**Chapter 2: Federal Reserve and the Tools of Monetary Policy**

* Financial system bailout
	+ Fed’s balance sheet was distorted by the financial crisis
	+ Fed undertook aggressive monetary action, buying Treasury and other securities, to stabilize the economy
	+ Mortgage backed securities purchases supported the housing market but were significantly riskier than Treasury purchases
	+ The purchases lowered interest rates close to zero but the economy did not rebound
	+ Fed began “Quantitative Easing” in 2009
		- Purchasing even more bonds and creating more reserves
		- Banks were holding onto their excess reserves instead of lending them out
		- 2010: QE2
		- 2012: QE3
* Fed conducts monetary policy by changing the monetary base
	+ MB=C+TR
	+ Sum of the currency in circulation plus the total reserves in the banking system
	+ TR = excess reserves + required reserves
		- RR = k/DEP
* Liabilities of the Fed
	+ Fed Reserve Notes
	+ Depository Institution Reserves
		- All banks must hold deposits at the FRBs
	+ Treasury Deposits
	+ Deferred Availability Cash Items (DACI)
	+ Capital
		- Money paid in by member banks to purchase stock
		- Banks get a 6% dividend
* Assets of the Fed
	+ Loans
		- Makes loans to banks and other depository institutions
		- Rate charged is the discount rate
	+ Government securities
		- Buy and sell through open market operations
	+ Cash Items in Process of Collection (CIPC)
	+ Float = difference between CIPC and DACI
* Tools of monetary policy
	+ Open market operations
		- Most useful and important
		- Fed directly changes money supply by buying or selling US government securities on open secondary market
			* Pays for securities by crediting new reserves to special bank accounts of selected dealers
			* Collects for sales by taking existing reserves back
			* Only the central bank can unilaterally create or retire money in this way
		- Increase in MS: buy
		- Decrease in MS: sell
		- Money supply changes immediately and dollar for dollar, making open market operations flexible and precise
		- Short term interest rates are pressured upward when Fed sells and downward when it buys
		- FOMC decides when they meet 8 times a year, issues policy directives to open market desk at FRB of NY
		- Operations of open market desk
			* Level of bank reserves necessary to support primary objectives + level of excess reserves – level of discount window borrowing = reserve target to be supplied by the desk
	+ Discount rate
		- Interest rate at which Fed lends to depository institutions
		- As Fed lends “at the window”, money supply increases
			* When banks borrow at the discount window, the funds they borrow are paid in reserves by the Fed—so there is an increase in reserves in the banking system and an increase in the money supply
		- Changes in discount rate theoretically affects incentives to borrow but banks do not necessarily respond to changes
		- Discount rate is more of a signal than direct control
			* Increase means Fed wants smaller money supply and higher rates
				+ Decreases MS
			* Decrease means Fed wants larger money supply and lower rates
				+ Increases MS
	+ Reserve requirements
		- Least used tool
		- Reserve requirements not used for “fine-tuning”
		- $0-15.5 million: 0%
		- $15.5-115.1 million: 3%
		- Over $115.1 million: 10%
		- Demand deposits = RR / k
		- Lowers rr to cause a higher money multiplier
		- Raises to cause a lower money multiplier

**Chapter 3: The Fed and Interest Rates**

* The Fed’s Monetary Policy Role
	+ Major objectives: promote economic growth, full employment, price stability, and a correct exchange rate for the dollar
	+ Method: controlling the level of bank intermediation
		- By controlling the **monetary base** (currency in circulation and reserve balances)
* Implementation of monetary policy
	+ FOMC meets 8 times a year to review goals
	+ At the end of the meeting, issues a directive to the manager of the system’s open market account in NY
* Monetary base vs. money supply
	+ Monetary base consists of Fed notes in circulation plus depository institution reserves **(reserve account balances and vault cash)**
		- These are the only assets financial institutions can use to satisfy reserve requirements
	+ Money supply definitions
		- M1=currency in circulation+checking accounts+interest on checking accounts
			* Focuses on money as a medium of exchange, consists of assets that people hold to buy things with
		- M2=M1+savings deposits+money market accounts+some overnight repurchase agreements+small time deposits less than 100,000
			* Includes the role money plays as a store of value as well as a medium of exchange
			* Includes accounts that will preserve purchasing power if there is inflation
* Fed controls monetary base
	+ To meet reserve requirements, depository institutions must transact with Fed in monetary base assets. They either:
		- Deposit adequate reserves at FRB
		- Maintain adequate cash in vault
	+ Either way, reserves earn no interest. The more cash or reserves an institution holds above its requirements with the Fed, the more it wants to make new loans or investments to avoid lost interest income
* Thus, the Fed controls the money supply
	+ Excess reserves appear as Fed:
		- Buys securities on open market
		- Lends at discount window
		- Lowers reserve requirements
	+ As depository institutions lend or invest excess reserves, M1 increases
		- New loan of excess reserves increases borrower’s transactional balances
		- Purchase on investment securities increases seller’s transactional balances
* Money supply affects the economy
	+ Proceeds of new loans or investments not only increase M1, but finance purchases by individuals and business of goods or services in real sector, contributing to economic growth
	+ By expanding or contracting monetary base, Fed:
		- Increases or decreases excess reserves, thus
		- Raising or lowering incentive to lend or invest, thus
		- Encouraging or discouraging expansion in real sector
* To influence interest rates, Fed targets but does not set Fed Funds rate
	+ Fed funds rate is a market-determined rate negotiated between borrowers and lenders in the market
	+ It’s the rate that banks change to lend overnight funds to one another
	+ It’s a benchmark rate measuring:
		- Return on bank reserves (most liquid of all assets)
		- Availability of reserves, which in turn influences banks’ decisions on making loans to borrowers
		- Intent and effect of monetary policy
* As Fed adjusts tools of monetary policy, reserve effects influence fed funds rate significantly in the short run
	+ Open market operations: buying treasury securities pressures ffr downwards, selling pressures ffr upwards
	+ Discount rate: cutting discount rate pressures ffr down, raising discount rate pressures ffr up
	+ Reserve requirements: cutting rr pulls ffr down, raising rr pushes ffr up
* Fed cannot set the ffr in the long run
	+ Ultimately, factors in real sector determine credit demand
	+ Fed cannot artificially sustain ffr too low or high
		- Borrowing costs too low:
			* M1 may grow too rapidly
			* Real investment decisions may be distorted
		- Borrowing costs too high:
			* M1 may not “keep up” with real sector
			* Economy may falter as real investment declines
* Monetarists
	+ Milton Friedman
	+ Constant, slow-growth
	+ Monetarists assume that when people have more money, they spend more freely and stimulate the economy directly
		- Is distorted by volatility in prices
	+ Thus, money supply can be used to influence aggregate demand
		- Adding reserves carefully should promote economic growth
		- Subtracting reserves carefully should slow down the economy
		- Central bank can distort price levels by over-adjusting either way
	+ Short term interest rates merely indicate monetary policy’s effects
	+ Argue that the GD was caused by a decrease in money supply which led to a decrease in P&Q
	+ The quantity theory: MV=PQ
		- If velocity and quantity stay constant, an increase in money supply will cause an increase in price
* Keynesians
	+ Keynes—first economist to advocate for government spending (deficit spending) to stimulate the economy
	+ Discount/disregard direct money supply effects
	+ Real sector economic growth is:
		- Stimulated by falling rates as economic activity costs less to finance
		- Slowed by rising rates as economic activity costs more to finance
		- Always and significantly susceptible to influence of monetary policy
	+ To Keynesians, money supply changes reflect reactions to interest rates
	+ A Keynesian would say that an increase in money supply will decrease interest rates, which will encourage an increase in quantity
	+ Liquidity trap: where increasing money supply does not lead to lower interest rates if consumers hoard cash rather than spend and invest
* Fiscal policy: control over government spending and taxes
	+ Controlled by the Treasury Department
	+ Money for budget comes from taxes collected by the IRS and from public debt through the sale of treasury securities
* Monetary and fiscal policy over time
	+ Great depression: Keynesian arguments came to the forefront
		- Government spending was financed by issuing debt
			* Infrastructure, dams, national parks
			* Deficit spending
	+ 1950s: Monetary policy important again
		- If money supply too low, it can constrict economic expansion
		- If money supply growing too fast, it can lead to inflation
	+ 1970s: economists looking for an optimal combo of fiscal and monetary policies, fiscal policy couldn’t solve stagflation
	+ 1980s: high inflation led to emphasis on money supply over keeping interest rates low
	+ 2000s: monetary policy seen as primary policy tool for economic stabilization
	+ Until 2008: direct stimulus to economy plus concern that expansion of money supply did not seem to stimulate economic activity
* Six basic goals of monetary policy
	+ Established by Humphrey-Hawkins Act of 1978
	+ Price stability
		- Consumer Price Index (CPI) based on basket of goods and services purchased by consumers
		- As price level increases, purchasing power of money declines
		- Inflation is the continuous rise in the average price level; as prices increase, the same amount of money buys fewer and fewer goods
		- High rates of inflation present 2 problems:
			* All economic units don’t have the ability to adjust equally to price level changes
			* Inflation is a disruptive force and can have an uneven effect
		- Inflation targeting: recently, Fed has been targeting about 2% of inflation
			* If rate is above target: fed will raise interest rates by open market sale of securities (reducing the money supply)
			* If rate is below target: fed will lower interest rates by open market purchase of securities (increasing the money supply)
	+ Full employment
		- * Unemployment rate only measures the percentage of those who are actively seeking work and can’t find a job
	+ Economic growth
		- Refers to the standard of living, goal is to have it increase over time
		- Depends on increased productivity of labor and capital
		- Measured through changes in GDP
	+ Interest rate stability
		- Low volatility in interest rates facilitates economic planning and GDP growth
		- High rates lead to decline in consumer consumption and business investment, low rates help to encourage capital expenditures
		- 1970s: high rates led to collapse of S&L industry
	+ Stable financial system
		- Lender of last resort
	+ Stable foreign exchange markets
		- Monitors value of the dollar
* Conflicts among the goals
	+ Most people argue that we can’t have both full employment and price stability
		- Increase the money supply to stimulate the economy (Keynes)
		- Increasing the money supply can lead to increased inflation (Monetarists)
		- 1970s: stagflation—low employment and high inflation
* Three expenditure channels for monetary policy
	+ Business investment in real assets
		- Present values of future cash flows from real assets depend significantly on general level of interest rates
	+ Consumer spending for durable goods and housing
		- Most of spending is on credit, so it tends to vary directly with credit conditions
			* Falling interest rates tend to encourage spending
			* Rising interest rates tend to discourage spending
	+ Net exports (gross exports less gross imports)
* Practical considerations in monetary policy
	+ Time lags in implementation reduce effectiveness
	+ Political pressures may influence fed reserve policy
	+ Technical factors demand constant adjustment
		- Cash drains
			* Cash holdings by public “use up” monetary base
			* Fed must try and offset with careful open market purchases
		- The float
			* Difference between deferred availability cash items (DACI) and cash items in process of collection (CIPC)
		- US treasury deposits
			* Treasury payments cause large shifts in reserves
			* Fed and treasury try to coordinate any large fluctuations
	+ Velocity of money difficult to predict
	+ Fed can only create incentives for firms to invest and consumers to spend
* Treasury department and fiscal policy
	+ Fiscal policy is a reflection of the work of Keynes
	+ Active responses by governments required to stabilize output over the business cycle
	+ Use government spending to increase demand for goods and services
* The 2008 financial crisis
	+ Subprime lending market
		- Subprime: borrowers with bad credit
	+ Deregulation
		- Made it easier for subprime borrowers to obtain loans
	+ Pricing credit risk
		- Flaws in the credit rating process for mortgage securities
	+ Abnormally low interest rates
		- Encouraged consumer and business borrowing
	+ Increase in uncertainty
	+ Lehman Brothers Bankruptcy

**Chapter 4: The Level of Interest Rates**

* What are interest rates
	+ Rental price for money
		- The price of borrowing
	+ Price to borrowers for consuming before earning
	+ Reward to savers for postponing consumption
	+ Expressed in terms of annual rates
		- APR, just going to assume it’s one period of compounding, no calculation in this class
	+ As with any price, interest rates serve to allocate resources
		- Allocate funds between SSUs and DSUs
		- SSUs want to buy financial claims with the highest yield, DSUs want to sell financial claims at the lowest possible interest rate
* The real rate of interest
	+ The rate of interest determined by:
		- The returns earned on investments in productive assets (capital investment)
			* The output generated by a capital project constitutes its return on investment, usually expressed as a percentage
			* Output: automobiles, houses, TVs, etc.
			* Example: firm has a capital project that costs $1,000 and it produces $200 in cash flows each year, the return on investment is 20%
			* For a project to be approved by management, its return on investment must exceed the firm’s cost of funds (debt and equity), called cost of capital
			* The level of interest rates affects the number of projects that can be funded in the economy. As interest rates increase, fewer capital projects are funded because fewer projects can earn an expected return that exceeds the firm’s cost of capital
		- The returns to individuals for postponing consumption (time preferences for consumption)
			* People generally prefer to consume goods today rather than tomorrow (called positive time preference)
			* The interest rate offered on financial instruments determines whether people will save or spend
				+ Low rates: people will spend
				+ High rates: people will save
	+ The real rate of interest is the return on real assets, and ignores inflation
	+ The interest rate we observe in the market is the nominal rate of interest
	+ Producers seek financing for real assets. Expected return on investment is the upper limit on interest rates producers can pay for financing
	+ Savers require compensation for deferring consumption. Time value of consumption is the lower limit on interest rate at which savers will provide financing
	+ Real rate occurs at equilibrium between desired real investment and desired saving
* Loanable funds theory
	+ Supply of loanable funds: all sources of funds available to invest in financial claims, SSUs purchase financial claims to earn interest on their excess funds
		- Consumer savings
			* In general, consumers save more as interest rates rise
		- Business savings
		- State and local government budget surpluses
		- Federal government budget surpluses
		- Federal reserve increases in the money supply
			* Open market purchase of Treasury securities
		- Shifters
			* Decrease in tax rate for individuals (right), lower tax rates leave people with more money to lend
			* Increase in the money supply (right), supplied by Fed
			* Change in state or federal government policy from a deficit budget to a surplus budget because of reduced government expenditures (right)
			* In general, when interest rates rise, the quantity of loanable funds increases
	+ Demand for loanable funds: all uses of funds raised from issuing financial claims, DSUs issue financial claims to finance expenditures in excess of their current income
		- Consumer credit purchases
		- Business investment
			* Higher interest rates stimulate business to finance investments out of internal sources (retained earnings and depreciation) rather than issuing new debt or equity
		- Federal government budget deficits
			* Fed gov typically a demander since it runs a deficit
		- State and local government budget deficits
		- Shifters
			* Technological advancements: shift to the right, because of the increase in investment opportunities
			* Reduction in corporate tax rate (right)
			* Increase in productivity of existing capital (right)
			* Increase in expected business product demand (right)
			* Demographic change such as a younger population, who tend to borrow more (right)
			* Increase in taxes reduces government deficits and government’s demand for funds (left)
	+ Equilibrium interest rate
		- If competitive forces operate in the financial sector, laws of supply and demand will bring rates into equilibrium
		- Equilibrium is temporary or dynamic: any force that shifts supply or demand will tend to change interest rates
		- Called the real rate of interest—the fundamental long-run interest rate in the economy
	+ Means there’s a supply and demand curve
		- When interest rates are higher, people spend less and save more, and business investment is choked off by the higher cost of funds
	+ Price is what you’re willing to pay to borrow and lend money
* Price expectations and interest rates
	+ Have to also consider the impact of price level-changes on the level of interest rates (inflation and deflation)
	+ Two important relationships to draw on:
		- The value of money is its purchasing power—what you can buy with it
		- There is an inverse relationship between changes in the price level and value of money
			* As price level increases (inflation), the value of money decreases
	+ Unanticipated inflation benefits borrowers at the expense of lenders
		- Borrower is helped by unanticipated inflation, lender is hurt
	+ Lenders charge added interest to offset anticipated decreases in purchasing power
	+ Expected inflation is embodied in nominal interest rates: The Fisher Effect
* Loan contracts and inflation
	+ Suppose you agree that 5% is a fair price to borrow money in a world with no inflation
	+ But, you expect 7% inflation
	+ The lender should be compensated for both the delay in consumption (at 5%) and for the loss of purchasing power (at 7%)
	+ Thus, if you borrow $1000 for a year:
		- Pay back $1000 of principal
		- Pay $50 for spending now rather than later
		- Pay $70 for loss of purchasing power
* Fisher Equation
	+ (1+i) = (1+r)(1+ΔPe)
	+ Where
		- i = the observed nominal rate of interest
		- r = the real rate of interest
		- ΔPe = the **expected** annual rate of inflation
* **Accurate** Fisher Equation
	+ From the Fisher equation, we derive the nominal (contract) rate:
		- i = r + ΔPe + (r\*ΔPe)
	+ We see that a lender gets compensated for
		- Rental of purchase power
		- Anticipated loss of purchasing power on the principal
		- Anticipated loss of purchasing power on the interest
* Fisher effect: example
	+ 1-year $1000 loan
	+ Parties agree on 3% rental rate for money and 5% expected rate of inflation
	+ The nominal interest rate is 8.15%



* Approximate Fisher Equation
	+ The third term in the Fisher equation is negligible, so it is often dropped. The resulting equation is:
		- i = r + ΔPe
* Expectations ex ante vs. experience ex post
	+ **Realized rate of return (rr)** reflects impact of inflation on past investments
	+ Ex post is what actually happened, ex ante is what you think is going to happen
	+ rr = i - ΔPa
		- Ex post: Where the “realized” rate of return from past transactions, rr, equals the nominal rate minus the actual annual rate of inflation
		- As inflation increases, expected inflation premiums, Pe, may lag actual rates of inflation, Pa, yielding low or even negative actual returns
		- Three possible outcomes:
			* If Pa>Pe, the lender will earn a lower rate of return
			* If Pa<Pe, the lender will earn a higher rate of return
			* If Pa=Pe, expectations are realized and there’s no transfer of purchasing power between the lender and the borrower
* Interest rate movements and inflation
	+ Historically, interest rates tend to change with changes in the rate of inflation, substantiating the Fisher equation
	+ Short-term rates are more responsive to changes in inflation than long-term rates
* Negative interest rates
	+ Negative interest rates may represent a “storage cost” for safety or a specific monetary policy, usually occur during times of economic stress
	+ Basically, paying someone to take your money
	+ Japan—1998—by buying Japanese Treasury securities with negative returns, investors were securing a safe place to store their funds instead of placing in banks that might default
	+ Happened in the US in 2010, before that during the Great Depression
	+ Ex. Give the bank $100, the bank will give you back $98 next year
		- For protection/security purposes
* Forecasting interest rates
	+ Firms and individuals are exposed to interest rate risk, i.e. the idea that they may be locked into contracts at incorrect costs of capital
	+ Thus, there is a value in being able to predict future interest rates
	+ Many models for interest rate forecasting
		- Models predict interest rates by estimating the statistical relationship between measures of the output of goods and services in the economy and level of interest rates
	+ In general, they do a poor job
	+ The Federal Reserve Bank of St. Louis offers the following model, 4 inputs that determine the interest rate:
		- Changes in the money supply
		- Changes in government spending
		- Changes in economic activity
		- Changes in inflation
		- Emphasizes the importance of the money supply (and inflation) on interest rates
		- Well-known monetarists, monetarism is consistent with a simple model
* Inflation and interest rates
	+ Inflation causes a distortion in the price level that allocates the resources of the economy
	+ If there is no inflation, i.e. a zero-inflation rate, the nominal interest rate equals the real interest rate
	+ However, the Fisher Theory tends to indicate that the nominal interest rate will adjust to expected inflation. We may see movement in the nominal rate if there is a perception that inflation is on the horizon
	+ In general, the Fisher theory has received credibility among practitioners and policymakers
	+ Fed funds rate is a key policy instrument, it’s the rate at which banks borrow from each other overnight
	+ Inflation scares occur when long-term rates rise relative to steady short-term rates
	+ Inflation scares are costly because they require the Fed to raise short term rates which may reduce economic growth
	+ Hesitation is also costly because it may signal that the Fed will allow higher inflation, which increases the cost of doing business
	+ In order to manage the dilemma, the Fed must maintain its credibility as a fighter of expected inflation
* Interest rates and currency values
	+ Exchange rates reflect the relation between the costs of the same goods in different economies
	+ If the foreign country has more inflation than the home country, the purchasing power in the foreign country declines
	+ Thus, the foreign currency becomes cheaper in terms of home country currency
	+ i.e. the foreign currency depreciates
	+ Foreign interest rates will increase to compensate for the loss of purchasing power

**Chapter 5: Bond Prices and Interest Rate Risk**

* Time Value of Money
	+ Investing—in financial assets or real assets—means giving up consumption until later
	+ Positive time preference for consumption must be offset by adequate return
		- Positive time preference: people would rather consume today than tomorrow
		- “a dollar today is worth more than a dollar received at some future date”
	+ Opportunity cost of deferring consumption determines minimum rate of return required on a risk-free investment
		- Present sums are theoretically not invested at less than this rate
		- Future cash flows are discounted by at least this rate
	+ Time value of money is not really about inflation
		- Inflation expectations affect discount rate but deferred consumption has opportunity cost by definition
* Future value/Compound value
	+ The future value (FV) of a sum (PV) is
		- FV = PV(1+i)n
	+ Where
		- i is the periodic interest rate
		- n is the number of compounding periods
* Present Value
	+ The value today of a sum expected at a future time is given by
		- PV = FV / (1+i)n
	+ With risk present, a premium will be added to the risk-free rate
	+ The higher the discount rate, the lower the present value
* What is a bond?
	+ A form of a loan—a debt security obligating a borrower to pay a lender principal and interest
	+ Borrower (issuer) promises contractually to make periodic payments to lender (investor or bondholder) over a given number of years
	+ At maturity, the holder (lender) receives principal (or face value or par value)
	+ Periodically before maturity, holder receives interest (coupon) payments determined by the coupon rate. The coupon rate is set as a percentage of par on the face value of the bond
		- Ex. If bond pays $80 of coupon interest annually and the face value is $1,000, the coupon rate is 8%
* How debt differs from equity
	+ Debtholders do not have ownership or voting rights
	+ Debt generally has a maturity date at which time the principal is repaid to the lender or owner of the debt
	+ Debt generally has fixed interest payments at specific dates
	+ Bonds have **first claim on the firm’s assets** in the event of bankruptcy. Equity holders are “residual” claimants
* Types of bonds
	+ Corporate bonds
		- Institutional investors, i.e. life insurance companies, pension funds, mutual funds, hold large amounts of this debt
		- Corporations will have many bond issues trading at any given time
		- Corporate bond market is much less liquid than equity or US government debt markets
		- Riskiness of corporate bonds varies across firms
	+ Municipal bonds
		- Issued by local or state governments and agencies
			* Fund local projects
			* Can be risky—depending on tax revenues of localities
	+ International bonds
		- Issued by foreign governments or foreign corporations
			* Also have foreign exchange risk
* Bond contracts
	+ Called the **indenture**. Lays out financial terms of a bond and defines the contractual obligations between the borrower and the lender
		- Name of issuer
		- Maturity date and redemption value
		- Coupon rate
		- Date of scheduled payments
	+ Some are sold with **warrants** which give the holder the option to purchase common stock
		- Keep the debt but then you also get the extra stock if you want it
	+ Some have **put features** which allow the holder to sell the bond back to the issuer under special circumstances
		- Protects you from the downside
	+ Coupon rates on new bonds are usually fixed
	+ Coupon rates are generally chosen so that the bond will sell at or near par value when issued
	+ Some bonds have coupon rates that float with treasury rates, LIBOR or commodity prices
	+ Original discount (OID) bonds are bonds issued with a coupon below prevailing rates
	+ Zero coupon bonds are OID bonds that pay no coupon payments at all
* Bond example
	+ Par value = 1000
	+ Coupon rate = 5%
	+ Issued today
	+ Matures 30 years from today
	+ Annual coupon payments
	+ So, the holder receives (the issuer pays):
		- $50 per year interest for 30 years (coupon rate\*par value)
		- 1,000 par value at the end of year 30
* Bond pricing: bond cash flows
	+ Bondholder thus owns the right to a stream of cash flows:
		- Ordinary annuity of interest payments
		- Future lump sum in return of par value
	+ So the price of the bond is the present value of these future cash flows, discounted by the interest rate
	+ These cash flows are discounted to their present value to find the bond’s value
	+ The same process can be used at any point during the life of the bond
	+ Thus, the value or price of a bond is the present value of the future cash flows promised, discounted at the market rate of interest consistent with the riskiness of the promised cash flows
	+ PV of bond cash flows



* Bond pricing: principles
	+ Cash flows are assumed to flow at the end of the period tend to be reinvested at i. Bonds typically pay interest semiannually
	+ Increasing i decreases price (PB); decreasing i increased price; thus, bond prices and interest rates move inversely
	+ If the bond’s coupon rate is equal to the market rate of interest on similar bonds (the bond’s yield), the bond trades at par
	+ If coupon rate exceeds market rate, the bond trades above par—at a premium
	+ If market rate exceeds coupon rate, bond trades below par—at a discount
		- If a bond with similar characteristics is yielding 8% and our bond is paying 5%, no one will buy it unless the price is reduced
	+ The market rate of interest determines the bond’s return
* Zero coupon bonds are “pure discount” securities
	+ No periodic coupon payments
	+ Issued at discount from par
	+ Single payment of par value at maturity
	+ PB is simply PV of FV represented by par value, discounted at market rate
	+ PB = FN/(1+i)N
	+ Examples are US Treasury bills and US Savings bonds
* Risk factors in bonds
	+ Yield rewards investor for at least 3 risks:
		- Credit/default risk: chance that issuer may be unable or unwilling to pay as agreed
		- Reinvestment risk: potential effect of variability of market interest rates on return at which payments can be reinvested when received
		- Price risk: inverse relationship between bond prices and interest rates
* Bond yields: set by market
	+ Discount rate at which bond price equals discounted PV of expected payments
	+ Measure of return ideally capturing impact of
		- Coupon payments
		- Income from reinvestment of coupons
		- Any capital gain or loss
* Common yield measures
	+ Yield to maturity
		- Investor’s expected bond yield if bond is held to maturity and all payments are reinvested at the same yield
		- PB=present value of future payments, analogous to IRR of capital project
		- The longer the maturity, the less valid the reinvestment assumption
		- Computing yield to maturity
			* Investor buys a 3 year, 5% coupon (semiannual payments) bond for $951.90
			* Answer=3.4%, then must multiply by 2 to get the annual rate 6.8%
	+ Expected yield
		- Predicted yield for a given holding period (same procedure as YTM, but for some holding period shorter than maturity)
			* Must forecast expected interest rate(s) and the bond price at the end of the holding period
			* N=# periods
			* PV=amount paid
			* PMT=coupons
			* FV=sale price
	+ Realized yield
		- Investor’s ex-post or “hindsight” actual rate of return, given the cash flows actually received and their timing. May differ from YTM due to:
			* Change in the amount or timing of promised payments (e.g. default)
			* Change in market interest rates affecting premium or discount
		- Computing realized yield
			* Investor pays $1,000 for 10-year 8% annual coupon bond; sells bond 3 years later for $902.63
			* Cash flows:
				+ $80 in years 1 and 2
				+ $80 + $902.63 = $982.63 in the third year
				+ i = 4.91%
	+ Total return
		- Considers capital gains or losses as well as changes in the reinvestment rate
		- Must determine:
			* The terminal value of the bond (the selling price if we sell the bond, the call price if the bond is called prior to maturity, or the par or face value of the bond if we hold it to maturity)
			* The accumulated future value of all the coupon payments received based on a known (or assumed) reinvestment rate
		- Computing total return
			* Terminal value of bond + future value of reinvested interest coupons = total accumulated
			* PB = Total accumulated/(1+i)N
		- Example: Expect to hold a bond for 4 years, 8% annual coupon. Price today is $1,000. Expect to sell the bond at 1098.35. Thus, we expect interest rates to fall
			* What is the total return if we can reinvest the coupons at 8%
				+ First step: FV of an annuity

N=4

I=8

PV=0

PMT=80

FV=?

FV=360.49

* + - * + The future sale price is $1098.35, thus the total cash flows at t=4 is equivalent to 1098.35+360.49
				+ Then plug into PV=FV/(1+i)N
				+ 1000=(1098.35+360.49)/(1+i)4=9.9%

N=4

I=8

FV=1,458.84

PV=-1,000

* Current yield
	+ Investors may be holding a bond for only a short period of time (~1 year)
	+ In this case, they are interested in the current yield
	+ The current yield is the amount of the annual coupon divided by the current market price of the bond
	+ A bond trades today at $900 and pays an annual coupon of $90. What is the current yield on the bond if purchased today?
		- Current yield = annual coupon/current trading price = 90/900=10%
* Other bond value measures
	+ Yield to call: what is the yield of the bond if it is paid off as of its yield date
		- Note that the corporation may also pay a premium to face value at the call as compensation to investors for early retirement of the debt
		- This is a bond feature that would have been known in the indenture and would have been priced in the initial issue price
* The yield curve is not flat
	+ When the yield curve is not flat (i.e. when the observed yields are not the same for all maturities), the correct procedure for valuing a bond promising a stream of known cash payments is to discount each of the payments at the rate corresponding to a pure discount bond of its maturity and then add the resulting individual values
	+ The yield to maturity can be found from this calculation
* Variation in bond prices
	+ Bond prices (and YTMs) will vary with many factors:
		- Creditworthiness of the issuer
		- Maturity
		- Coupon rate
		- Tax considerations
		- Bond features—callabilty, convertibility, etc.
		- Closeness to maturity
* Bond price volatility
	+ Price risk
		- Percentage change in price for given change in interest rates:
			* %ΔPB= (Pt—Pt-1)/Pt-1 x 100
	+ Maturity
		- Long-term bonds have greater price volatility than short term bonds
		- Exhibit 5-1
			* 3, 4, 5: bond is earning 5% but interest rates rose to 6%, must buy it at a discount to make up for that 1% difference
			* 6, 7, 8: bond is earning 5% and interest rates have dropped to 4%, going to buy at a premium
	+ Coupon rate
		- The lower a bond’s coupon rate, the greater is the percentage price change (price volatility) for a given change in yield
		- So, lower coupon bonds have a greater interest rate risk
	+ Interest rate
		- The lower the starting interest rate (yield to maturity), the greater the bond price volatility for a given change in the exchange rate
		- If interest rates are high, distant cash flows are less important
		- Thus, the bond effectively has a shorter maturity in present value terms at higher interest rates. The valuable CFs are earned in the near term
* Bond pricing relationships summary
	+ Bond prices are inversely related to bond yields
	+ The price volatility of a long-term bond is greater than that of a short-term bond, holding the coupon rate constant
	+ The price volatility of a low-coupon bond is greater than that of a high-coupon bond, holding maturity constant
	+ Price volatility is inversely related to the starting market interest rate
* Interest rate risk and duration
	+ Price risk: the variability in bond prices caused by their inverse relationship with interest rates
	+ Reinvestment risk: variability in realized yield caused by changing market rates at which coupons can be reinvested
	+ Price risk and reinvestment risk work against each other
		- As interest rates fall:
			* Bond prices rise (good)
			* But coupons are reinvested at a lower return (bad)
		- As interest rates rise:
			* Bond prices fall (bad)
			* But coupons are reinvested at a higher return (good)
	+ Duration lets us find the exact spot where they offset each other
		- Duration: weighted average of the number of years until each of the bond’s cash flows are received



* Duration and bond properties
	+ The denominator is the price of the bond
	+ The numerator is the PV of all cash flows weighted according to the length of time to receipt
* Duration Example
	+ Suppose we have a bond with a 3-year term to maturity, an 8% coupon paid annually, and a market yield of 10%. Duration is:



* Practicing computing duration
	+ With a zero-coupon bond, the duration is always equal to maturity aka when you have a 5-year bond, it will take 5 years to get your money back
	+ As the coupon gets higher, the duration gets shorter (you get your money back more quickly)
* Duration concepts (all else equal)
	+ Higher coupon rates mean shorter duration and less price volatility
	+ Duration equals term to maturity for zero coupon securities
	+ Longer maturities mean longer durations and greater price volatility
	+ The higher the market rate of interest, the shorter the duration
* Duration can be calculated for a portfolio
* Using duration to measure and manage interest rate risk
	+ Duration is the holding period for which reinvestment risk just offsets price risk: the holder obtains the original, promised yield to maturity
	+ Financial institutions use duration to manage interest rate risk and actually achieve the desired yield for the desired holding period
* How to mitigate interest rate risk using duration
	+ Zero-coupon approach: these bonds have no reinvestment risk
		- The duration of a “zero” equals its term to maturity
		- Buy a “zero” with the desired holding period and lock in the YTM
		- Must hold to maturity to evade price risk
		- Problems
			* Must pay taxes on it
			* Not many available
	+ Maturity matching: selecting a term to maturity equal to the desired holding period eliminates price risk, but not reinvestment risk
	+ Duration matching: to realize YTM, investors select bonds with durations matching their desired holding periods
		- Best strategy
* Matching duration to investment horizon
	+ Immunization of the portfolio: to lock in a given target return to your investment, structure your bond investment such that the duration of the bond or bond portfolio equals your holding period
* Duration and investing
	+ If you believe interest rates are going to increase and want to bet on this, the duration of your portfolio should be less than the investment horizon
		- Decrease in price < gain in reinvestment income, potential return increases
	+ If you believe interest rates are going to decrease and want to bet on this, the duration of your portfolio should be greater than the investment horizon
		- Increase in price > loss in reinvestment income, potential return increases
* Financial institutions and duration
	+ In this analysis, have only one interest rate change
	+ In actuality, for a financial institution, the YTM changes frequently and the duration of the bond depends on that YTM
	+ Financial institutions will actively manage their portfolios to keep duration at a certain level
	+ Banks, pension funds, insurance companies will use duration matching to manage the payout risk in their portfolios

**Chapter 6: The Structure of Interest Rates**

* Five major characteristics that result in differences in yields on securities
	+ Term to maturity
	+ Default risk
	+ Tax treatment
	+ Marketability
	+ Special features such as call and put options
* Term to maturity and term structure
	+ Term to maturity is the length of time until the principal amount is payable, relationship between YTM and term to maturity is known as term structure
	+ Yield curve is graphical representation of the term structure; it shows the relationship between maturity and a security’s yield at a point in time
	+ May be ascending (normal), flat, or descending (inverted)
	+ The expectation theory
		- The shape of the curve is determined solely by expectations of future interest rate movements, and changes in these expectations lead to changes in the shape of the curve
			* Ascending: future rates expected to increase
			* Descending: future rates expected to decrease
			* Flat: no change expected in future short-term rates
	+ Term structure formula
* An implied one-year forward rate



* Forward rates are the rates of return required in the future to make the yields of different investment strategies the same
* Expectations theory example
* The expectations theory assumes that investors are indifferent between holding a long-term security and holding a series of short term securities that are rolled over to their investment horizon, aka investors are indifferent toward interest rate risk
* Example 6.1
	+ Spot rate: rate **today** for an investment of the given horizon
* Liquidity premium theory
	+ Long-term securities have greater risk and investors require greater premiums to give up liquidity
		- More sensitive to interest rates (have more price risk)
		- Have less marketability
		- Expectations theory assumed that investors were indifferent to these concerns
	+ Longer term securities generally have greater liquidity premiums, explains why yield curve slopes upward most of the time
	+ Premiums will increase when interest rates are more uncertain
* Market segmentation theory
	+ Maturity preferences by investors may affect security prices (yields), explaining variations in yields by time
	+ Market participants have strong preferences for securities of particular maturity and buy and sell securities consistent with their maturity preferences
	+ If market participants do not trade outside their maturity preferences, then discontinuities and spikes are possible in the yield curve
	+ Investors have preferences for specific maturity securities
	+ Thus, at each maturity, the supply and demand for that maturity determines the equilibrium interest rate
		- Demand determined by investment horizon of investors
		- Supply determined by borrowers tailoring securities to match the timing of their need for borrowed funds
* Preferred habitat theory
	+ Extension of the market segmentation theory
	+ Less restrictive in that it allows market participants to trade outside of their preferred maturity if adequately compensated for additional risk (premium)
	+ Allows investors to change their investment strategy if adequately compensated for risk
* Which theory is right?
	+ Day to day changes in the term structure are most consistent with the preferred habitat theory
	+ However, in the long run, expectations of future interest rates and liquidity premiums are important components of the position and shape of the yield curve
* Yield curves and the business cycle
	+ The term structure of interest rates provides info about market expectations of future business activity
	+ Slope of the yield curve can be used to assess the market’s expectations about future interest rates
	+ Investors can use yield curve to identify under-priced securities for their portfolios
	+ Investors may use the yield curve to price their securities
	+ Slope is important in managing financial intermediaries
	+ An upward sloping yield curve is generally favorable for institutions because they borrow most of their funds in the short term and lend the funds at longer maturities
		- Ex. Bank borrows from consumers at 3% and makes 5 year loans for 5%, bank’s gross profit margin is 2%
	+ The steeper the yield curve slopes upward, the wider the spread between the borrowing and lending rates and the greater the profit for financial intermediaries
	+ Business cycle
		- Beginning of expansion: upward sloping, low interest rates
		- Mid-cycle: flat, high rates
		- Beginning of contraction: downward, higher rates

Default risk

* The probability of the borrower not honoring the security contract
* Risk averse investors want adequate compensation for expected default losses
* Credit default swaps have arisen as a way to insure against default risk
* Default risk premiums (DRP) increase in periods of recession and decrease in economic expansion
* DRP=i-irf
	+ DRP is the difference between the promised rate and the yield on a comparable (same term) riskless security (treasury security)
	+ Investors are satisfied if the DRP is equal to the expected default loss
* Flight to quality: change in investor willingness to own bonds of different credit ratings over the business cycle
	+ Economic prosperity: willing to hold bonds with low credit ratings because there is little chance of default and these bonds normally have higher yields and vice versa
* Bond ratings
	+ Credit rating agencies such as Moody’s measure and grade relative default risk security issuers
	+ Cash flow, level of debt, profitability, and variability of earnings are all indicators of default riskiness
	+ AAA-BBB for S&P and Aaa-Baa for Moody’s are investment-grade bonds
	+ Big 3: Moody’s, S&P, Fitch
	+ Contributed to financial crisis

Tax Effects on Yields

* The taxation of security gains and income affects the yield differences among securities
* The after-tax return, iat, is found by multiplying the pre-tax return by one minus the investor’s marginal tax rate:
	+ iat=ibt(1-t)
* Municipal bonds’ interest income is tax-exempt

Impact of marketability on interest yields

* Marketability: the costs and speed with which investors can resell a security
	+ Cost of trade
	+ Physical transfer cost
	+ Search costs
	+ Information costs
* Securities with good marketability have higher prices and lower yields (because demand is higher)

Contract options and yields

* Option: contract provision which gives the holder or the issuer the right, but not the obligation, to buy/sell/redeem/convert an asset at some specified price within a defined future time period
* Call option permits the issuer to call the bond before maturity at a pre-specified price
	+ Call bonds if interest rates decline, because then they can issue it to a new lender and pay them less interest
	+ Investors in callable securities bear the risk of losing their high-yielding security
	+ Investors demand a call interest premium (CIP)
		- CIP=ic-inc
		- A callable bond (ic) will be priced to yield a higher return (by the CIP) than a non-callable (inc) bond
* Put option permits the lender to sell the bond back to the issuer at a pre-specified price before maturity
	+ Investors likely to put their bonds during periods of increasing interest rates
	+ Put interest discount (PID), difference in interest rates between putable and non-putable contracts
	+ The yield on a putable bond will be lower than the yield on a nonputable bond
* Conversion option permits the investor to convert a bond into another security (usually common stock)
	+ Generally, have lower yields
	+ Conversion yield discount (CYD) is the difference between the yields on convertibles relative to non-convertibles

Interest rates and business cycles

* The real rate of interest has historically averaged about 3%
* The real rate of interest rises during expansionary periods and falls during contractionary periods
* The nominal interest rates tend to rise and fall with changes in the actual rate of inflation
* The nominal interest rates tend to rise during expansionary periods and decline during contractionary periods

**Derivatives**

* Derivative security: value depends on (is derived from) some underlying security
	+ Ex. The value of a futures contract to buy corn at some future point in time is derived from the price of corn
	+ Most common: forwards, futures, options, and swaps
* Forward markets
	+ Let people arrange a transaction forward in time
	+ Forward contract: involves two parties agreeing today on a price (forward price) at which the buyer will purchase a specified amount of an asset from the seller at a fixed date sometime in the future
		- Buyer is said to have a **long position** and is obligated to pay the forward price for the asset
		- Seller is said to have a **short position** and is obligated to sell the asset to the buyer in exchange for the forward price
		- Future date is called settlement date
		- Buyers and sellers are counterparties from each other
	+ Forward price
		- F = current price [1+(effective annual rate/n)]when you’re buying

**News Articles**

* Trump proposes the most sweeping tax overhaul in decades
	+ Plan would collapse the tax brackets from 7 to 3 with rates of 12%, 25%, and 35%
	+ Aims to simplify and cut taxes for the middle class
	+ Reducing corporate tax rate to 20% from 35%
	+ “deficit reducing”
* Six charts that help explain the republican tax plan
	+ Tax brackets
	+ Increase the standard deduction
		- Tax deductions for children
	+ Eliminate the state and local tax deduction
		- Primarily helps people in blue states where taxes (and often incomes) are higher
	+ Create a new tax rate for “pass-through” businesses
		- 25% tax rate
		- Sole proprietorships, partnerships, and S corporations that are currently paying taxes at the individual rate of their owners
	+ Lower the corporate rate while eliminating some tax breaks
		- Lower to 20% from 35%
* Do tax cuts generate growth
	+ In reality there’s no evidence that a tax cut would spur growth
	+ Laffer curve
	+ Reagan tax cuts were probably not the only reason for growth in the 80’s
* Puerto Rico debt
	+ White House dials back Trump’s vow to clear PR debt
	+ Suggested that island would have to solve its own financial issues
	+ For over a year, PR has clashed with investors who hold slivers of its $73 billion debt, and who have pushed them to pay up
	+ Most of the debt is held in the form of municipal bonds
	+ Trump said he’s going to “wipe out the debt”
	+ Been in recession since 2006
	+ 2016: Congress enacted special law (Promesa) that put PR’s finances under a federal oversight board and halted the creditor’s lawsuits
* Background on PR debt
	+ 2016 island ran out of cash and stopped paying its debt
	+ $123 billion in debt
	+ Borrowed too many municipal bonds, owes billions more in pensions to retired workers
	+ Residents do not pay federal personal income tax
* Nobel Laureate Richard Thaler
	+ Book “Nudge” about helping people make better decisions
	+ Established that people are predictably irrational—they consistently behave in ways that defy economic theory
	+ Pushed people away from assumption that people behave rationally
	+ He showed that people depart from rationality in consistent ways
* Shorten duration in periods of rising interest rates
* Michael Milken and junk bond ratings
	+ 1970s: realized that investors could make more money on a risk-adjusted basis from buying the bonds issued by companies with lower credit ratings than they could by investing in the bonds of triple A rated companies
	+ Plead guilty to six charges of criminal violation of securities laws
	+ Banned from working in the securities industry