discount loans and float.

   (a) Discount Loans are loans that the Federal Reserve makes to commercial banks that are in the need of short-term liquidity. These loans are typically millions of dollars.

   (b) Float is a by-product of the Fed’s check-clearing business. These are the short-term loans made to banks that occur when a check is transported between Federal Reserve Districts. These are typically much smaller than discount loans.

   U.S. securities are by far the largest asset at the Federal Reserve.

17.1.2 Liabilities

A central bank has liabilities that come from three major places: currency, the government’s deposit account, and the deposit accounts of the commercial banks. Let’s take a more detailed look at these parts of the balance sheet.

1. Currency. Nearly every central bank has a monopoly on the issuing of currency. Currency which is not held at the bank, is a liability of the central bank. In the U.S., currency makes up roughly 90 percent of the total liabilities of the Fed.

2. Government’s Account. Governments need a bank just like any other economic agent. They need to have a place to deposit income and pay bills. The central bank provides just that place which the government can
deposit its income (tax revenues) and write checks and make electronic payments. The U.S. government also keeps accounts at some commercial banks, where is transfers money from its Fed account to cover purchases. The account at the Fed typical stays in the area of $5 billion.

3. Commercial bank accounts (reserves). Commercial bank reserves are the sum of two things: deposits at the Fed plus the cash in the vaults at the banks. Deposits at the Fed function a lot like a checking account for the commercial banks. In 2004, the U.S. Commercial banks held roughly $45 billion in reserves, most of which were held at the Fed.

While the reserves are not the largest liability of the central bank, we will see that these are the most important part in determining the amount of money in the economy. Monetary policy is focused on changes in reserves. Increases lead to a rise in deposits and to growth in available money and credit. Decreases do the opposite. There are generally two type of reserves in the system: required and excess. Required reserves are exactly that, every bank is required to hold a certain fraction of their liabilities in the form of cash. Excess reserves are any cash reserves in addition to the required levels. These are the reserves which can be used for making additional loans.

17.1.3 The Importance of Disclosure

One of the most important objectives of any central bank is to disclose information to the public. Included in this information is the financial state of the bank’s balance sheet. Without this type of disclosure, the public is unable to tell whether monetary policymakers are doing their jobs correctly. Any delays in reporting the balance sheet are strong signals of financial crises on the horizon.

Another size of potential problems is whenever we see a misrepresentation in the balance sheet of the central bank. Basically the central bank lies about its balance sheet. In the most famous recent example, the Philippines central bank was ordered to print massive amounts of cash so that Ferdinand Marcos could use the money to buy votes and stay in power. The unique setup in the Philippines is that it can only print money that is back by a loan it has with the International Monetary Fund (IMF). As part of this agreement the IMF tracks the currency buy telling the Philippines central bank to use unique numbers on each bill. Well, this didn’t happen, they printed three of each serial number. Thus, they printed three times as much money as was thought.

17.1.4 The Monetary Base

The total amount held as currency and banking reserves make up the monetary base. As we will study, the central bank can control the size of the monetary base. Also, we will see that when the monetary base expands by a dollar, the quantity of money in economy rises by several dollars.

To show some evidence of this consider the following. In August of 2004, the monetary base of the U.S. was $757 billion. AS the same time M1 was
$1.3$ trillion and $M2$ was $6.3$ trillion. So, $M1$ was roughly twice the size of the monetary base, and $M2$ was more than $8$ times larger than the monetary base. Let’s look at how the central bank adjusts its balance sheet and the monetary base.

17.2 Changing the Size and Composition of the Balance Sheet

The tools of monetary policy typically involve adjusting the size and composition of the central bank’s balance sheet. Unlike the typical economic agent, the central bank can almost change its assets and liabilities at will. Think about a standard transaction where the central bank buys a $1$ million in government securities. What’s the difference between this transaction, and that of a typical household? First, it is the size of the transaction which not many households can duplicate. There is also a difference in how the instrument is paid for. The central bank will write a check to the bond issuer. After the check is deposited, the dealer’s commercial bank account is credited $1$ million. The commercial bank then sends the check back the central bank which then simply credits the reserve account of the commercial bank $1$ million. That’s where the process stops. If a household were to buy the bond there would be a withdraw of funds from the household’s financial accounts. This does not happen with the central bank. Thus, the central bank buys an asset by creating liabilities which offset the additional asset. It can pretty much increase the size of its balance sheet at will.

Turning to specifics we will look at four types of transactions: an open market operation, a foreign exchange intervention, the extension of a discount loan, and individual cash withdrawals. The first three transactions all affect the size of the central bank’s balance sheet and change the monetary base. The cash withdrawals shift the components of the monetary base, but not its size.

The understand the impact of these transactions remember a simple rule: When the value of an asset on the balance sheet increases, either the value of another asset must decrease or the value of a liability must rise. Let’s now take a more detailed look of these transactions through the actions of the Federal Reserve.

17.2.1 Open Market Operations

When the Fed buys or sells securities, it engages in open market operations. The open market purchases and sales have a direct impact on the Fed’s balance sheet. To see these, suppose the New York Reserve Bank purchases $1$ billion in U.S. Treasuries. to pay for the bonds, the Fed transfers $1$ billion into the reserve account of the seller. The result of this transaction has the following effect on the Fed’s balance sheet. Its assets and liabilities both go up by $1$ billion, increasing the monetary base by the same amount.

The Fed exchanged $1$ billion in securities for $1$ billion in reserves, both of which are an asset for the banking system. There are no effects on the liability
side of the banking system’s balance sheet. The Fed’s open market operations are changing the composition of assets in the banking system.

The exact opposite would happen if the Fed were to sell securities to the banking system which would add securities to the banking system and reduce reserves from the banks to pay for the bond.

17.2.2 Foreign Exchange Intervention

What happens if the U.S. Treasury instructs the Federal Reserve to buy $1 billion in a foreign currency? The answer is that the New York Federal Reserve Bank buys bonds issued in foreign denominations. These purchases are generally made from the foreign exchange departments at large commercial banks and paid for in dollars. Like an open market operation, this transaction is electronic and the $1 billion is credited directly to the reserve account of the bank from which the bonds were bought. The impact on the Fed’s balance sheet is basically the same as that of an open market operation. The assets and liabilities of the bank both rise by $1 billion and the monetary base expands.

Since the Fed bought these bonds from a commercial bank, the impact on the balance sheet of the banking system is simple. This all a change to the composition of the assets of commercial banks. They now have $1 billion less in securities and $1 billion more in reserves. The only difference between a foreign exchange intervention and an open market operation is the type of security bought: US government bonds versus foreign denominated bonds.

17.2.3 Discount Loans

The Fed does not force commercial banks to borrow money. The banks must ask for loans. For a bank to be approved for a discount loans, they typically need to put up some form of collateral in the form of U.S. Treasuries. Thus, whenever the Fed makes loan, it change the balance sheets of both the Fed and the commercial bank. For the borrowing bank, the loan represents and additional liability that is matched by an equal increase in the level of its reserve accounts. For the Fed, the loan is an asset that is created in exchange for credit to the borrower’s reserves. This impact is similar to what happens during an open market operation. The increase of credit to the banking system raised the level of reserves and expands the monetary base.

The impact on the banking system’s balance sheet mirrors the impact on the Fed. Discount loans generate an increase in both assets and liabilities. They have extra cash, but also owe a loan back to the Fed.

In summary, open market purchases, an increase in foreign exchange reserves, and the extension of discount loans all increase the reserves available to the banking system expanding the monetary base.

17.2.4 Cash Withdrawal

All of these previous tools all changed the size or compensation of the central bank’s assets. The Fed does not really have options to influence its liabilities.
The Fed is always ready to exchange reserves for currency on demand, and it
does not control the mix of the two. It is the public who hold cash, that controls
the mix in the Fed’s liabilities.

Every time you make a withdrawal from an ATM machine, you are changing
the balance sheet of the Fed. Consider an example where you take $100 from
your checking account. The transaction changes the asset side of your balance
sheet adding $100 to currency and taking $100 from deposits. Also, this $100
transaction had an effect on your bank’s balance sheet. The cash that was taken
from the ATM comes from the reserves of the bank so we have a $100 decrease
in both the assets and liabilities of your bank. It has $100 less in reserves and
deposits.

Finally, there is an effect at the Federal Reserve. This withdraw has changed
the composition of the Fed’s liabilities. There is an additional $100 in currency
and a reduction of $100 in reserves.

There has been no influence on the monetary base which is the sum of
currency plus reserves. There has just been a change in the composition of the
monetary base. The following table summarizes the impact of these different
transactions on the Fed balance sheet.

<table>
<thead>
<tr>
<th>Transaction</th>
<th>Initiated By</th>
<th>Typical Action</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Market Operation</td>
<td>Central Bank</td>
<td>Purchase Bond</td>
<td>Increases Reserves</td>
</tr>
<tr>
<td>Foreign Ex. Intervention</td>
<td>Central Bank</td>
<td>Purchase Foreign Bond</td>
<td>Increases Reserves</td>
</tr>
<tr>
<td>Discount Loan</td>
<td>Commercial Bank</td>
<td>Extension of Loan</td>
<td>Increases Reserves</td>
</tr>
<tr>
<td>Cash Withdrawal</td>
<td>Public</td>
<td>Withdrawal of cash</td>
<td>Decreases Reserves</td>
</tr>
</tbody>
</table>

The other important difference between these transactions is that the Cash
Withdrawal leaves the size of the central bank balance sheet unchanged.

17.3 The Deposit Expansion Multiplier

The liabilities of the central bank form the base on which the supplies of both
money are credit are built. The central bank has the ability to expand and
contract the monetary base. What is the relationship between the liabilities
of the central bank and the monetary measures like M1 and M2? How do the
reserves become bank deposits? The answer is the process of multiple deposit
creation.

17.3.1 Deposit Creation in a Single Bank

Now we are going to see how deposits are created. Let’s begin by working in
a situation where the Federal Reserve buys $100,000 worth of securities from a
bank called First Bank. Let’s just assumes that the Fed initiated the transaction.

The purchase leaves the bank’s total assets unchanged, but it shifts $100,000
out of securities and $100,000 into reserves. The important part here is how Fist
Bank responds to this additional $100,000 in reserves. Remember it just sold
interest bearing bonds to the Fed and receive non-interest bearing reserves in return. Thus, if it does nothing the revenue stream for the bank will fall. With liabilities of the bank unaffected, the required reserves are also unchanged. So, the additional $100,000 is all excess reserves. So, what will the bank do with excess reserves.

The most natural thing is for the bank to lend out these excess reserves. Assume that First Bank receives a loan application for $100,000. With these excess reserves, the bank can approve the loan and credit the companies checking account $100,000. Thus, immediately following the new loan there has been an increase of $100,000 in both assets and liabilities for First Bank.

Now this new loan is not going to stay at First Bank. The company who needed the loan is going to withdraw the money to pay bills. So, in the end First Bank’s balance sheet is simply changed with an additional $100,000 in Loans and a $100,000 reduction in securities.

17.3.2 Deposit Expansion in a System of Banks

The additional loan made at First Bank is not the end of the story because this $100,000 was used to pay bill to suppliers. The suppliers will then take this money and deposit it in their banks creating extra deposits for other banks. As the checks make their way through the financial system, First Bank’s reserves were transferred to the reserve accounts on the suppliers’ banks. Only the Fed can create or destroy the monetary base. It is the public that determines how much of it ends up as reserves and as currency. All the banks can do is move the reserves they have around among themselves. Let’s take a look at a typical, simply situation and see how reserves created by the Fed influences the monetary base.

To setup the story we need to make four assumptions:

1. Banks hold no excess reserves
2. The Reserve Requirement is 10 percent
3. When the level of checking deposits and loans changes, the quantity of currency held by the public does not
4. When a borrower write a check, none of the recipients of the funds deposit the funds back into the borrower’s bank

Let’s say the borrower of the $100,000 uses the money to pay for steel at American Steel Co. American Steel will take the money and deposit it in their bank Second Bank. When the check clears, the reserve account at Second Bank is credited with $100,000. Thus, we have a transfer of reserves from First Bank to Second Bank.

The story does not stop there, it is just starting. Second Bank has an additional $100,000 in reserves and liabilities. Given a reserve requirement of 10%, we know that for an additional $100,000 in liabilities, Second Bank only
needs an additional $10,000 in reserve. So they have $90,000 in excess reserves. What will Second Bank do? Issue an additional $90,000 in loans. Thus the change in the balance sheet of Second Bank looks like

<table>
<thead>
<tr>
<th>Balance Sheet Change at Second Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
</tr>
<tr>
<td>Reserves +$10,000</td>
</tr>
<tr>
<td>Loans +$90,000</td>
</tr>
<tr>
<td>Liabilities</td>
</tr>
<tr>
<td>American Steel Checking Account +$100,000</td>
</tr>
</tbody>
</table>

This new loan and the reserves that go with it must now go somewhere. Let’s say that it is deposited in another bank, Third Bank. the change in Third Bank is similar to that of Second Bank, only the additional loan is $90,000 instead of $100,000. Thus the balance sheet changes as

<table>
<thead>
<tr>
<th>Balance Sheet Change at Third Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
</tr>
<tr>
<td>Reserves +$9,000</td>
</tr>
<tr>
<td>Loans +$81,000</td>
</tr>
<tr>
<td>Liabilities</td>
</tr>
<tr>
<td>Checking Account +$90,000</td>
</tr>
</tbody>
</table>

At this point in the process the $100,000 open market operation has created $100,000 + $90,000 = $190,000 in new checking deposits and $100,000 + $90,000 + $81,000 = $271,000 in new loans at the three banks. This process continues to work its way through the system with each bank seeing a similar change in their balance sheet. Fourth Bank would make a loan that was 90% of $81,000 or $72,900 and this would be deposited. This would just continue.

In the end, with this 10% reserve requirement, the $100,000 open market purchase will generate an additional $1,000,000 in deposits and $1,000,000 in loans. Thus, every $1 of the open market purchase, increases the quantity of money by a factor of 10.

This 10 is called the deposit expansion multiplier. There is an easy and hard way to calculate the deposit expansion multiplier. Let’s start with the easy way.

As seen from the previous example. What drives the factor at which open market purchases expands the quantity of money? It is the reserve requirement. Remember in this story banks hold no excess reserves, thus the required reserves at a bank can be expressed as a fraction of deposits. That is

\[
\text{Required Reserves} = \text{Reserve Requirement} \times \text{Deposits}
\]

\[
RR = r_D \times D
\]

Any changes in deposits creates a corresponding change in reserves,

\[
\Delta RR = r_D \times \Delta D
\]

Now some simple algebra

\[
\Delta D = \frac{1}{r_D} \times \Delta RR
\]

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So, for every dollar increase in reserves, deposits increase by \( \frac{1}{r_o} \). If the reserve requirement is 10% the deposit expansion multiplier must be \( \frac{1}{0.1} = 10 \). That is why a $100,000 increase in reserves generated and additional $1,000,000 in deposits.

The hard way to calculate the multiplier is to simply continue our previous example, each time keeping a running total of the change in deposits. Since the change is decreasing each time we go through a bank, this effect will eventually go to zero. The total sum will be \( \frac{1}{r_o} \times \Delta RR \). Which is exactly what we just found.

### 17.4 The Monetary Base and the Money Supply

We are beginning to understand the link between the central bank’s balance sheet and the quantity of money in the economy. A change in reserves results in a significant change in the amount of loans and deposits in the banks. However, this story was a little to simple. We ignored two important facts

1. Bank do hold some amount of excess reserves
2. The public holds some of the deposits as cash and as their deposits rise, they tend to hold more cash.

Both of these things influence the relationship between reserves, the monetary base, and the quantity of money in the economy. Let’s look at this in more detail.

#### 17.4.1 Deposit Expansion with Excess Reserves and Cash Withdrawals

To study the importance of excess reserves and cash holdings, let’s take them into account from our deposit expansion story. Assume that banks want to hold excess reserves equal to 5 percent of checking account deposits and that the holder of the account withdraws 5 percent of a deposit in cash. Remember the reserve requirement is 10 percent.

Let’s go bank to an example where the Fed purchases $100,000 of securities. The story from the previous section is unaffected until we get to Second Bank. If American Steel decided to take some of the $100,000 as cash and Second Bank wants to hold excess reserves, the additional loans issued by Second Bank cannot be $90,000 they must be less.

Assuming that American Steel takes 5 percent as cash, that leaves $95,000 that goes into the liabilities and reserves of Second Bank. Since Second Bank wishes to hold excess reserves or 5\% of deposits, it will want to keep a total of 15\% of the $95,000 as reserves. Thus, the bank will chose to hold $14,250 as reserves and make loans totaling only $80,750. The effects are shown in the
following table

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Reserves</td>
<td>+$9,500</td>
</tr>
<tr>
<td>Excess Reserves</td>
<td>+$4,750</td>
</tr>
<tr>
<td>Loans</td>
<td>+$80,750</td>
</tr>
<tr>
<td>American Steel Checking Account</td>
<td>+$95,000</td>
</tr>
</tbody>
</table>

This means less deposits are passed through to the next bank. This story would be similar at every bank throughout the system. Thus, when we include excess reserves and cash on hold, the deposit expansion multiplier should be much lower. These two things have an effect which is very much like an increase in the reserve requirement.

17.4.2 The Arithmetic of the Money Multiplier

To gain a better understanding between reserves and deposits we can derive the money multiplier which measures how the quantity of money is related to the monetary base.

Let’s define the quantity of money as $M$, the monetary base as $MB$, and the money multiplier as $m$. Then we know

$$M = m \times MB$$

To derive the money multiplier we start with a few basic ideas: money $M$ equals currency $C$ plus checkable deposits $D$, the monetary base $MB$ equals currency $C$ plus reserves $R$ and reserves equals the required reserves $RR$ plus excess reserves $ER$. That is:

$$M = C + D \quad \text{Money} = \text{Currency} + \text{Deposits}$$

$$MB = C + R \quad \text{Monetary Base} = \text{Currency} + \text{Reserves}$$

$$R = RR + ER \quad \text{Reserves} = \text{Required Reserves} + \text{Excess Reserves}$$

We now move the banks. We know that their holding of required reserves depends on the required reserve ratio $r_D$. Now what about excess reserve? Banks tend to hold excess reserves as a proportion of their deposits. The amount of excess reserves a bank holds depends on the costs and benefits of holding them. The cost of excess reserves is the interest on the loans that could be made with them. The benefits of excess reserves have to do with the safety net they provide in case large deposits are withdrawn. The higher the interest rate, the lower the bank’s excess reserves will be. The higher the concern for a possibility of a bank run, the higher the excess reserves will be.

Let’s define the excess reserve-to-deposit ratio as $\frac{ER}{D}$. Given this we can
rewrite the reserves of a bank as
\[
R = RR + ER \\
= r_D D + \left( \frac{ER}{D} \right) D \\
= \left( r_D + \left( \frac{ER}{D} \right) \right) D
\]

This says that banks hold reserves as a proportion of their deposits.

We can now turn to the behavior of the general public. Just like with banks, we assume that people hold currency as a fraction of their deposits. That is,
\[
C = \left( \frac{C}{D} \right) D
\]

where \( \frac{C}{D} \) is the currency to deposit ratio. The decision on how much currency to hold depends on costs and benefits. The cost of holding currency is the interest that would be earned on deposits. The benefits include lower risk and liquidity. If the riskiness of alternatives rises or liquidity falls, then cash becomes more desirable and we would see \( \frac{C}{D} \) rise.

Let’s bring this all together now. We can now rewrite the equation summarizing the monetary base as
\[
MB = C + R \\
= \left( \frac{C}{D} \right) D + \left( r_D + \left( \frac{ER}{D} \right) \right) D \\
= \left( \frac{C}{D} \right) + r_D + \left( \frac{ER}{D} \right) D
\]

The monetary base comes from three uses: required reserves, excess reserves, and cash. Our interest is in expressing the relationship between the quantity of money and the monetary base. To find this we need to rewrite the previous equation in terms of deposits. Doing so we find,
\[
D = \frac{1}{\left( \frac{C}{D} \right) + r_D + \left( \frac{ER}{D} \right) } * MB
\]

This expression, which is the deposit expansion multiplier, tells us how much deposits change as we change the monetary base. If we ignore excess reserves and cash on hand, we get the same result as the before calculate deposit expansion multiplier.

Next, take the expression for money and rewrite it as
\[
M = C + D \\
= \left( \frac{C}{D} \right) D + D \\
= \left( \frac{C}{D} + 1 \right) D
\]

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Substituting $D$ from the deposit expansion multiplier gives us the final solution:

$$M = \left(\frac{c}{D}\right) + \frac{1}{\left(\frac{c}{D}\right) + r_D + \left(\frac{ER}{D}\right)} \times MB$$

This is a complicated expression, but it tells us that the quantity of money in an economy depends on four variables:

1. The monetary base, which is controlled by the central bank
2. The reserve requirement that is imposed by bank regulators
3. The desire by banks to hold excess reserves
4. The desire by the public to hold their deposits as currency

To understand how each of these four things impacts the quantity of money we can simply study how these things influence the money multiplier. First, as the monetary base expands, holding all else constant, the quantity of money will rise. Looking at the next two things, we see that an increase in either the reserve requirement or banks’ excess reserve holdings will decrease the money multiplier. So for a fixed monetary base, and increase in $r_D$ or $\frac{ER}{D}$ will reduce $M$.

Finally, there is the currency to deposit ratio which appears in both the numerator and denominator of the money multiplier. When an individual withdraws money, increases $\frac{c}{D}$, this will correspond to a decrease in reserves at your bank. This will cause a multidollar contraction in deposits. Thus the net effect is a reduction in the quantity of money.

Let’s do a short numerical example where we calculate the money multiplier. For following are the stats of the banking system as of August 2004.

1. Total Bank Required Reserves = $43.9 billion
2. Total Bank Excess Reserves = $13.3 billion
3. Currency in the hand of the public = $686.2 billion
4. Deposit accounts = $645.2 billion

These figures give us the following results:

Require Reserve Ratio = $r_D = \frac{43.9}{645.2} = 0.068$

Excess Reserve Ratio = $\frac{ER}{D} = \frac{13.3}{645.2} = 0.021$

Currency to Deposit Ratio = $\frac{C}{D} = \frac{686.2}{645.2}$
Let’s plug these numbers into the money multiplier formula for M1,

\[
M = \frac{(\frac{\frac{\text{h}}{10} + 1}{\text{h}}) + r_D + \left(\frac{\text{K} \cdot R}{D}\right)}{\frac{1.064 + 1}{1.064 + 0.068 + 0.021}} = \frac{2.064}{1.153} = 1.79
\]

The following table summarizes the factors which affect the quantity of money

<table>
<thead>
<tr>
<th>Factor</th>
<th>Who Controls</th>
<th>Change</th>
<th>Impact on M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary Base</td>
<td>Central Bank</td>
<td>Increase</td>
<td>Increase</td>
</tr>
<tr>
<td>Require Reserve/Deposit</td>
<td>Bank Regulator</td>
<td>Increase</td>
<td>Decrease</td>
</tr>
<tr>
<td>Excess Reserve/Deposit</td>
<td>Commercial Bank</td>
<td>Increase</td>
<td>Decrease</td>
</tr>
<tr>
<td>Currency/Deposits</td>
<td>Public</td>
<td>Increase</td>
<td>Decrease</td>
</tr>
</tbody>
</table>

17.4.3 The Limits of the Central Bank’s Ability to Control the Quantity of Money

We should now discuss how factors which influence the quantity of money change over time. An easy example is the market interest rate. Changes in the interest rate affect the cost of holding excess reserves and currency. As the interest rate rises you would expect banks to hold fewer excess reserves and the public to hold a smaller portion of their deposits as currency. This will increase the money multiplier and the quantity of money. If these changes are predictable, a link should exist between the monetary base and the quantity of money. However, unless we are talking about a developing economy, such a link does not seem to exist. The link is very weak in developed economies. As stated earlier, it is the public, not the Fed that influences that amount of currency in circulation.

It used to be standard practice for the Fed to target growth in monetary aggregates. However, without control over such things as currency, in 2000 the FOMC announced that targets for money growth were no longer being considered.

Thus, the theory of the money multiplier isn’t very useful for policy. The problem is that the money multiplier is just too volatile. In the last twenty plus years the money multiplier on M1 has fallen from around 3 to under 2. That is a reduction of over 50%. The conclusion is that the relationship between the monetary base and the quantity of money is not something that a central bank in the U.S. can exploit. Now central banks watch the growth of money for one reason. the growth of money is ultimately what determines the rate of inflation. For short-run policy though, interest rates have become the monetary policy tool of choice.
18 Chapter 18: Monetary Policy: Using Interest Rates to Stabilize the Domestic Economy

Central banks have a long list of objectives and a limited number of ways to accomplish these objectives. They are tasked with trying to stabilize prices, output, and the financial system by simply having the power to manipulate their own balance sheet. Policymakers attempt to change the size of the monetary base by selling and buying assets and making loans to banks. Central banks do not have direct control over the quantity of money in the economy. They gain indirect control by controlling interest rates. This is the primary monetary policy tool.

Interest rates are nothing more than the price of borrowing and lending. Higher interest rates tend to restrict borrowing by making it more costly and difficult to obtain credit. This will slow business expansion and new job growth. This is mainly why the market is so interested in how the FOMC will change its target.

In 2001, the FOMC lowered the target federal funds rate 11 times from 6.5 to 1.75 percent. This aggressive stance was meant to spur borrowing and job creation and thus keep the GDP growth going at a time it looked like we were headed for a serious recession. In the end GDP only fell 1 percent and the recession lasted 8 months. This is a lasted example of monetary policy looking successful at stabilizing the economy.

We know that monetary policymakers use interest rates to meet their objectives. The purpose of this section is study three links:

1. the link from the central bank’s balance sheet to its policy tools
2. the link from the policy tools to the objectives
3. the link from the monetary to the real economy

On a final note, we will look at how the target interest rate is chosen by discussing the Taylor Rule.

18.1 The Federal Reserve’s Monetary Toolbox

First, it should be known that the central bank has the ability to control the quantity of reserves the commercial banks hold. This can be controlled by the size of the Fed’s balance sheet. Like most central banks the Fed motivates its operations by looking at prices. The two prices that it is most concerned with are the interest rate at which banks borrow and lend reserves overnight and the interest rate at which banks borrow reserves from the Fed.

When we examine monetary policy it is important to realize that the tools available are dictated by the institution structure of the particular central bank. We will be focused on the tools of the Federal Reserve System and the European Central Bank.

The Federal Reserve has three monetary policy tools at its disposal:
1. The Target Fed Funds Rate, the interest rate which banks use to make overnight loans to each other.

2. The discount rate, the interest rate the Fed charges on loans made to commercial banks

3. The reserve requirement, the level of reserves that banks are required to hold in their vaults or as deposits at the Fed.

Let’s examine each of these tools more closely.

18.1.1 The Target Fed Funds Rate and Open Market Operations

The Target Fed Funds Rate is the FOMC’s primary tool. FOMC meetings always involve a discussion about the target and whether it should be raised, lowered, or left alone. This basically is US monetary policy. It is important to realize that this is a target. The actual fed funds rate is set by the market not by the Fed. So there is a difference between the target fed funds rate and the market fed funds rate.

The name federal funds comes from the fact that the loans that use this interest rate come from the reserve balances at the Fed. Every bank, on a daily basis, has a certain level of reserves that they would like to hold at the Fed. Over the business day the level of reserves will change, and at the close of business, they may have more or less reserves than they want. This difference gives rise to the market for reserves where banks with too many reserves will loan their excess to banks which have a shortage. The Fed does not get involved in the actual lending or borrowing of excess reserves. There are really two reasons why the Fed does not get involved:

1. Since federal funds loans are uncollateralized, this is an extra risk that the Fed does not wish to take on.

2. There is valuable information about the creditworthiness of banks in this market. When a bank can not get an overnight loan, this is a signal that the bank could be in financial trouble.

So, the Fed is in a strange position, it wants to set the interest rate without participating in the interbank loans market. The Fed chooses to control the fed funds rate by manipulating the quantity of reserves. Using open market operations, the Fed adjusts the supply of reserves with the goal of keeping the market fed funds rate close to the target.

We can display the market of interbank loans in a standard supply-demand framework where the demand for reserves is downward sloping and the supply of reserves is a horizontal line. The Fed has no control over the demand, but can set the level of the supply. So changing the target rate is as simple as changing the supply of reserves.

Maintaining the target is the job of the Open Market Trading Desk at the Federal Reserve Bank of New York. Every morning, a group of people forecast
the level of the demand for reserves. Then they supply the level of reserves that keeps the fed funds rate near the targeted level. Usually, the desk will open once a day at 10AM to make transactions do adjust the supply of reserves. Since this happens fairly early in the day, it should come as no surprise that there can be deviations between the target and market rate. Sometimes the gaps can be several percentage points, but only last for a short period. The last big deviation was on Sept 19, 2001 when the target rate was 2 percent and the actual rate was around 1 percent. These types of deviations are rare and the market is becoming more and more stable with time.

18.1.2 Discount Lending, the Lender of Last Resort, and Crisis Management

When a central bank lends to a commercial bank, its balance sheet changes. So, by controlling the quantity of loans made to banks, the central bank has control over the size of reserves the size of the monetary base, and interest rates. The Fed does not really use this avenue to control interest rates. Thus, this discount lending is not an important part of the Fed’s policy toolbox. This tool is mainly used to help maintain short-term stability, eliminate bank panics, and prevent the sudden collapse of a financial institution. In some situations, this market can explode. On Sept 12th 2001, banks borrowed $45.5 billion from the fed. On a typical day, banks borrow $100 million.

Thus, when it comes to the discount loan market, this is used to satisfy the Fed’s role as the lender of last resort. The Federal Reserve System was first established to help promote stability in the financial system is a lot of this stability is driven from the Fed’s ability to help solvent banks stay liquid. Several rule changes over the years have made the requirements for discount loans easier, and banks are not as adverse to using these loans as they used to be.

The discount loan market also helps the Fed promote interest rate stability. To see how this works, we need to look into the details of how the Fed’s lending works. The Federal Reserve makes three types of loans called primary credit, secondary credit, and seasonal credit. As with the fed funds rate, the Fed controls the interest rate on these loans, not the quantity of loans. Let’s look at each of these types:

1. Primary Credit: These overnight loans are extended to banks that appear to be financial sound. Banks must provide collateral for the loans and the interest rate on these loans is the primary discount rate which is currently set 100 basis points, 1% above the fed funds rate. As long as a bank qualifies and is willing to accept the interest rate, they can get the loan.

2. Secondary Credit: These loans are offered to banks that do not qualify for primary credit. Because of the extra risk associated with these loans, the secondary discount rate is set 50 basis points above the primary discount rate. There are two reasons why a bank may take out secondary credit. The first is a temporary shortage of reserves. The second is that they are
unable to find credit anywhere else. By being willing to pay the added interest, the bank is signalling to other banks that it does not quality for primary credit. This is a statement that the bank may be in trouble.

3. Seasonal Credit: These are loans that are typically made by agricultural banks in the Midwest to help manage the cyclical nature of farming.

18.1.3 Reserve Requirements

Reserve requirements are the third monetary policy tool. Since 1935, the Fed has mandated that banks must hold a minimum amount of reserves in an account at the Fed or in their own vaults. As we saw in the last chapter, changes to the reserve requirement affect the money multiplier and the quantity of money in the economy. Increasing the requirement reduces the deposit expansion potential of banks. Thus, the monetary base supports less money in the economy. So, by adjusting the reserve requirement, the central bank can manipulate economic activity. However, this is not a useful monetary tool. Why?

Small changes in the reserve requirements, have large impacts on the level of deposits and the ability of other types of monetary policy to adjust the quantity of money in the economy. The requirement helps maintain the market for interbank loans and keeps the market fed funds rate close to target. The requirement is currently held between 8 and 14 percent of all transaction deposits in the bank. Currently the requirement is 10 percent of all deposits over $40 million. The reserve requirement is based off a two-week average of the banks deposit liabilities.

18.2 Operational Policy at the European Central Bank

The tools of the European Central Bank are quite similar to that of the Federal Reserve. Their tools include an overnight interbank rate, the rate at which the central bank lends to commercial banks, and a reserve requirement. In addition, the ECB pays interest on reserves so there is also a reserve deposit rate.

18.2.1 The ECB’s Target Interest Rate and Open Market Operations

Unlike the Federal Reserve, the ECB only occasionally buys securities. They provide reserves through what are called refinancing operations. The main refinancing operation is a weekly auction of two-week repurchase agreements where the ECB, provides reserves to banks in exchange for securities and then reverses the transaction two weeks later. The policy tool for the ECB is the minimum interest rate that is used in these transactions. This is called the minimum bid rate. This is very similar to the federal funds rate in the U.S.

While these operations look similar to the open market operations of the Federal Reserve, there are some differences. First, these operations are done at all National Central Banks. This is different from the Federal Reserve in that all open market operations take place a the Reserve Bank of New York only.
Second, the number of different participants is much large in Europe. There are hundreds of potential trading partners in Europe while only the largest 20 or so commercial banks get involved in the U.S. The use of collateral is much more broad in the ECB system because the rules of collateral vary by country. Not all of this collateral will be government debt some will come from private entities.

18.2.2 The Marginal Lending Facility

The Marginal Lending Facility of the ECB is entity through which the ECB lends funds to commercial banks. The ECB provides overnight loans to commercial banks at an interest that is currently set at 1% above the minimum bid rate. Other than that the function of lending to commercial banks is almost identical to that under the Federal Reserve.

18.2.3 The Deposit Facility

At the end of a business day, any bank with excess reserves can deposit them in the ECBs deposit facility at an interest rate below the target refinancing rate. Since the rate is so low, there are not typically very many excess reserves. It is important to realize that there is a floor placed on the interest and that the ECB pays interest on excess reserves which is not the case with the Federal Reserve. This gives banks more of an incentive to hold excess reserves and no loan will ever be offered at an interest rate less than what is being paid by the deposit facility.

18.2.4 Reserve Requirements

The ECB requires all banks to hold a minimum level of require reserves. The reserve requirement is generally 2 percent of all checking and other short-term deposits. Unlike the Federal Reserve, the ECB pays interest on the required reserves held at the central bank. The rate is generally set to be close to the interbank lending rate. As a result, banks find that meeting the reserve requirement are almost costless.

The European system is designed to give tight control over short-term rate. Empirical evidence shows that this is in fact true. The overnight cash rate, their fed funds rate, fluctuates but always stays within 100 basis points of the targeted rate. So, short term rate are somewhat more stable in the European system.

18.3 Linking Tools to Objectives: Making Choices

So, monetary policymakers have several objectives and a list of tools to try and accomplish these objectives, which ones do they choose to use? Generally there is some consensus on which policy tools are more appropriate:

1. The reserve requirement is not useful as a policy tool
2. Central bank lending is necessary for financial stability

3. Short-term interest rates are the tool to use to stabilize short-term fluctuations.

To get at this logic let’s look at what characteristic distinguish a good policy instrument from a bad one.

18.3.1 Desirable Features of a Policy Instrument

Generally, a quality policy instrument will have three characteristics:

1. It is easily observable by everyone.

2. It is controllable and quickly changed

3. It it tightly linked to the policymakers’ objectives

Requiring that a policy tool is observable and controllable leaves very few options. The reserve requirement does not work since the banks can not shift their balance sheets that quickly. Any changes to the reserve requirement would have to be made in advance and thus the requirement is not quick to change. The other choices mostly involve components of the central bank’s balance sheet: commercial bank reserves, the monetary base, loan, and foreign exchange reserves. Other choices are prices that include interest rates and exchange rates. Over the years we have seen that the Federal Reserve and other central banks tend to choose prices and policy tools. The question is why prices instead of quantities? This mainly has to deal with observability and controllability. The banking system and even the public have an easier time interpreting information from prices instead of quantities. Also, it is easier to control the responses that come out price changes. Targeting quantities can be useful when the Fed wants to set prices at level that would be politically undesirable.

18.3.2 Operating Instruments and Intermediate Targets

We should take a moment to become familiar some terms that are frequently used in central banking.

- Operating Instruments: These are the actual tools of policy Examples: Interest Rates, Monetary Base

- Intermediate Targets: These are instruments that are not directly controlled by the central bank, but lie between their objectives and their tools. Examples: Growth in Monetary Aggregates.

- Final Objectives: These are the goals of monetary policy. Examples: Low Inflation, High Growth.
18.4 A Guide to Central Bank Interest Rates: The Taylor Rule

Central banks primarily try and set interest rates, and in their eyes this is all about numbers. The question is how do they set the numbers that they do. Generally these targets are selected by a committee only after a long meeting where information is discussed and then a vote is taken. It is generally to complicated to discuss all of the details that go into setting any particular rate.

To gain an understanding of how rates are set we can come up with a simple formula which estimates what the FOMC does. This simple rule is called the Taylor Rule. This rule tracks the actual behavior of the target federal funds rate and relates it to the real interest rate, inflation and output. The formula is:

\[ \text{Target Fed Funds Rate} = 2.5 + \text{Current Inflation} + 0.5 \times \text{Inflation Gap} + 0.5 \times \text{Output Gap} \]

This formula is assuming that the long-run real interest rate is 2.5%. The inflation gap is the measure of the current inflation minus some target inflation level. The output gap is current GDP minus its potential level in percentage terms. For example, if inflation is currently 3 percent, the target inflation rate is 2 percent, and GDP equals its potential level so that there is no output gap. Then the target fed funds rate should be:

\[
\begin{align*}
\text{Target Fed Funds Rate} &= 2.5 + 3 + 0.5 \times 1 + 0.5 \times 0 \\
&= 6 \text{ percent}
\end{align*}
\]

This rule makes intuitive sense: When inflation rises above its target, the response is to raise interest rates. When output falls below the target level, the response is to lower interest rates. If inflation is on target and there is no output gap, then the fed funds rate should be set at the inflation rate plus 2.5%.

The Taylor Rule has some interesting properties that gauge how much the fed rate should react to different changes in the economy. First, notice what happens if inflation rises by 1 percent holding everything else constant. If this happens, two terms in the Taylor rule increase, the current inflation increases by one percent and the inflation gap increases by 1 percent. The increase in the inflation gap corresponds with a .5% rise in the target fed funds rate. Combined with the change in current inflation we get a straightforward relationship. A 1 percentage point increase in inflation raises the target federal funds rate 1.5 percentage points.

The Taylor rule also states that for each percentage point increase in output over its potential we should see a .5 percentage point increase in the target fed funds rate. This tells use one thing about the fed funds rate, it is more sensitive to changes in inflation than to changes in output.

If we think about finding the Taylor Rule, we need four inputs:

1. The constant term set at 2.5%
2. A measure of inflation
3. A measure of the inflation gap
4. A measure of the output gap

The constant term is pretty straightforward. The next terms are measures of inflation and the inflation gap. What should we use? The CPI is generally the first measure that comes to mind. However, central bankers tend to use the personal consumption expenditure (PCE) index to measure inflation. The PCE comes from national income accounting and is basically measured off of the spending approach to measuring GDP. That is

$$GDP = C + I + G + X - M$$

The PCE comes from the term C which is household consumption. As for an inflation target, we will simply follow Taylor and say 2 percent. That means the neutral fed funds rate is 4.5%. For the output gap, the choice is typically is the percentage deviation that GDP takes from is long-term trend.

Empirical data shows that the Taylor rule does doe a reasonable job of matching the changes in the target fed funds rate. This is especially true if you take a purely qualitative look at the data. The Taylor rule does a great job of predicting which way the fed funds rate will move. It is important to realize that the rule is far from perfect and is too simple to handle crisis situations like the response after Sept 11th.

Another difficulty of the Taylor rule is that is uses national income accounting data which is not real-time data. Monetary policymakers have no choice but to make important decisions on incomplete information. So is some sense the success of monetary policy depends on the judgements of people working at the central bank. However, we have seen that even though policymakers are given a really difficult task, they seem to accomplish their goals of stabilized inflation and high growth.

19 Chapter 19: Exchange-Rate Policy and the Central Bank

Not going to be covered

20 Chapter 20: Money Growth, Money Demand, and Modern Monetary Policy

What seems to be clear about modern monetary policy, at least as we have discussed thus far, is that it seems to have less to do with money than it does with interest rates and exchange rates. Contrary to this thought, it is important to realize that economists and central bankers do care about money. One of the
most quoted statements in this area was written by Milton Friedman. He wrote "inflation is always and everywhere a monetary phenomenon". Most economists agree that the instability in money growth is tied to instability in prices. Stable prices are the primary objective of almost all central banks. So, yes central bankers do care about money.

Why, if both the Federal Reserve and ECB place the same high priority on stable prices, do we see different treatments on money growth across central banks. The ECB makes regular statements about money growth in their public statements. At the same time, the Federal Reserve never mentions money only interest rates. If money growth and inflation are tied together, why don’t policymakers pay more attention to money growth? To get at this we are going to be looking at two things. First, what is the link between money growth and inflation. Second, we will try to explain the focus that the Fed had on interest rates.

20.1 Why We Care about Monetary Aggregates

Let’s start our discussion with the single most studied fact in monetary economics: the strong link between money growth and inflation. Empirical evidence shows that countries with high money growth always end up with high inflation. There are no examples of countries with high inflation and low money growth or low inflation and high money growth.

Most countries fall into the same category: low inflation and low money growth. The correlation between money growth and inflation is lower for these low money growth/low inflation economies. However, the relationship is still there higher money growth yields higher inflation. This empirical evidence generates one simple rule. To avoid episodes of high inflation, a central bank must be concerned with money growth. Avoiding high inflation means avoiding rapid money growth.

Another interesting feature comes out of the empirical evidence. In high inflation countries, the rate of inflation exceeds the rate of money growth. In low inflation countries, the rate of money growth exceed the inflation rate. To understand this, let’s look at an extreme example: Nicaragua. Nicaragua has seen suffering through some of the highest inflation rates ever recorded. There 20 plus year average inflation rate from 1980-2003 was 1200%! This corresponds to a 5% rise in prices a week. When the currency is losing value this quickly, people will try to spend any currency they have as quickly as possible. Thus, the velocity of the currency flowing through the economy is very quick. Every unit of currency bounces quickly from person to person. Well this quick movement of currency is a lot like having more money and thus the high velocity of money mimics additional money growth and the rate of inflation exceeds the true money growth rate.

This link between inflation and money growth is the foundation of modern monetary policy. Central banks like the ECB closely monitor changes in monetary aggregates that signal money growth. However, to use the monetary aggregates as an objective or target, the central bankers need to understand
how this link between inflation and money growth works. They also need to realize that money growth is not the only reason we see inflation. There can be a substantial spread in the inflation rate across countries who all have similar rates of money growth. Let’s get at a better understanding of this link between money growth and inflation.

20.2 The Quantity Theory and the Velocity of Money

In this section we will try and account for the link between high money growth and high inflation. In times of inflation the value of money is falling which means the buying power of anyone holding money is also falling. It takes more dollars to buy the same goods and at the same time it would take less goods to buy a dollar.

As with all goods, the price of money is determined by the supply and demand for money. Given a steady demand for money, an increase in the supply of money drives the price of money down. That’s inflation. If the central bank floods the economy with a large amount of additional money, inflation will be high.

20.2.1 Velocity and the Equation of Exchange

To understand the link between money growth and inflation, we need to simply think of money as a means of payment. Let’s put together a simple economy of four people where each person has the following:

<table>
<thead>
<tr>
<th>Person</th>
<th>Endowment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$100 in currency</td>
</tr>
<tr>
<td>2</td>
<td>2 tickets worth $50 each</td>
</tr>
<tr>
<td>3</td>
<td>$100 calculator</td>
</tr>
<tr>
<td>4</td>
<td>25 drawing pencil worth $4 each</td>
</tr>
</tbody>
</table>

Now these four people want to make exchanges. Suppose the following transactions take place:

- Person 1 wants a calculator, so she trades her $100 in currency to person 3 for their calculator.
- Person 3 wants the tickets so they take the $100 in currency from person 1 and gives it to person 2 for the tickets.
- Person 2, who now has the $100, needs the drawing pencils and gives the $100 to person 4 for the pencils.

Let’s analyze these transactions. The total value of the transactions was:

\[ 100 \times (1 \text{ calculator}) + 50 \times (2 \text{ tickets}) + 4 \times (25 \text{ pencils}) = 300 \]
In this economy, the $100 in currency was used three times and generated $300 worth of transactions. In general this would be

\[(\# \text{ of Dollars}) \times (\text{Times Used}) = \text{Value of Transactions}\]

In this case

\[100 \times 3 = 300\]

The number of times the dollars were used is also called the velocity of money. The more frequently each dollar is used, the higher the velocity of money.

We can apply this idea on a more grand scale with a real-world economy. We can tie together the quantity of money, the velocity of money, and Nominal GDP using this same relationship. That is

\[M \times V = \text{Nominal GDP}\]

where \(M\) = quantity of money and \(V\) = velocity of money.

In 2004 we have \(M_1 = 1.3\) trillion, \(M_2 = 6.3\) trillion, and Nominal GDP = $11.6 trillion. Given this information we can calculate the velocity of \(M_1\) and \(M_2\) which are just different measures of money. For \(M_1\) we find

\[\text{Velocity of } M_1 = \frac{11.6}{1.3} = 8.9\]

and for \(M_2\) we find

\[\text{Velocity of } M_2 = \frac{11.6}{6.3} = 1.8\]

Let’s do one more thing. Remember Nominal GDP satisfies the following relationship

\[\text{Nominal GDP} = \text{Price Level} \times \text{Real GDP}\]

Incorporating standard notation that would be

\[\text{Nominal GDP} = P \times Y\]

So we can put this into our previous express and get.

\[MV = PY\]

This is called the equation of exchange and says that the quantity of money multiplied by its velocity equals the level of nominal GDP written as the price level multiplied by real GDP.

With the quantity of money on the left and the price level on the right, the equation of exchange provides a link between money and prices. Inflation is
simply the change in price levels. We can rewrite the equation of exchange in terms of percentage changes (I will avoid mathematical details). as:

\[
\%
\Delta M + \%
\Delta V = \%
\Delta P + \%
\Delta Y
\]

Money Growth + Velocity Growth = Inflation + Real Growth

where \%
\Delta stands for percentage change. The percentage change in the quantity of money is money growth; the percentage change in the price level is inflation and the percentage change in real GDP is real growth. So the equation tells us that money growth plus velocity growth equation inflation plus real growth.

20.2.2 The Quantity Theory of Money

The quantity theory of money simply states that money growth translates directly into inflation. To get at the quantity theory we need the following. First, think of applying the equation of exchange to the short-run. In the short run, there will be very little change to financial innovation and the cost of holding money will not change thus velocity should be constant and \%
\Delta V = 0. Also, in the short run, and changes in real output are generated from economic resources and technology which would also be constant in the short term. Thus real output would be constant and \%
\Delta Y = 0. Thus the quantity theory of money states

\[
\%
\Delta M = \%
\Delta P
\]

Numerically, every 1% increase in the money supply will generate a 1% increase in prices.

We can the quantity theory of money to analyze an equilibrium in the market for money. That is, given the fact that individuals require money to complete transactions which means that the number of dollars needed equals the total dollar value of transactions divided by the number of times each dollar was used. More specifically, money demand (\(M^d\)) equals the total value of transactions divided by the velocity of money. For the economy as a whole this would be

\[
M^d = \frac{1}{V}PY
\]

The supply of money (\(M^s\)) is determined by the central bank and the banking sector. Equilibrium would require that money supply equals money demand (\(M^d = M^s\)) which equals the quantity of money in the economy (\(M\)). This gives us \(MV = PY\). If we reapply the assumptions of constant velocity and output to get the same conclusion money growth equals inflation.

This theory tells us two things that appear in empirical evidence:

1. It obviously shows us why high inflation and high money growth move together.

2. It also explains why money growth exceed inflation in low-inflation economies.

The money growth can be partly absorbed because these countries are seeing real growth.
To see the second point let us suppose that a country has 5% money growth, constant velocity, and 3% real growth. What does the equation of exchange predict for the inflation rate. We find

\[ 5 + 0 = \% \Delta P + 3 \]
\[ \% \Delta P = 2 \]

We would expect inflation to be 2% which is clearly less than money growth.

20.2.3 The Facts about Velocity

If velocity were indeed constant, this would make monetary policy much more predictable especially if you think economic growth is tied with resources and technology. To maintain stable low inflation, the central bank should maintain stable low money growth. Still this only works if velocity is assumed constant. The question is whether or not this is a safe assumption. The answer is the velocity is not constant. In the U.S. the velocity of M1 has a clear upward trend, while M2 has a slight upward trend. Both M1 and M2 velocity show substantial short-term volatility. This empirically evidence states that if the Fed uses M2 as a benchmark then the theory is correct in the long-run. In the long-run, the velocity of money is stable and controlling inflation is simply done by controlling the growth of money.

However, monetary policy is short term policy. In this timeframe velocity is not constant. Thus, controlling inflation becomes much more difficult and dynamic. Changes in velocity, which can be large, could lead to large and quick changes in money growth. Consider the following. If the goal of Fed policy were to achieve 2 percent inflation in a world with real growth of 3.5%, the policymakers should set money growth at 5.5% minus the growth rate of velocity. If velocity increases by 3 percent, then money growth needs to be 2.5%. If velocity falls by 3 percent, money growth would need to be 8.5% to achieve the same level of inflation. When inflation is low, velocity volatility can lead to large swings in the rate of money growth needed to obtain any inflation target.

To understand why velocity is volatile in the short run, we need to look at the past. There was a dramatic increase in velocity in the late 1970s and early 1980s. This time frame was characterized by high interest rates and financial innovations. With high interest and less need to hold currency, the return on money fell to around -20% (around the level of the nominal interest rates of the time). Thus, people quickly disposed of any excess cash and every dollar went through more hands and velocity of money rose.

These data suggests that fluctuations in velocity are tied to changes in people desire or demand to hold money. To understand changes in velocity policymakers must understand what drives the demand for money.

20.3 The Demand for Money

The best way to understand the fundamentals of money demand, the velocity of money, and the relationship between money and inflation is to ask a very simple
question. Why do people hold money and what do they do with it? Money has three basic roles as a means of payment, a unit of account, and a store of value. The unit of account is critical for measuring prices in the economy, however, it does help to explain why households hold money. Instead it is money’s role as a means of payment and store of value which seems to be the main reasons why people hold money. The demand for money is a combination of two types of demand:

1. Transactions Demand for Money: demand that people have to hold money to pay for goods and services
2. Portfolio Demand for Money: demand that people have to hold money as an asset (store of wealth).

Let’s look at each of these demand types and see how they have a role in understanding why the velocity of money changes over time.

20.3.1 The Transactions Demand for Money
The quantity of money people hold for transactions depends on the following

1. Nominal Income
2. Cost of holding money
3. Availability of substitutes

The first point is obvious because higher nominal income is tied with higher spend and thus a need for more money. Thus, the higher is the nominal income, the higher will be the demand for nominal money.

When deciding how much money to hold it is also important to take into account the cost and benefits of holding money. The benefits of holding money are clear: holding money allows people to make payments for goods and services. The costs are also clear, they are the foregone interest earnings you would make if you didn’t hold money. The cost is the difference between the nominal return on money which is zero and say a bond which pays an interest rate. So the decision to hold money depends on the return of other assets.

Let’s look at an example of managing cash balances and the role of other assets. Suppose you have $3000 in deposits at the first of every month from your paycheck and the your bills cost you $100 a day for 30 days. So if you do nothing you will have $3000 in your account at the beginning of the month, $1500 on the 15th day, and $0 on the 30th day. Suppose your bank gives you another option to manage your account. That is you can shift funds between a cash and bond account, but there will be a $2 service charge for the service. How should you manage your account? Plus, if you choose to shift your account, how often should you do it?

Let’s compare two options:
1. You just leave the $3000 alone and draw it down $100 a day and do no shifting.

2. You split your account with $1500 in cash and $1500 in bonds on the first of the month, then at the end of the 15th day you take the $1500 in bond and return it back to cash. There will be a service charge of $2 on this option.

Which option do you choose? Well, it depends on the interest rate earned on the bond funds. This interest is the opportunity cost of holding money. If the interest income is at least as much as the service charge, you will choose option 2. Otherwise, you will chose option 1. So, let’s figure out the interest rate that changes your decision. If you decide to switch your balances in the middle of the month, you will have $1500 in bonds for 15 days and $0 for 15 days. That means your average bond balance would be $750. The bank fee is $2 which is a monthly interest rate of

$$\frac{$2}{$750} = 0.0027$$

Which means that the $2 fee corresponds to an interest rate of 0.27 percent. If the bond fund generates more than 0.27 percent interest per month you will chose option 2. Otherwise, you will choose the first one. This generates a general conclusion.

As the nominal interest rate rises, then, people reduce their checking account balances. They will be shifting more funds into interest earning accounts and keep lower balances in checking only adding money when needed. In this example the annual salary would be $36,000. If you choice option 1, your average money balance would be $1,500 and the velocity of your money would be

$$\frac{$36,000}{$1,500} = 24$$

However, if the monthly interest rate rises above 0.27 percent, you would switch to option 2 which means an average money balance of $750 and velocity would be

$$\frac{$36,000}{$750} = 48$$

So, the higher the nominal interest, the high the opportunity costs of money. This means lower money balances and a higher velocity of money.

Besides interest rates, the transaction demand for money is also changed by technological advances in the financial system. Anything that allows people to hold fewer money balances reduces the opportunity cost of holding money. This low cash balances and a higher velocity of money. So of these improvements are things like ATM machines and more liquid asset accounts. This probably accounts for the increases we have seen in the velocity of M1.
Finally, we hold money to insure ourselves against possible shocks. This is called the precautionary demand for money. This part of demand is usually tied to our income and level of spending. This is just our rainy day fund and grows if we find ourselves in riskier situations.

20.3.2 The Portfolio Demand for Money

Money is also a financial instrument that we can hold as an investment. As a store of value, money does provide a role in diversification of one’s portfolio. The portfolio demand for money is a lot like thinking about the demand for bonds. Money could be thought of as a bond with zero maturity.

The portfolio demand for money depends on several things:

- Wealth Level: as wealth rises the quantity of all assets rises this includes money
- Return relative to Alternatives: A decline in interest bearing assets will make money look relatively more attractive as an investment.
- Expected Future Interest Rates: If you expect interest rates to rise in the future, bonds will become less attractive and you will sell bonds and hold more money. If expected interest rates rise, so does money demand.
- Liquidity Relative to Other Assets: If bonds, stocks, or other assets become less liquid, the demand for money will increase.

20.4 Targeting Money Growth in a Low-Inflation Environment

In a high inflation/high money growth economy, the primary objective and strategy of the central bank is clear. The primary objective is to reduce inflation. The primary way to do this is by reducing the rate of money growth. In a low-inflation environment, controlling inflation is not that simple. The quantity theory of money shows that the tie between money growth and inflation is dependent on the stability of the velocity of money. In the US the velocity of M2 is quite stable and thus can be used as a benchmark for stabilizing inflation. In the short-run the velocity can change, but the long term stability still allows the Federal Reserve to look at money growth.

As stated in the previous section, policymakers often use intermediate targets to gauge the successfulness of a tool in getting at a final objective. This statement holds here because:

1. There does appear to be some link between the monetary base and the quantity of money
2. There is a somewhat predictable relationship between money growth and inflation.
These two points are relatively easy to see. Point one is established by looking at how the Fed changes its balance sheet and the effects on the quantity of money. The second point can be established by using the theories discussed in this chapter. Of course, one requirement of getting point 2 is that money demand is stable and predictable. This had been a problem for the Federal Reserve.

### 20.4.1 The Instability of U.S. Money Demand

To get at the instability of money demand we need to look at two factors which influence the transaction demand for money: nominal income and interest rates. Using the equation of exchange we should find that income should be proportional to money demand. If we triple someone's income they should engage in three times more transaction and demand three times more money. Since this appears logically, we can simply focus of income divided by the quantity of money. This is the velocity of money. This brings us to the second point: interest rates. Is there a stable relationship between the velocity of money and the opportunity cost of holding it?

Empirically evidence says that the answer to this question is mostly yes. As the opportunity cost of money increases, measured as the gap between the 3-month T-bill and return to M2, the velocity of money increases. Between 1979 and 1991 we see a strong linear relationship and a 1 percent rise in the opportunity cost of money increases velocity by 1.5 percent. Then in the 1990s a new linear relationship formed with a different slope. That is a 1 percent rise in the opportunity cost of money drive velocity up by about 6 percent. For some reason the velocity of money became 4 times more sensitive to changes in interest rates. The question is why?

This is important because this makes the demand for money look unstable. However, no real explanation can explain the change in sensitivity. The most popular store is the introduction of new financial instruments in the 1990s which earned more interest than money and could be used as means of payments. There is also talk about changes in mortgage refinancing which fell dramatically in the 1990s. Mortgage refinancing generally increases the demand for money. The typical refinancer is taking some equity out of their house and turning it into more liquid assets including money. Empirical evidence show that the demand for refinancing is very sensitive to interest rate changes and it is this sensitive which is generating some sort of feedback in the demand for money. It will be interesting to see if the system reverts back to the previous levels of sensitive once the refinancing market cools in the wake of rising interest rates.

### 20.4.2 Targeting Money Growth: The Fed and the ECB

The targeting of money growth is a rare practice in central banks. Though this practice was common as recently as the 1970s and FOMC actually made money growth a primary objective in 1970. In 1975, Congress passed a law that required the Federal Reserve Chairman to come testify before Congress every
3 months and announce what the targeted goals were for monetary policy. In 1978, the Fed was required to publish this goal twice a year in written form.

It is important to realize that setting a target and getting the actual numbers to hit the target are different things. The FOMC rarely hit the mark. Because of the difficulty, the FOMC stopped publishing written objectives for money growth in 2000 once it was legal to do so. There we still people in the Federal Reserve that believed that the money growth targets could be achieved using the tools of monetary policy. However, most people also believe that achieving such a goal would require frequent large changes in the Fed funds rate which was undesirable.

The European view on money growth is quite different. The ECB still announces a money growth rate and a desired growth rate. Any large deviations from the desired rate require explanation. The differences between the Fed and ECB central around beliefs in the stability of money demand. Most studies report that the demand for the Euro is stable, and thus any changes in the velocity of the currency should be predictable. This is why the ECB still places importance on looking at money growth. The thoughts of the ECB are generated from empirically evidence that shows that the velocity of money in Europe, over the long-run, has been falling significantly over the last 20 plus years. This would have large implications on the role of money growth with inflation as talk about in earlier sections.

Even given the differences between the Fed and the ECB, they both choose to target interest rates as their primary monetary policy tool. The reason is that interest rates are the link between the financial system and the real economy. Stable interest rates help to stabilize the real economy from financial shocks. When innovations occur in the financial system they can have direct implications on the velocity of money. From this point the Fed can do two things: keep interest rates constant by adjusting liquidity, or keep money growth constant and allow interest rates to fluctuate. Monetary policymakers prefer the first approach as volatile interest rates would destabilize the real economy. Targeting interest rates is the best way to stabilize inflation in the short run, while maintaining low money growth is the best way to stabilize long run inflation.