INTEREST RATES

Overview

- Real vs. Nominal Rate
- Equilibrium Rates
- Interest Rate Risk
- Reinvestment Risk
- Structure of the Yield Curve
- Monetary Policy

  * Some of the following material comes from a variety of sources but especially - Financial Markets and Institutions, Madura

Structure of the Yield Curve: how required return on government securities varies with time, comparing Bills to Bonds. Usually long maturity = high return. We will need to understand the theories behind Yield Curve Shape.

We know the prices of the securities (and financial products) are driven by supply and demand. Now what is a required return on a security?

Risk = Underlying non-risk return + risk premium $R_s = R_F + R_{Premiun}$

This class is on R_F, the next class will be on $R_{Premium}$. We are working up to understanding Real and Nominal returns. The difference between the two is made up by INFLATION which eats up our PURCHASING POWER.

Real vs. Nominal Rate

- Suppose I purchase a one-year zero-coupon bond
  * Face value \$1,000 ← I receive this in one year
  * Price \$930 ←Price purchased for today, I make \$70 over 1 yr
- What is the rate of return on this investment?

  I invest \$930 and receive \$1,000 in one year, so if the nominal return is R then:

930 x (1 + R) = 1,000

so

R = (1000/930) – 1 = 7.5% Nominal Return

Zero-Coupon Bond: a discount bond, lump sum paid at end, no interest payments (coupons).

$$\frac{\text{Earnings}}{\text{Initial Investment}} = \frac{\$1{,}000 - \$930}{\$930} = 7.5\%$$

Real vs. Nominal Rate

- Suppose now that inflation is working against us making my cost of living increase by 3% over the same period
- Now, my $1,000 does not purchase as much as it could compared to the beginning of the period
- Think about it in concrete terms
  - Imagine all I consume is pizzas
  - At the beginning they cost $8 each
  - Their price increases at the rate of inflation, up 3% in one year

Our investment does not equate to a 7.5% real return due to the effects of inflation. Dollar return is not a real concern, what is important is what I can buy with my return!

Real vs. Nominal Rate

- What is my return in pizzas? (a real quantity, not eroded by inflation)
- Pizza prices will be

$8 x (1 + inflation) = $8 x 1.03 = $8.24 in one year

- So at the beginning my $930 would buy

930 / 8 = 116.25 pizzas

- And at the end my $1,000 will buy

1,000 / 8.24 = 121.36 pizzas

- What is the rate of return on the investment in pizzas?

I invest 116.25 pizzas and receive 121.36 pizzas in one year, so if the real return is r then:

116.25 x (1 + r) = 121.36,

so r = (121.36/ 116.25) – 1 = 4.4%

- Algebraically, if we define I as the inflation rate then:

$$1 + r = (1 + R)/(1 + i)$$

or restated

$$r = \frac{(R - i)}{(1 + i)}$$

- Approximate real = $r = R - I$ = *nominal rate - inflation*

Consumption and purchasing power. Be concerned with real, r.

Equilibrium Rates

- Interest rate levels are a factor of the supply and demand of credit
- The supply of credit is increased by an increase in the amount of money made available to borrowers.
  - For example, The more banks can lend, the more credit there is available to the economy:
    - As the supply of credit increases, the price of borrowing (interest) decreases

Greater availability of funds shold equal lower interest rates.

Equilibrium Rates

- Inflation will also affect interest rate levels.
  - **The higher the rate of inflation, the more interest rates are likely to rise.**
    - Lenders will demand higher interest rates as compensation for the decrease in the purchasing power of the money they will be repaid in the future.
- The government through the Federal Reserve (the Fed) affect interest rates.
  - The federal funds rate, or the rate that institutions charge each other for extremely short-term loans, affects the interest rate that banks set on the money they lend

Generally argued that investors want a certain real return in order to invest.

High Inflation = Less Savings = More Barrowing = Less Funds Available

During inflation the FED will raise rates to try and dampen. These are nominal rates.

Loanable Funds Theory

- **Loanable funds theory** suggests that the market interest rate is determined by the factors that affect the supply of and demand for loanable funds
  - Can be used to explain movements in the general level of interest rates of a particular country
  - Can be used to explain why interest rates among debt securities of a given country vary

Market interest rates set by supply and demand of funds.

Loanable Funds Theory (cont'd)

- Household demand for loanable funds
  - Households demand loanable funds to finance what? (consumption)
  - There is an inverse relationship between the interest rate and the quantity of loanable funds demanded

High demand for loanable funds means high interest rates for loanable funds.

Loanable Funds Theory (cont'd)

- Business demand for loanable funds
  - Businesses demand loanable funds to invest in fixed assets and short-term assets (invest in projects)
  - Businesses evaluate projects using Net Present Value (NPV):
    - Projects with a positive NPV are accepted
  - There is an inverse relationship between interest rates and business demand for loanable funds

$$NPV = -INV + \sum_{t=1}^{n} \frac{CF_t}{(1+k)^t}$$

← Future Cash Flows

← Discount factor

k equates to the risk, the cost of capital
t = the number of years in the future

If NPV for a project is positive the project is GOOD. If NPV for the project is negative, the project is BAD. Businesses demand loanable funds to invest in the projects, thus the price of the loans increases.

All things being equal, low interest rates should lead to economic expansion.

Loanable Funds Theory (cont'd)

- Government demand for loanable funds
  - Governments demand funds when planned expenditures are not covered by incoming revenues
    - Municipalities issue municipal bonds
    - The federal government issues Treasury securities and federal agency securities
  - Government demand for loanable funds is **interest-inelastic**

The government decides how much funds it needs without regard for the interest rate (up to a point). Government barrows continuously. Large government should result in high interest rates for loans.

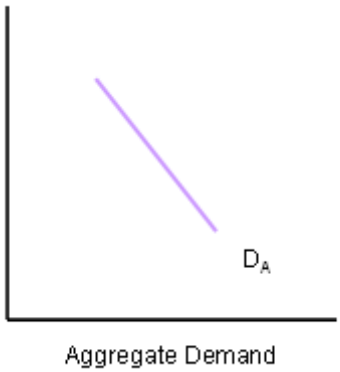
Loanable Funds Theory, Foreign Demand

- Foreign Demand for loanable funds
  - Foreign demand for U.S. funds is influenced by the interest rate differential between countries. If lower here than higher demand here.
  - The quantity of U.S. loanable funds demanded by foreign governments or firms is inversely related to U.S. interest rates
  - The foreign demand schedule will shift in response to economic conditions

Economy with lowest rate gets the demand.

Loanable Funds Theory (cont'd)

- Aggregate demand for loanable funds
  - The sum of the quantities demanded by the separate sectors at any given interest rate is the **aggregate demand** for loanable funds



As interest rates increase the demand for loanable funds decreases.

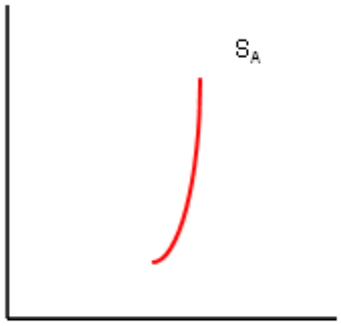
Loanable Funds Theory (cont'd)

- Supply of loanable funds
  - Funds are provided to financial markets by
    - Households (net suppliers of funds)
  - Suppliers of loanable funds supply more funds at higher interest rates

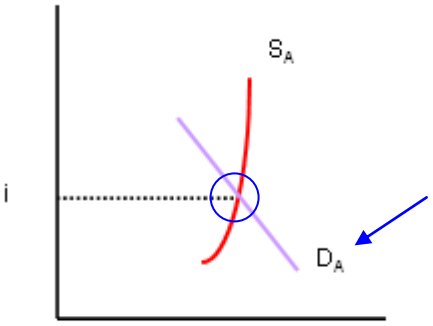
Households are more likely to invest if interest rates are high. Otherwise they will save.

Loanable Funds Theory (cont'd)

- Supply of loanable funds (cont'd)
  - Foreign households, governments, and corporations supply funds by purchasing Treasury securities
    - Foreign households have a high savings rate
  - The supply is influenced by monetary policy implemented by the Federal Reserve System
    - The Fed controls the amount of **reserves** held by **depository institutions**
  - The supply curve can shift in response to economic conditions
    - Households would save more funds during a strong economy



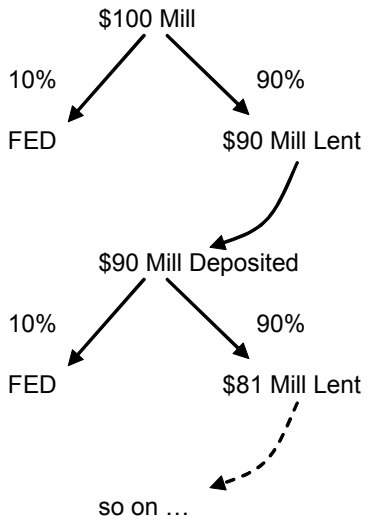
Aggregate Supply



Equilibrium Interest Rate - Graphic

The amount (percentage) depository institutions are required to keep in reserve is set by the FED. The FED can adjust this rate as it wishes according to it's monetary policy. Right now the rate is at 10%.

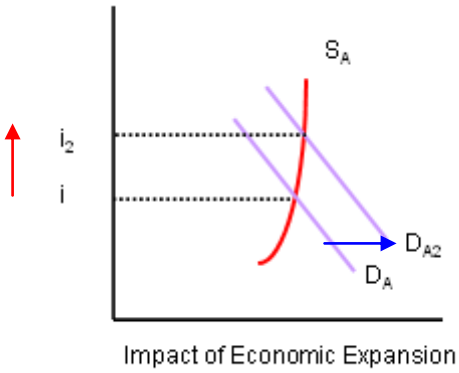
Bank receives $100 Mill, 10% goes to FED, 90% goes out to be lent. The $90 Mill will end up on deposit in the bank system (assuming no leakage). Again, 10% goes to FED and 90%, $81 MILL goes out to be lent. Cycle repeats. The FED reserve percentage is drained out of the liquidity each cycle. In the end, $100 Mill will actually increase funds availability in the system by $\frac{\$100 MILL}{10\%} = \$1$ Billion



Loanable Funds Theory (cont'd)

Economic Forces That Affect Interest Rates

- Economic growth
  - Shifts the demand schedule outward (to the right)
  - There is no obvious impact on the supply schedule
    - Supply could increase if income increases as a result of the expansion
  - The combined effect is an increase in the equilibrium interest rate



Impact of Economic Expansion

Economic growth should lead to higher supply and higher demand. Economic expansion.

In a strong economy households will generate more income and put it in the bank (or investments) where it is available to lending.

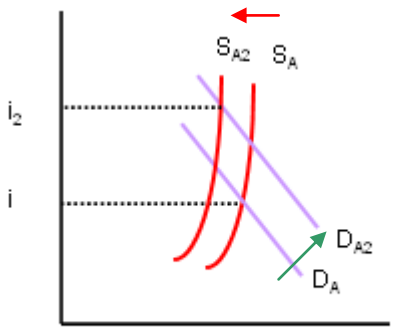
Generally speaking, more wealth = higher supply of loanable funds.

What forces change the shape of these lines?

Loanable Funds Theory (cont'd)

Economic Forces That Affect Interest Rates

- Inflation
  - Shifts the supply schedule inward (to the left)
    - Households increase consumption now if inflation is expected to increase
  - Shifts the demand schedule outward (to the right)
    - Households and businesses borrow more to purchase products before prices rise



Impact of Expected Increase in Inflation

Shifts supply inward (left). Less loanable funds, households not saving. The net result is an increase in interest rates.

Loanable Funds Theory (cont'd)

Economic Forces That Affect Interest Rates (cont'd)

- Fisher effect
  - Nominal interest payments compensate savers for:
    1. Reduced purchasing power
    2. A premium for forgoing present consumption
  - The relationship between interest rates and expected inflation is often referred to as the **Fisher effect**

I must be compensated for two things in order to invest.

Economic Forces That Affect Interest Rates (cont'd)

- Fisher effect (cont'd)
  - Fisher effect equation:

$$i = E(INF) + i_R$$

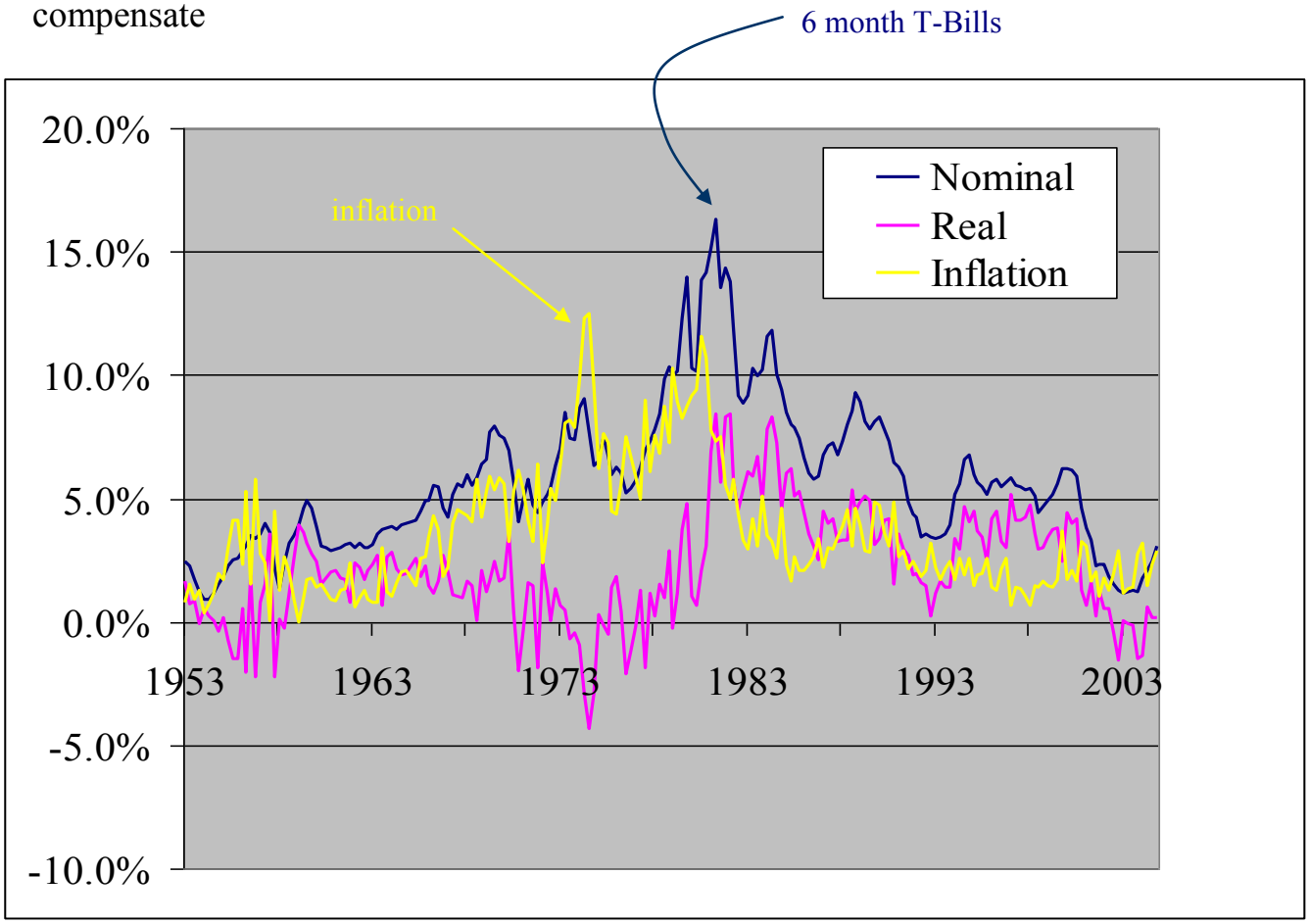
- The difference between the nominal interest rate and the expected inflation rate is the **real interest rate**:

$$i_R = i - E(INF)$$

i_R is the required constant level of real interest rate.

Fisher Relationship

- As inflation increases, investors require higher nominal returns to compensate



Nominal should increase when inflation increases. This is the Fisher Effect or Loanable Funds Theory.

Economic Forces That Affect Interest Rates (cont'd)

- Money supply
  - If the Fed increases the money supply, the supply of loanable funds increases and market interest rates should decline.
    - If inflationary expectations are affected, the demand for loanable funds may also increase
  - If the Fed reduces the money supply, the supply of loanable funds decreases, flip side.
  - During 2001, the Fed increased the growth of the money supply several times

ESSAY 2: How can the FED effect the availability of funds?

1. Reserve Requirements, if FED increases them then the amount of deposits available for lending is decreased and market interest rates should increase.
2. Adjust the Targeted Federal Funds Rate. This is the interest rate of the short term overnight bank-to-bank lending rate. This bank-to-bank short term lending is done to cover the FED reserve funds requirements. The FED tries to change the market rate by adjusting this rate.
3. They call the trading desk at the FED bank and tell them to buy back government bonds which increases liquidity in the system. Selling bonds has the opposite effect.

Buying and selling of government bonds by the government influences the liquidity in the market, the amount of cash available for lending. When supply of funds is reduced (shifts the supply curve LEFT) the rate goes up.

(There is one other method needed for essay 2, see below)

Economic Forces That Affect Interest Rates

- Money supply (cont'd)
  - September 11
    - Firms cut back on expansion plans
    - Households cut back on borrowing plans
    - The demand of loanable funds declined
  - The weak economy in 2001–2002
    - Reduced demand for loanable funds (FED took money out)
    - The Fed increased the money supply growth
    - Interest rates reached very low levels

THESE ARE OTHER SHOCKS WHICH AFFECT THE AVAILABILITY OF FUNDS AND THUS INTEREST RATES.

Economic Forces That Affect Interest Rates (cont'd)

- Budget deficit, Overspending by Government
  - A high deficit means a high demand for loanable funds by the government
    - Shifts the demand schedule outward (to the right)
    - Interest rates increase (should)
  - The government may be willing to pay whatever is necessary to borrow funds, but the private sector may not
    - Crowding-out effect (inelastic, leads to crowding out of business)
  - The supply schedule may shift outward if the government creates more jobs by spending more funds than it collects from the public

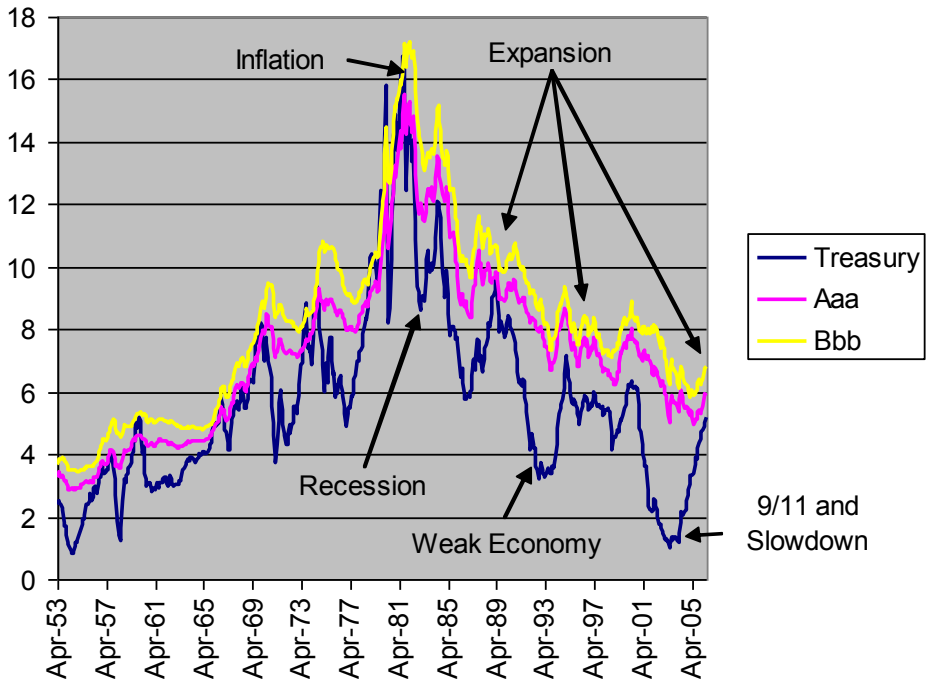
Rates can increase to the point where businesses refuse to take out loans.

More jobs created could increase available funds (government spending of taxes).

Economic Forces That Affect Interest Rates (cont'd)

❑ Foreign flows of funds

* The interest rate for a currency is determined by the demand for and supply of that currency, lowest rate currency gets most business which shifts funds from one currency to another.
  - Impacted by the economic forces that affect the equilibrium interest rate in a given country, such as:
    - Economic growth
    - Inflation
* Shifts in the flows of funds between countries cause adjustments in the supply of funds available in each country (Rates spike up during expansion.)



❑ Explaining the variation in interest rates over time

* Late 1970s: high interest rates as a result of strong economy and inflationary expectations
* Early 1980s: recession led to a decline in interest rates
* Late 1980s: interest rates increased in response to a strong economy
* Early 1990s: interest rates declined as a result of a weak economy
* 1994: interest rates increased as economic growth increased
  - Drifted lower for next several years despite strong economic growth, partly due to the U.S. budget surplus

Interest rates decline as economy goes down. This increases risk of bankruptcy. Investors want an extra premium for the risk of bankruptcy so the spread between the yellow and black lines increase.

Interest Rate Risk

- Suppose a company has an obligation falling due in 4 months for $10 million (company must make a $10 mill in 4 months)
  - The company wishes to ensure it has sufficient funds at that date so decides to invest in T-bills today. (earmark the reserved funds)
  - Suppose the only available T-bill matures in 6 months
    - It currently sells for 98% of its face value
  - Assuming market rates stay constant, how much should the company invest?

T-Bill is a zero coupon bond.

Currently selling at 2% off it's face value.

Interest Rate Risk

- The bond will pay R = (100/98) – 1 = 2.04% over its 6 month life
- The return over 4 months will be $(100/98)^{4/6} - 1 = 1.36\%$, assuming rates do not change
- So to have $10 million in 4 months invest $10 million /(1 + 1.36%) = $10 million / 1.0136 = $9,866,218

Growth = face value * rate = $9,866,218 x 1.0204 = $10,067,570

$$(1+r)^{\frac{6}{4}} = 1 + 2.04\%, \text{ solve for r} = 1.0204^{\frac{4}{6}} - 1 = 1.36\%$$

Basically we solved for an equivalent 4 month rate. Will sell the bond in 4 months but we do not know if anyone will want to buy it at the rate we need, market rates may have changed.

Rate of Return over Life of Bond = $R = \left(\frac{100}{\text{Purchase Price as a \% of Face Value}*100}\right) - 1$,

$$\text{Initial Investment} * (1+r)^n = \text{Amount Paid at Maturity}$$

$$\text{Face Value} * \text{Sale Price \% Off Face} * (1+r)^n = \text{Amount Paid at Maturity}$$

$$r = \left(\frac{\text{Amount Paid at Maturity}}{\text{Face Value} * \text{Sale Price \% Off Face Value}}\right)^{\frac{1}{n}} - 1$$

where **r is the return per year** and n is the number of periods.

Interest Rate Risk

- Suppose the **yield increases** during the period so that at the time to sell, rates have **increased by 20 basis points** (market rate changes)
- What was the original rate of the last two months of the life of the bond?
  $(100/98)^{(6-4)/6} - 1 = 0.68\%$ ←solve for 2 month period
- New rate is 0.68% + 0.20% = 0.88%←now ADD the 20 BASIS POINTS
- **The asset is worth $10,067,570 / 1.0088 = $9,980,174**

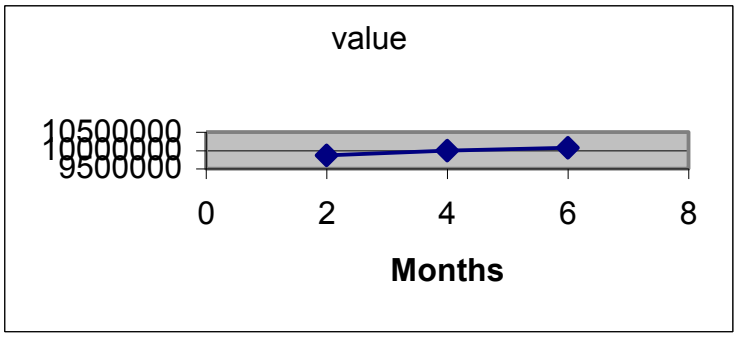
10,067,570 is from Growth calculation on last page.

$9,980,174 is the face value with two months left, we are short of our $10 Mill goal required to make the necessary payment!

1 Basis Point = 0.01% = 0.0001	100 Basis Points = 1%

- So we are short by $10 million – 9,980,174 = $19,826

Interest Rate Up → Asset Price Down, will be short
Interest Rate Down → Asset Price Up, will have excess



EXAMPLE

In this example we have an obligation due in 1 year but are buying a 2 year bond.

Obligation comes due in 1 year for $100 million. We wish to invest in a zero coupon bond today so that we will have the $100 million in 1 year. The only zero coupon bond available matures in 2 years. The bond is currently selling at a 1.2% discount to it's face value. The bonds face value is $10,000. How many bonds should we purchase assuming market rates stay the constant?

$r \equiv$ Annual Rate of Return, Yield to Maturity. Write out the return equation and solve for r.

Face Value * Sale Price % Off Face * $(1+r)^n$ = Amount Paid at Maturity

$10{,}000 * .88 * (1+r)^n = 10{,}000 \rightarrow r = (\frac{1}{.88})^{\frac{1}{2}} - 1 = 6.6\%$

So 12% over 2 year life is 6.6% per year. In 1 year we need $100 million, based on our earning rate of 6.6 per year we need to invest how much money?

$\frac{\$100 \text{ Million}}{1.066} = \$93{,}808{,}630$ invested today will grow into the required 100 million in 2 years at 6.6% return. How many bonds do we need to buy? Remember that we calculate this at the PURCHASE PRICE if the bond, not the face value.

$$\text{Bonds to Purchase} = \frac{\text{Amount Imust Invest Today}}{\text{Purchase Price of each Bond}} = \frac{\$93{,}808{,}630}{\$10{,}000*(1-12\%)} = \frac{\$93{,}808{,}630}{\$8{,}800} = 10{,}660$$

Now 1 year goes by and we want to sell our bonds. But we find that the **market rate** of these types of bonds **has increased 20 BASIS POINTS**! This raise in the market value of this bond means I am going to be short of my $100 million goal. We are going to experience **Interest Rate Risk**.

My 10,660 bonds mature to $10,000 each in one year meaning I have $106,600,000 worth of bonds I want to sell (these bonds still have 1 year left to maturity). But the market price for this type of bond has increased to 6.8%. An investor buying today is willing to pay $\frac{\$10{,}000}{1.068} = \$9{,}363.30$ per bond. When I sell my 10,660 bonds at todays rate of 6.8% I will receive 10,660 * $9,363.30 = **$99,812,234**.

Because market rate of return on this type of bond have increased I am short of my goal by

$$\$100{,}000{,}000 - \$99{,}812{,}234 = \$187{,}766$$

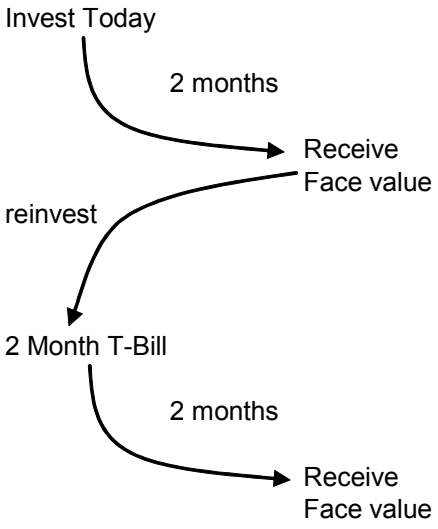
This is Interest Rate Risk. Company will have to barrow to make up the difference (or they could have bought 1 year bonds if available).

Interest Rate Up → Asset Price Down, will be short
Interest Rate Down → Asset Price Up, will have excess

Reinvestment Risk

- Suppose the company still has an obligation falling due in 4 months for $10 million
  - Once again, the company wishes to ensure it has sufficient funds at that date so decides to invest in T-bills today.
  - Suppose the only available T-bills matures in 2 months
    - It currently sells for **99% of its face value**
- Suppose at the end of the first two-month period there will be another 2-month t-bill to invest in.
- Assuming market rates stay constant, how much should the company invest?
- The return over 2 months will be

(100/99) – 1 = 1.01%, $R = \left(\frac{100}{\text{Purchase Price as \% of Face Value}*100}\right) - 1$



$R = \left(\frac{100}{.99*100}\right) - 1 = 1.0101\%$ This is the per 2 month period return but it's more helpful to calculate the return over two investment periods, or 4 months.

$R = \left(\frac{100}{.99*100}\right)^2 - 1 = 2.03\%$, return over 4 months.

To have $10 million in 4 months invest $\frac{\$10 \text{ mill}}{1.0203} = \$9,801,000$ today. The face value of the **first** investment will be $9,801,000*1.0101 =$**$9,900,000**.

- Suppose the yield decreases during the first period so that at the time to reinvest, rates have **decreased** by 25 basis points
- So at reinvestment, the new rate will be?
  1.01% - 0.25% = 0.76%
- At reinvestment we have **$9,900,000** to invest
- This will yield $9,900,000 x 1.0076 = $9,975,250

Here we are not considering what we can resell the asset for to another investor, we are looking at what our final return will be after 4 months when after the first purchase, and before we could reinvest at the 2 month point, market rates dropped. Now we reinvest at a lower rate than we thought we would get and our final income after 4 months is short of our goal by: $10,000,000 – 9,975,250 = **$24,750**.

What is the solution to Reinvestment Risk and Interest Rate Risk? Get a bond for the exact term you need and hold it to maturity. Of course this may not be available.

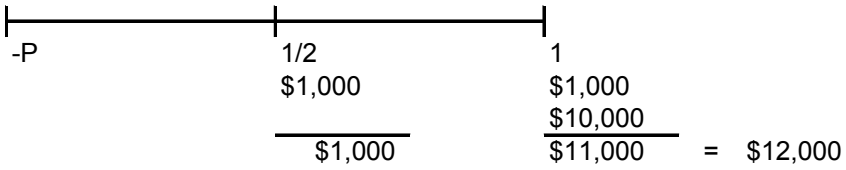
A bond will sell for face value when market rate equals coupon rate. If yield to maturity is greater than coupon then face value is greater than price.

EXAMPLE: Reinvestment Risk

Obligation of $100 mill due in 1 year. Invest in government bonds with face value of $10,000 and an annual coupon of 20% paid semi-annually (this means the total value of the two coupon payments will be $2,000. The payments will be $1,000 made every 6 months). The coupon rate here is 10%.

The 6 month yield to maturity on this bond is R=8%. This means investors require an 8% return in order to invest.

How much is each bond worth today? Find the Present Value.



Key is to figure out the payment schedule (above) and then compute PV for each payment.

P (Price) is the present value of the cash flows discounted at the market rate. Convert the $1,000 and the $11,000 into today's money. Do this by dividing each payment by R, the required rate of return.

$$P = \frac{1000}{(1.08)^1} + \frac{11000}{(1.08)^2} = \$925.93 + \$9,430.73 = \$10,356.65$$

This is what investors will pay today for the bond. Ultimately they will receive $12,000 back. Note that the bond is selling above it's face value. A bond will sell above it's face value when the market rate is below the coupon rate. (?)

How much should we invest today to meet our $100 million obligation? Let x=amount to invest today. We know we have equal return for two periods, $x*(1.08)^2$.

Want $100 mill back so, $(1.08)^2$ x = 100 million → $x = \frac{100 \text{ mill}}{(1.08)^2} = \$85,733,882$

This is the amount to invest today. How many bonds to purchase?

$$\frac{\$85,733,882}{\$10,356.65} = 8278 \text{ number of bonds to buy}$$

Now check that this works, that we will make our $100 mill return. Lay out our payments:

$8,278,150 + $8,278,150 + $82,781,500 = $99,337,800 !!! MISSED by $662,200!

This is because the first coupon payment should have been reinvested at the 1.08 return rate, now retry:

$8,278,150*1.08 + $8,278,150 + $82,781,500 = $100,000,052 GOOD !!

Reinvestment rate will effect our earnings of the reinvested coupon payments. In order to make the goal the investment rate must hold for the duration of the bond. This might not be the case.

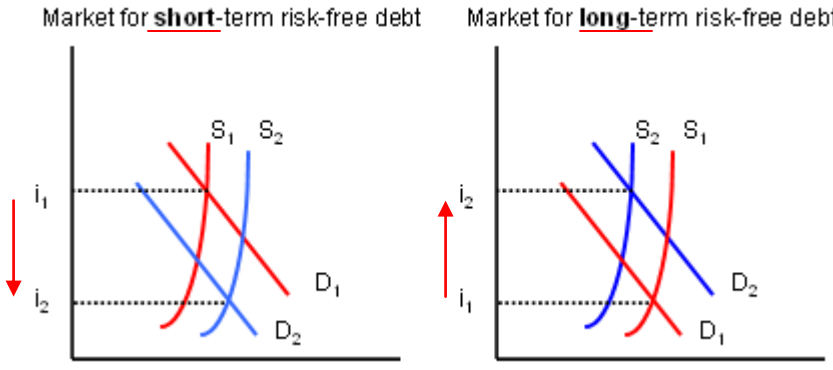
A Closer Look at the Term Structure

❑ Pure expectations theory

* Pure expectations theory suggests that the shape of the yield curve is determined solely by expectations of future interest rates
* Assuming an initially flat yield curve:
  - The yield curve will become upward sloping if interest rates are expected to rise
  - The yield curve will become downward sloping if interest rates are expected to decline

If I am a business and I think rates are heading up I will do all of my barrowing now! Barrow long term funds to lock in the rate. Demand for short term funds is reduced.

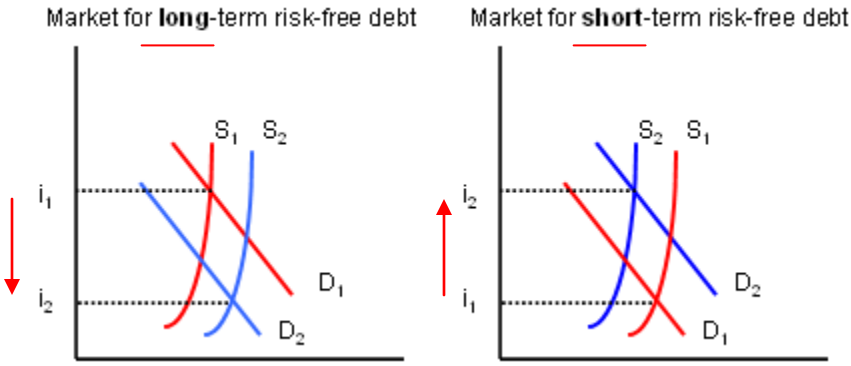
Sudden Expectation of **Higher Interest Rates**

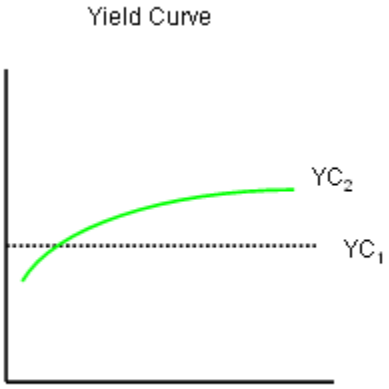


Short Term: In this case the net-net result is a decline in short term rates.
Long Term: Long term rates currently low so demand increases.

Something happens in the market causing investors to believe rates will be going up. So they maintain a short term liquid position, that way they can get ahold of ther case when the rates do increase.

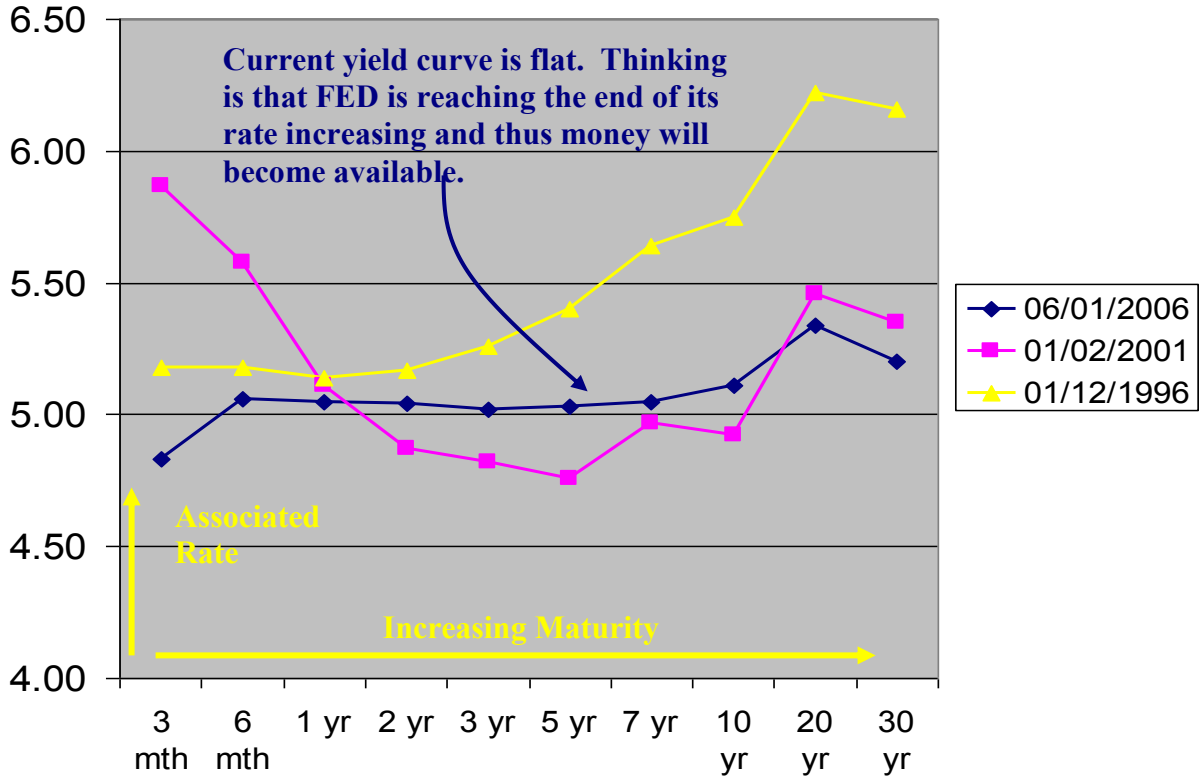
Sudden Expectation of **Lower Interest Rates**





Sudden Expectation of Lower Interest Rates causes the originally flat yield curve to slope up. (the opposite would be true for an expectation of higher rates)

Yield Curve



Here we have examined government securities of different maturities. Found that current yield at 3 points (2006, 2001, 1996). Notice how short term bonds carry less risk and thus have a lower yield. RATES QOUTED ON THIS GRAPH ARE **NOMINAL RATES**.

EXAM

What is a flat yield curve telling us about the economy and what are the theories behind it?

Comments on the Yield Curve

- It shows nominal interest rates
  - Inflation will erode the value of future coupon dollars and principal repayments
- The Federal Reserve directly manipulates only the short-term interest rate at the very start of the curve
  - **The Fed's main tool is the federal funds rate**
- The rest of the curve is determined by supply and demand

ESSAY 2
We should put info about this in essay 2

Spot Rates

- On Friday the yield on 1 year and 2 year treasury securities was 3.51% and 3.82%, respectively. These are annual rates.
  - **These are 1 and 2 year spot rates**
- Thus if an investor bought $1 million of 1 year treasuries then he would have
  $1 mm x (1.0351) = $1,035,100 in one year
- And if an investor bought $1 million of 2 year treasuries then he would have
  $1 mm x $(1.0382)^2$ = $1,077,859 in two years (can't guarantee unless it's zero coupon)

Spot Rate is what you can lock in when making an investment.

Forward Rates

- What is the additional return earned over the second year?
- It will be r_f where
  $1,035,100 x $(1 + r_f)$ = $1,077,859
  So r_f = 4.1%
- This is the forward rate for year two

$1 mm x (1.0351) x $(1 + r_f)$ = $1,077,859 ← This is the 2 year return of bond at 2 yr rate

This is the 1 year return of bond at 1 year rate.

Solving for r_f (return forward) for the return we are expecting for the second period.

Relationship – Forward and future spot rates

- Suppose an investor has a two-year investing horizon
  - He wishes to invest in treasury securities and has two strategies (if only one year and two year bonds existed)
  - **Strategy I**. Invest in a one year bond and at the end, roll over the proceeds in a new one year bond
  - **Strategy II**. Invest in a two year bond

Relationship – Forward and future spot rates

- Given the above data on the two strategies, what will the one-year spot rate need to be in one year to yield identical returns?
- It would be 4.1% since in the above calculation r_f was calculated fro the relationship:

$$(1 + 3.51\%) \times (1 + r_f) = (1 + 3.82\%)^2$$

Solve for $r_f = 4.1\%$

- The only problem is, a future spot rate is an estimate.

r_f is only our current best estimate based on our strategies.

Relationship – Forward and future spot rates

- If we believe that forward rates are set so as to equal the spot rate over the same period then we believe in the ***Expectations Hypothesis***
- Generally this will only hold if investors are risk neutral
  - Economists believe that investors need to be induced to hold riskier long-term bonds, over smaller bonds and rolling over, thus expected spot rates are likely smaller than their corresponding forward rate.

What returns will look like in the future.

A Closer Look at the Term Structure (cont'd)

- ***Liquidity Premium Theory***
  - According to the liquidity premium theory, the yield curve changes as the liquidity premium changes over time due to investor preferences
    - Investors who prefer short-term securities will hold long-term securities only if compensated with a premium
    - Short-term securities are typically more liquid than long-term securities
  - **The preference for short-term securities places upward pressure on the slope of the yield curve**

Short term treasury securities are more liquid so investors demand higher returns from long term securities in order to invest in them. Investors are wanting more in exchange for giving up liquidity.

A Closer Look at the Term Structure (cont'd)

❑ ***Liquidity Premium Theory*** (cont'd)

* Estimation of the forward rate based on a liquidity premium
  - The yield on a security will not necessarily be equal to the yield from consecutive investments in shorter-term securities:

$$(1+{}_{t}i_{2})^{2} = (1+{}_{t}i_{1})(1+{}_{t+1}r_{1}) + LP_{2}$$

  - The relationship between the liquidity premium and the term to maturity is:

$$0 < LP_{1} < LP_{2} < LP_{3} < \ldots < LP_{20}$$

* Estimation of the forward rate based on a liquidity premium (cont'd)
  - A positive liquidity premium (slight upward slope ?) means that the forward rate overestimates the market's expectations of the future interest rate
  - A flat yield curve means the market is expecting a slight decrease in interest rates
  - A slight upward slope means no expected change in interest rates

❑ ***Segmented Market Theory***

* According to segmented markets theory, investors and borrowers choose securities with maturities that satisfy their forecasted cash needs
  - Pension funds and life insurance companies prefer long-term investments
  - Commercial banks prefer short-term investments
* Shifting by investors or borrowers between maturity markets only occurs if the timing of their cash needs change

Each part of the yield curve has it's own supply and demand forces.

* Limitations of the ***Segmented Market Theory***
  - Some borrowers and savers have the flexibility to choose among various maturity markets (not locked into particular markets)
    - e.g., Corporations may initially obtain short term funds if they expect long-term interest rates to decline
    - If markets were segmented, an adjustment in the interest rate in one market would have no impact on other markets, but evidence shows this is not true

Shocks in the market tend to effect the entire yield curve. Blows this theory away.

* Implications of the ***Segmented Market Theory***
  - The preference for particular maturities can affect the prices and yields of securities with different maturities and therefore the shape of the yield curve
  - The preferred habitat theory is a more flexible perspective
    - Investors and borrowers may wander from their markets given certain events

A Closer Look at the Term Structure (cont'd)

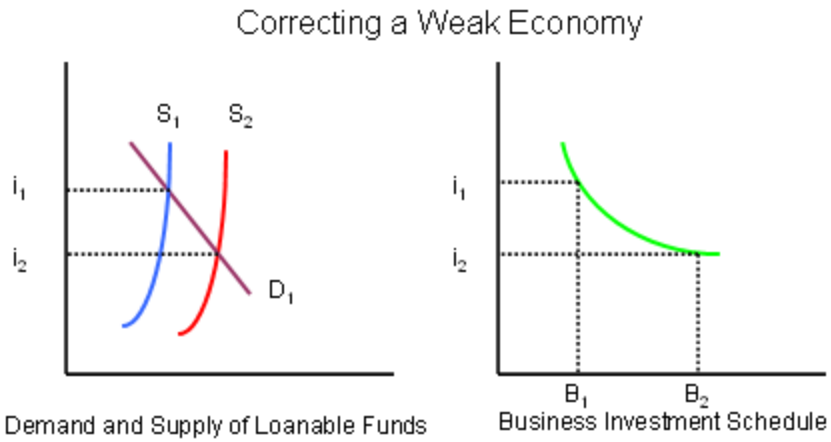
- Research on term structure theories
  - Interest rate expectations have a strong influence on the term structure
  - The *forward rate* from the yield curve *does not accurately predict future interest rates*
  - Variation in the yield-maturity relationship cannot be explained by interest rate expectations or liquidity
  - General research implications
    - Some evidence for pure expectations, liquidity premium, and segmented markets theory

The research suggest a mixture of all these theories is at work.

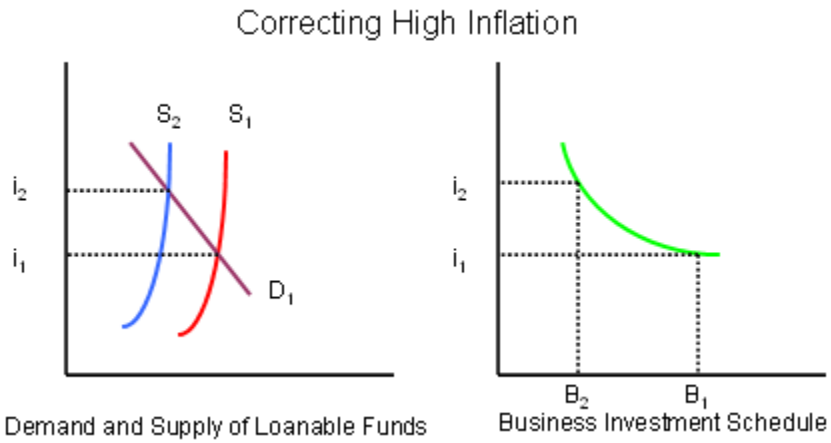
(below here not covered in class)

Monetary Theory

- Pure Keynesian Theory
  - One of the most popular theories influencing the Fed
    - Developed by John Maynard Keynes
  - Suggests how the Fed can affect the interaction between the demand for money and the supply of money to influence:
    - Interest rates
    - The aggregate level of spending
    - Economic growth
  - Can be explained by using the loanable funds framework
    - Demand for and supply of loanable funds determine the equilibrium interest rate
    - The business investment schedule illustrates the inverse relationship between interest rates on loanable funds and the level of business investment
  - Correcting a weak economy
    - The Fed would use open market operations to increase the money supply
    - A higher level of the money supply would reduce interest rates
    - Lower interest rates encourage more borrowing and spending
    - Keynesian philosophy advocates an active role for the government in correcting economic problems



* Correcting high inflation
  - The Fed would sell Treasury securities (decrease the money supply)
  - A lower level of the money supply reduces the level of spending
  - Less spending slows economic growth and reduces inflationary pressure (demand-pull inflation)



* Effects of a credit crunch on a stimulative policy
  - The economic impact of monetary policy depends on the willingness of banks to lend funds
  - If banks are unwilling to extend credit despite a stimulative policy, the result is a credit crunch

Monetary Theory (cont'd)

- Quantity Theory and the Monetarist approach
  - The quantity theory suggests a relationship between the money supply and the degree of economic activity in the equation of exchange:

$$MV = P_G Q$$

    - Velocity is the average number of times each dollar changes hands per year
    - The right side of the equation is the total value of goods and services produced
    - If velocity is constant, a change in the money supply will produce a predictable change in the total value of goods and services

  - An early form of the theory assumed a constant Q
    - Assumes a direct relationship between the money supply and prices
  - Under the modern quantity theory of money, the constant quantity assumptions has been relaxed
    - A direct relationship exists between the money supply and the value of goods and services
  - Velocity represents the ratio of money stock to nominal output
  - Velocity is affected by any factor that influences this ratio:
    - Income patterns
    - Factors that change the ratio of households' money holdings to income
    - Inflationary expectations

- Comparison of the Monetarist and Keynesian Theories
  - The Monetarist approach advocates stable, low growth in the money supply
    - Allows economic problems to resolve themselves
  - Keynesian approach would call for a loose monetary policy to cure a recession
  - Monetarists are concerned about maintaining low inflation and are willing to tolerate a natural rate of unemployment
  - Keynesians focus on maintaining low unemployment and are willing to tolerate any inflation that results from stimulative monetary policies

- Theory of Rational Expectations
  - Holds that the public accounts for all existing information when forming its expectations
  - Suggests that households and business will use historical effects of monetary policy to forecast the impact of an existing policy and act accordingly
    - Households spend more with a loose monetary policy to avoid inflation
  - Suggests that households…
    - Businesses will increase their investment with a loose monetary policy to avoid higher costs
    - Labor market participants will negotiate higher wages with a loose monetary policy
  - Supports the Monetarist view that changes in monetary policy do not have a sustained impact on the economy

- Which theory is correct?
  - The FOMC recognizes the virtues and limitations of each theory
    - The FOMC adjusts monetary growth targets to control economic growth, inflation, and unemployment
    - Recognizing the Monetarist view, the FOMC is concerned about the inflation resulting from a loose monetary policy

Tradeoff Faced by the Fed

- Ideally, the Fed would like:
  - Low inflation
  - Steady GDP growth
  - Low unemployment
- There is a negative relationship between unemployment and inflation
  - Phillips curve
  - A tight money policy can curb inflation but increase unemployment and vice versa
- Impact of other forces on the tradeoff
  - Cost factors such as energy costs and insurance costs can influence the tradeoff
  - When both inflation and unemployment are high, Fed members may disagree as to the type of monetary policy that should be implemented