Definitions of the Money Supply

It turns out there are multiple definitions of the money supply, depending on what you consider to be money. We can all agree that currency and coins are money. But what about checking account balances? Savings account balances? Are they really money? Folks can disagree.

As such, there are multiple definitions of the money supply. In general, we will let M stand for the money supply. Below you will see three alternative definitions of M. We'll generally go with M1, which will serve our purposes well.

M1 includes:

- Currency outside banks
  (*Cash and Coins)*
- Demand Deposits at Banks
  (*Non-interest-bearing checking accounts)*
- Other checkable deposits at banks and thrifts
  (*Interest bearing checking accounts (NOW accounts))*
- Traveler's Checks

M2 includes:

- M1
- Small-denomination time deposits
  (*CDs)*
- Money Market Deposit Accounts and Savings Deposits at Depository Institutions
  (*Savings Account Balances)*
- Retail Money Market Mutual Fund Shares
  (*Individuals with idle money in brokerage accounts)*

M3 includes

- M2
- Large-denomination time deposits ($100K+) at Depository Institutions (10%)
  (*Big CDs for corporations)*
- Institutional Money Market Mutual Fund Shares (10%)
  (Big money market mutual funds for corporations, government)
- Bank Repos and Eurodollars
  (*Overnight loans for financial institutions)*

How big is each component?

See your text on p. 15 for the breakdown of the values of M1, M2, and M3 as of 3/2003. I've updated the information to reflect the most recently available government statistics, as of 5/2008. I've given you the seasonally adjusted values.[1] If you'd like to see for yourself, check out the link below to the Fed website. Also, if you are wondering if I was just be lazy with regard to M3, the Fed no longer collects data on M3.

http://www.federalreserve.gov/releases/h6/Current/

Also, there is a bit more information in some cases in my "glossary" at the end of these notes.

[1] Don't worry about the seasonal adjustment process. If you are interested, come talk to me. The basic story is that there are predictable seasonal patterns in the money supply. The figures are adjusted for by those that calculate M so that observed month-to-month changes in the money supply are more informative. The predictable component of the month-to-month is removed.

All of the figures below are in billions of dollars.

M1 = 1363.5
- Currency = 762.5 (55.9%)
- Demand Deposits = 286.0 (21.0%)
- Other Checkable Deposits at Banks and Thrifts = 308.8 (22.6%)
  - Other Checkable Deposits at Commercial Banks = 170.0
  - Other Checkable Deposits at Thrifts = 138.8
- Traveler's Checks = 6.2 (0.5%)

M2 = 7684.6
- M1 = 1363.5 (17.7%)
- Savings Deposits = 4051.4 (52.7%)
  - Savings Deposits at Commercial Banks = 3136.2
  - Savings Deposits at Thrifts = 915.2
- Small Den. Time Deposits = 1205.3 (15.7%)
  - Small Den. Time Deposits at Commercial Banks = 811.8
  - Small Den. Time Deposits at Thrifts = 393.5
- Retail Money Funds = 1064.4 (13.9%)

Some Organization

At first glance, the maze of various components in M1 and M2 can be dazzling. But there are really only three main differences. They include whether or not the component earns interest, whether or not checks can be written, and whether or not there are (time) restrictions on access to the funds.

Of course, money is money (M1). It does not bear interest, and writing checks is not applicable.

Demand deposits (M1) have checking privileges, but do not bear interest.

Nearly everything else we encounter is classified in the table below. All of the items in the table below are interest-bearing accounts.

Interest Bearing Accounts:

		Time Restrictions	
		Yes	No
Checking	Unlimited	----	NOW accounts (other checkable) (M1)
	Limited	----	Money Market Deposit Accounts (M2)
	None	Time deposits (CDs) (M2)	Savings Deposits (M2)

Also, we have Money Market Mutual Funds (M2) floating around, that aren't in the table above, but are similar to Money Market Deposit Accounts in that they have no time restrictions and offer limited checking.

The Benefits of using money

Money serves three broad functions

1. Means of payment
2. Store of Value
3. Unit of Account

First, an aside on liquidity

Before we go on wit these, let's go back to what is money. A major issue is liquidity. A **liquid asset** is something you can turn into the generally acceptable medium of exchange quickly without taking a loss.

There is a continuum of liquidity. That is to say some things are very liquid, some things very illiquid, and everything in-between.

Money is by definition, the most liquid. Checking account balances extremely liquid, and that of course, is why they are included in M1.

Are CDs (Certificates of Deposits) as liquid as money? Why or why not?[2]

Why aren't Savings account deposits as liquid as money?[3] Are they still very liquid?

Why aren't MMDA and MMMF liquid?[4] They are pretty liquid?

What about treasury bonds? Shares of Microsoft stock? Baseball cards? Fancy Arts? Houses?

Back to the Benefits of Holding Money?

I think, the best way to see the benefits of holding money is to imagine a world without money – a barter economy. A **barter economy** is an economy without a medium of exchange or a unit of account. We can examine how not having a medium of exchange would impact the economy. We can also examine how not having a unit of account would impact the economy.

First, the unit of account. How many eggs is a Britany Spears CD worth? How many pairs of running shoes is an Ipod worth? How many Yankees tickets for a Madonna concert ticket? Without a unit of account, we'd have exponentially more prices to have to remember and write down. Your book makes a comment about how big the price tags at grocery stores would be. Being a checkout person at Wal-Mart would be tough.

Next, the medium of exchange. In a barter economy, trading requires the **double coincidence of wants**. If you have eggs and want Yankees tickets, you need to find someone who not only has Yankees tickets, but also wants eggs. But what if the guy who has Yankees tickets doesn't want eggs, but instead needs the services of a divorce attorney?

So in a barter economy (without money) we have to run around all day looking for people to trade with, and remember all those prices. This takes up time and effort, and makes us worse off. Of course, having money around to serve as a medium of exchange eliminates the need for barter. If you have eggs, you exchange your eggs for money, and then exchange your money for Yankees tickets. Also, by having the unit of account, we quote all prices in terms of dollars.

Super important: A good medium of exchange has the characteristic that it is **generally acceptable in trade**. That is, it can be passed on. It also has the characteristic that the **uncertainty about is value must be very low**.

Does the US dollar fit the bill? Have you ever had a hard time getting people to accept a dollar in exchange? I haven't. Do you have uncertainty about the value of the dollars? I don't think so.

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[2] If you buy, say a 3-month CD, and one month later want your money, you pay a substantial penalty – you forgo some of the interest you have earned for early withdrawal. Why is a CD not liquid, then? Because some of its value has been lost in exchanging into money.

[3] Because they don't come with checking privileges. First you have to convert the savings account into something that does. But that is not so difficult.

[4] They are pretty liquid, in some argue they should be in M1. Perhaps it is because of the limited checking privileges.

Consider an alternative. What is someone offered you a lump of shiny gold metal for your car. Would you do it? Are you certain of its value? Is it really gold? What is gold really worth (if it is gold)? Can you trade in the gold to someone else? Would they accept it?

What if your boss started paying you in chips from the Amelia Belle Casino? Would you accept them? Can you pass them along? Are you uncertain about their value?

Some related questions for you to think of.

Why do they have elaborate pictures of presidents on US money and little metal strips inside and a watermark?

What is the main way in which our medium of exchange deteriorates in value?[5]

Why doesn't an ice cream cone make a good exchange of value?

Money is Pervasive

Even in situations where the government is not "responsible" for money, something is adapted to serves as medium of exchange. Barter is tough.

Native Americans used Wampum, folks in the US have used silver, gold, pieces of paper backed by gold, and piece of paper with dead presidents (backed by nothing), northerners used the Continental, and southerners used the Confederate. Folks on the island of Yap used large stones as money. Interestingly enough, they didn't carry them around, they just kept track of whose money it was. For more, see this article:

http://economistsview.typepad.com/economistsview/2005/09/yapping_about_m.html

What serves as the medium of exchange in prison? Smokes, of course.

Why does money have value?

A good medium of exchange then has value because other people think it has value. Our current monetary system is called **fiat money**. It has no intrinsic value. It is not backed by gold or any other metal. It has value only insofar as people think it has value. Its value is derived from the fact that people are willing to accept it in exchange. In some sense, it is a fiction, or a house of cards. But because everyone else thinks it has value, it has value.

Very important, as alluded to above. The **value of money** is determined by the average level of prices. If prices increase (inflation), a dollar is worth less, because it will buy fewer goods. If prices decrease (deflation), a dollar is worth more, because it will buy more. Or more succinctly, the value of money is inversely related to the price level.

Later we'll sometimes think of inflation as a tax on those who are holding money. Think about why this makes sense.

A previous of coming attractions. Who determines how much money there is?

The money supply will be determined by the Fed, the banking system, and the general public. Just how, is what we intend to find out.

Another coming attraction. What is the Fed? The Fed is short for the **Federal Reserve System**. It is the central bank of the United States. Think of it as a bank for banks. It is the government institution

[5] The answer here is that the price level increases, or inflation.

responsible for, amongst other things, the execution of **monetary policy**. Monetary policy is tinkering with money supply.
The Fed was created by Congress in 1913. It has 12 district Federal Reserve Banks scattered about throughout the countries, with the headquarters so to speak being the **Board of Governors** in Washington. Boston, New York, Philadelphia, Cleveland, Richmond, Atlanta, Chicago, St. Louis, Minneapolis, Kansas City, Dallas, San Francisco. We are in the Atlanta district. If you'd like to see a map, use the link below.

http://www.federalreserve.gov/otherfrb.htm

Bank reserves and the federal funds market will be very important. We'll discuss each in great detail later in the semester.

We'll also discuss the velocity of money later in the semester.

Flow of Funds

Those who can make profitable investment opportunities are often not the people who generate savings. Financial systems will serve the purpose of having funds flow from saver-lenders to borrower-spenders. Having a financial transmission mechanism allows those with profitable investment opportunities access the funds from savers. As a result, there is more economic activity (higher GDP, richer country). What sort of investment ideas does your cheap grandmother have? Wildcat oil drilling? Software companies? Or maybe just watching Matlock?

Information will be very, very important. Borrowers need to know about borrowing opportunities - how they can access funds. Savers need to know about lending opportunities. Savers need to have information about the quality of borrowers. This will require much information. Much more later.

This flow of funds can occur in two main fashions. I think the picture is a bit misleading.

Direct finance – directly through financial markets. Lender-savers buy securities from borrower-spenders. The funds are flowing from lender-savers to borrower-spenders. The securities are flowing from borrowers-spenders to lender-savers.

Example: IPO? (A bit sketchy)

Indirect finance – thorough financial intermediaries. Lenders purchase financial claims of financial intermediaries. Financial intermediaries purchase financial claims of borrowers.

Example: Lender purchases CD. Bank makes a business loan, like purchasing IOU from business firm. Notice that the lender does not directly purchase the IOU from the business firm, but do provide the firm funds indirectly. At the end of the day, the person signing up for the CD ended up providing the funds to the firm who wanted a business loan.

Who are saver-lenders? Households, though occasionally firms and governments (state, local, federal).

Who are borrower-spenders? Business firms and governments, also households (credit, mortgages),

Primary Markets vs. Secondary Markets

When borrower-spenders raise funds (directly) in the financial markets, they do so by issuing securities in what is referred to as the **primary market**. Borrower-lenders issue securities and distribute them to saver-lender. They do so with the help of an investment bank, which gathers information, finds potential buyers, helps the borrower-lender set a price for the securities, and helps them sell the securities. An example would be an initial-public-offering of a stock. The investment bank is really just a marketing firm for newly issued securities.

After securities have been issued, there is a **secondary market**, where these securities can be sold. Examples here are the New York Stock Exchange, NASDAQ, or the O-T-C markets.

Things you should read about

If these are new, do read p. 35 – 40.

Bonds – borrowing of money by the government or corporation that originally sold the bond. They are basically IOUs. When people refer to the maturity of bonds, they are referring to the time period after which the bond will be paid off. Examples, 5 year, 10 year, 20 year, 30 year. Bonds promise to pay back the principal at maturity and interest for a stated number of years. Many coupon bonds gave coupons that bondholders redeem every six month to collect the interest, while zero-coupon bonds have no coupons.

Example: $1000 face value 8% coupon bond. The bondholder might pay $1000 to purchase the bond. The bondholder will receive interest payments of $40 every 6 months beginning 6 months from the date of issue, and then receive $1040 (the principal and last coupon payment) in 10 years.

Zero-coupon bonds are sold below their face value, with the different between the price and their face value representing the interest.

Example: $1000 face value zero-coupon bond. The bondholder might pay $400 to purchase the bond. In 10 years, the bondholder will receive $1000, which can be viewed as $400 worth of principal and $600 in interest payments.

Stocks - ownership. Only corporate. May pay dividends. Preferred stock and common stock. Preferred stock gets fixed dividends, and receives dividends before common stockholders receive their dividends. Capital gains. If you don't know what a stock is, please read.

Mortgages – debts incurred by someone purchasing a house. Collateral is house. Amortized. Fixed rates / adjustable rates. Can be prepaid (sell house). Pass throughs. CMOs. Securitization. A lot of information here that won't come in hand for us, for quite some time. We'll come back.

Derivatives – options and futures. Won't be a big deal for us.

Terms that you should know

Capital market – financial instruments with original maturities of more than a year and equities.

Money market – financial instruments with original maturities of less than one year. Commercial Paper, Negotiable CDs, U.S. Treasury Bills.

Capital Market (billions of dollars)

Corporate Stocks	$11,735
Residential Mortgages	$6.463
Corporate Bonds	$2,699
US government agency securities	$2,374
US government securities	$2,316
Commercial and farm mortgages	$2,019
State and Local government bonds	$1,433

Money Market (billions of dollars)

Commercial Paper	$1,343
Negotiable bank CDs (large-denomination)	$921
U.S. Treasury bills	$889

Types of Financial Intermediaries

Asset size, as of 2002, in billions

$7357 Commercial Banks
$3686 Private Pension Funds
$3635 Mutual Funds (stock and Bond)
$3366 Life Insurance Companies
$2224 Money market mutual funds
$1968 State and local government retirement funds
$1358 Savings and loan associations and mutual savings banks
$1189 Commercial and consumer finance companies
$912 Property and casualty insurance companies
$563 Credit Unions

In order of size, from biggest to smallest…

1. **Commercial Banks**

   What you think of when you hear the term bank. Wachovia, Chase, Teche.

   Sources of funds: traditionally demand deposits, but increasingly savings and time deposits.
   Uses of funds short-term government securities, long-term business loans, home mortgages.

2. **Private Pension Funds**

   The retirement funds of companies that offer pensions. This will be a big issue on down the road because they are under-funded.

   Sources of funds: pension contributions.
   Uses of funds: long-term corporate bonds, high-quality stocks. Of course, they pay out the pension funds upon retirement.

3. **Mutual Funds**

   Vanguard, Fidelity, T. Rowe Price. Can be investing in both stocks and bonds, and occasionally mortgages. Pools savings of small investors and purchases securities. Provides diversification.

   Sources of funds: contributions.
   Uses of funds: varies depending on investment objectives of particular mutual fund

4. **Life Insurance Companies**

   Prudential, State Farm, Allstate. These guys are also in the property casualty game.

   Sources of funds: premiums.
   Uses of funds: Long-term corporate bonds and long-term commercial mortgages. Of course, they pay out the death benefits.

5. **Money Market Mutual Funds**.

   Just like mutual funds, only invests in short-term money market instruments.

6. **State and Local Government Retirement Funds.**

   See private pension funds.

7. **Savings and Loan Associations (S & Ls)**, Savings Banks

   Sources of funds: savings deposits (aka "shares").
   Uses of funds: mortgages, some consumer and business loans.

8. **Commercial and Consumer Finance Companies**

   Typically finance arm of companies that sell consumer goods. Buy a car from GM, and borrow the money to pay for the car from GMAC.

   Sources of funds: commercial paper.
   Uses of funds: car loans, companies' products, equipment loans to business firms.

9. **Property and Casualty Insurance Companies** – homeowners, car, fire, malpractice, negligence

   Source of funds: premiums.
   Use of funds: municipal bond, corporate bonds, high-quality stocks, money market instruments.

10. **Credit Unions** – organized around groups (employees of same company, churches, schools)

    Nicholls had a credit union. Folks borrow to buy cars, vacations, expensive items.

    Source of funds: savings deposits ("shares").
    Use of funds: consumer loans, some long-term mortgages.

Some Terms – there will be some redundanct

I've mostly stolen most of these right out of the glossary, but added a few tidbits along the way.

Currency - Coins and bills used as money

Demand Deposits - Non-interest bearing checking accounts. The reason they are called demand deposits is because your deposits is payable "on demand" – no restrictions.

Negotiable order of withdrawal (NOW) account - An interest bearing checking account. Historically, banks were not allowed to offer interest on checking accounts. NOW accounts are the result of a loophole that was exploited in the late 1970s.

Certificates of Deposit (aka CDs, time deposits) - Deposits with specific maturities, also referred to as time deposits. CDs that mature in 3mo, 6mo, 1yr, 2yr, 3yr, and 5yr can be purchased. There is an interest penalty for early withdrawal. For rates:

http://cdrates.bankaholic.com/

Thrift Institutions - Savings and loan associations, mutual savings banks, and credit unions are referred to as thrift institutions. Compare to commercial banks. Louisiana Examples: Home Federal, Nicholls Credit Union.

Commercial Bank - A financial institutions that offers a wide variety of services, including checking accounts and business loans. Compare to thrift institutions. Louisiana Examples: BankOne, Teche, Regions, Hibernia

Savings Deposit - Non-transaction deposits (no check writing) that can be withdrawn at any time such as a money market deposit account. Compare to time deposits and NOW accounts. If an account has unlimited

check writing privileges, it would be an other checkable deposit (NOW). If the timing of withdrawals were limited, it would be a time deposit (CD).

Money Market - The financial market for short-term securities (securities with a maturity of a year or less).

Money Market Deposit Accounts - Deposits with limited checking account privileges that typically pay an interest rate comparable to treasury bills or other money market instruments. Typically limited to 6 transactions a month including 3 checks. They are FDIC insured. See also Money Market Mutual Funds. For rates:

http://www.bankaholic.com/money-market/

Money Market Mutual Funds - Mutual funds that invest in money market instruments. Limited check-writing privileges. They are not FDIC insured and have management fees associated with their use. For rates:

http://www.bankrate.com/brm/rate/mmmf_tax.asp

Commercial Paper – short term liabilities of the most creditworthy business firms and finance companies.

Negotiable CDs – CDs that can be traded in a secondary market. Higher interest rates that that of t-bills.

Treasury Bills – short-term debts of the US government, very liquid, very actively traded.

Simple Interest

Simple Interest

In simple interest, T = 1, looking at only one period.

Principal * Rate * Time = Interest
Principal * Rate * 1 = Interest

Future Amount = Principal + Interest = Principal + Principal * Rate = Principal * (1 + Rate)

Suppose Principal = $100, Rate = 8% (0.08)

In this case, the future amount = Principal * (1 + Rate) = $100 * (1 + 0.08) = $100 * 1.08 = $108

Important. If offered the choice between $1 today and a $1 tomorrow, choose the $1 today, because you could lend it out and turn it into more than dollar a year form now.

Also important. The flip side of that same coin. $1 you receive in a year is worth less than a $1 you receive today.

Compound Interest

$100 and lent it out for three years, you might think you'd end up with $124. But you won't.

Today = $100
End of year 1 = $100 * (1 + 0.08) = $108
End of year 2 = $108 * (1 + 0.08) = $116.64 not $116
End of year 3 = $108 * (1 + 0.08) = $125.97 not $124

But what have we really done to figure out this total at the end of year 3?

$100 * 1.08 * 1.08 * 1.08 = $100 * $(1.08)^3$ = Principal * $(1 + \text{Rate})^3$

More generally, the future amount = principal * $(1 + \text{Rate})^n$, where n represents the number of years the payment is allowed to grow.

We can review things have the same value:

$100	and	$108 in one year
$100	and	$116.64 in two years
$100	and	$125.96 in three years

Now go backwards. Say you knew you were going to get $125.96 in 3 years and you wanted to know how many dollars it was worth today. Instead of multiplying by 1.08 three times, you'd divide by 1.08 three times.

This idea is called discounting, and the answer is called the **present value**.

Present Value = Future Value / $(1 + \text{Rate})^n$

Examples

You pay $900 for a $1000 face value 8 percent coupon bond that matures in 10 years. You plan on holding it all 10 years. What annual interest rate are you getting?

First, what does the coupon rate mean? The coupon rate determine the amount of interest you will be paid. While in actuality most bonds pay interest twice a year, we will follow the text and assume that you receive interest only once a year.

Coupon rate = annual coupon payment / face value.

Alternatively, annual coupon payment = coupon rate * face value = 0.08 * $1000 = $80

Current Yield

Current Yield = annual dollar interest payment / price you paid.

In the example above, you are getting $80 in interest you paid $900, so

Current yield = $80 / $900 = 8.89%

What is wrong? It misses the capital gain, because you paid only $900 and at maturity, you'll get the face value of $1000. It is used because it is very, very easy to calculate.

It is also the case that when the price of the bond is the same as its face value, current yield will be correct, and equal to the yield to maturity (which we will calculate next). This is because there will be no capital gain aspect to the bond.

Yield to Maturity

Yield to maturity of a security is that particular interest rate (discount rate) that will make the sum of the present value of all the future payments of the security equal to its purchase price.

Look at the payments of the coupon bond.

$80 one year from today
$80 two years from today
$80 three years from today
…
$80 nine years from today
$1080 ten years from today when the bond matures (last coupon and face value

We could calculate the present value of each individual payment, add these up, and get the present value of the whole bond.

Present Value = $80 / (1 + r) + $80 / $(1+r)^2$ + $80 / $(1 + r)^3$…. + 1080 / $(1+r)^{10}$

More generally,

$P = C_1 / (1 + r) + C_2 / (1 + r)^2 + C_3 / (1 + r)^3 + \ldots + (C_n + F_n) / (1 + r)^n$

The yield to maturity is the interest rate that results in this present value being equal to the price paid for the bond.

On your financial calculator

$80 = Pmt
$1080 = FV
10 = number of period to maturity (N)
$900 = PV
Press the r or %

9.60%

Zero Coupon Bonds

Easier:

$P = C / (1 + r)^n$

P = $400, F = $1000, yield to maturity = 9.60%. Confirm you can figure this out on your calculator.

Change in Price

Change the price to $925 and let your calculator do the tapping. The yield to maturity is 9.18%. Price increases, yield to maturity falls.

Why does this make sense? From the perspective of the buyer of the bond (the lender), they are paying more money for the same future payments, and thus the yield must decrease.

Change the price to $875. Yield to maturity is 10.04%. Price decreases, yield to maturity rises.

Why does this make sense? From the perspective of the buyer of the bond (the lender), they are paying less money for the same future payments, and thus the yield must increase.

We have assumed we know P and want to find the interest rate. We could turn it around. What price is implied by a particular yield. Why? You'll see.

Long Term Bonds are riskier than shorts

Bond A: Face Value = $1000, 8% coupon, 20 years to maturity. Price = $1000.
Bond B: Face Value = $1000, 8% coupon, 2 years to maturity. Price = $1000.

Current Yield = $80 / $1000 = 8%

Because price is equal to face value, yield to maturity = 8%. Confirm this on your calculator.

Now, suppose, the interest rate rises by 2%, to 10%. The payments associated with this bond haven't changed. But the **value**s of the payments have changed.

We can recalculate the values of the bonds.

But there is some economics going on here. If everyone else in the world was offering a yield of 10%, why would anyone buy your bond if it only yielded 8%? What must happen to make your bond in line with the others in the market? It must have its yield increase. And as we saw above, how can the yield increase? Only if the price falls. Competitive forces in the bond market will drive down the price until the yield of your bond is now 10%, equal to those in the market. Thus you know the yield must be 10%.

But you miss some of the fun just using your calculator. Below I have calculated the present value of each individual payment in both bonds, using an interest rate of 8% and using an interest rate of 10%. I've then calculated how much they've changed.

Notice that the percentage changes in the prices are much larger for those payments that are father into the future. They are more sensitive to interest rates. As a result, we can conclude that long run bond prices are more sensitive to interest rate changes than short run bond prices.

Years	Payment	PV (8%)	PV (10%)	% Diff
1	80	74.07	72.73	-1.8%
2	80	68.59	66.12	-3.6%
3	80	63.51	60.11	-5.4%
4	80	58.80	54.64	-7.1%
5	80	54.45	49.67	-8.8%
6	80	50.41	45.16	-10.4%
7	80	46.68	41.05	-12.1%
8	80	43.22	37.32	-13.7%
9	80	40.02	33.93	-15.2%
10	80	37.06	30.84	-16.8%
11	80	34.31	28.04	-18.3%
12	80	31.77	25.49	-19.8%
13	80	29.42	23.17	-21.2%
14	80	27.24	21.07	-22.7%
15	80	25.22	19.15	-24.1%
16	80	23.35	17.41	-25.4%
17	80	21.62	15.83	-26.8%
18	80	20.02	14.39	-28.1%
19	80	18.54	13.08	-29.4%
20	1080	231.71	160.54	-30.7%
	Total	1000	829.73	-17.0%

Years	Payment	PV (8%)	PV (10%)	% Diff
1	80	74.07	72.73	-1.8%
2	1080	925.93	892.56	-3.6%
	Total	1000	965.29	-3.5%

As we see, the rise in yield involves a fall in price of $1000 to $830 for the 20-year bond, but a fall in the price from $1000 to only $965 for the two-year security.

For those of you who like math, it turns out the percentage change in the overall bond is a weighted change of the percentage change in each individual payments.

Take a look at the bond with only two years until maturity. It has a little piece whose values falls by 1.8% and a huge piece whose value falls by 3.6%. Overall, the bonds value decreases by 3.5%. Essentially, this bond is a bond of just under 2 years in weighted average maturity.

The other bond has lots of chunks. Its duration turns out to be about 10.3 years. Check out the appendix to Chapter 5 on Duration.

Return versus Yield to Maturity

There isn't a whole lot going on here, but make sure that you understand yield to maturity assumes you will hold the bond until maturity. If you hold the bond for a shorter time period, you will likely sell the bond at a price that is different from the price you paid. In that case, you must calculate the return. The formual below is a bit silly, because it assumes you sell it at the end of the year and have just received the coupon payment. It is a bit messier if you sell it in the middle of the year…Nonetheless,

Return = (Selling Price – Purchase Price + Coupon) / Purchase Price

The only point here is that you have to worry about the capital gain (or capital loss) if you don't hold to maturity.

What determines the level of interest rates?

We'll talk about the "the interest rate" because interest rates tend to move together for now. More later.

The interest rate is a price. It is determined by supply and demand.

1. Insert Supply and Demand curve for loanable funds here.

2. Discuss equilibrium adjustment process. R too high. R too low.

If, for example, all of the sudden, people were more wiling to lend, this would be an increase in the supply of loans, and would decrease the equilibrium interest rate.

3. Draw picture with increased supply.

Alernative – consider the price of securities instead of market for "loanable funds"

Alternatively, we could think of the market for securities (bonds). If you wish to borrow, you'd be selling (supplying) securities. You'd sell a piece of paper that promise to pay back, say , $1000. You'll be more willing to sell this security if you get a better price for it now ($950) than if you got a lousy price ($850). The supply curve is upward sloping.

To lend, you'll be buying securities. You'll be less willing to buy the $1000 IOU at a price of $950 than you will at a price of $850. The demand curve is downward sloping.

Gong back to the same example as before, suppose there was suddenly an eagerness to lend. That means people will be wanting to buy a bunch of securities, increasing the demand and driving up the price of securities. And as you know from above, if the price rises, the yield will fall. Same answer as before.

4. Draw in picture of increase in demand.

Why does the interest rate fluctuate?

First, a refresher on the difference between movements along a demand curve and shift in the demand curve. Take as an example, mortgages. People are more willing to borrow funds for a house at low interest rate than a high interest rate. This is a movement along a demand curve.

If, however, tenants suddenly feel rich and want to buy their own homes, this is a shift in the demand curve for loans. It is brought about by a change in something other than the interest rate.

Recollect, the (demand curve for funds) borrowing comes from:

1. Business Firms - acquiring inventories or buying capital equipment.
2. Households - borrowing to buy cars, goods, or homes.
3. State and local governments - borrowing to build sewers, roads, schools
4. The federal government - borrowing to finance budget deficits.

Potential demand for funds shifters would then include:

Anticipated future profits?
Expectations of future incomes?
Population increases?
Big Wars in Iraq?

Potential supply for funds shifters would include:

Perhaps the Fed makes it more difficult for banks to lender.
People decide to save less.

Typical Article

Inflation / Bernanke

http://money.cnn.com/2008/07/15/markets/bondcenter/treasurys/index.htm?postversion=2008071515

You can, with a bit of work, relate the popular press accounts to our economic models. Take for instance, the article above.

Story:

Short-run:

(1) Short-run: Increased expectations of inflation? (Think market for loanable funds.)

Changes: ↑ Demand for LF, ↓ Supply of LF
Results: ↑ (Short-run) Interest Rates, ↓ (Short-run) Bond Prices

But on the other hand, the price of oil has decreased, alleviating these concerns in the short-run?

(2) Short-run: Substitution from stocks to short-run bonds. (Think S/D model of securities).

Changes: ↑ Demand of (Short-run) Bonds
Results: ↑ (Short-run) Bond Prices, ↓ (Short-run) Yields

Long-run:

Long-run: Increased expectation of inflation? (Back to market for loanable funds).

Changes: ↑ Demand for LF, ↓ in Supply LF, in long-run
Results: ↓ (Long-run) Interest Rates, ↓ (Long-run) Bond Prices

Tuesday's changes in prices:

2 yr: + 5/32
5 yr: +12/32
10 yr: +9/32
30 yr: - 7/32

Conclusion: Oil prices and more likely substitution operating on the short-run end of the yield curve, and inflation expectations operating on the long-run end of the yield curve?

Chapter 12 - Depository Financial Institutions

Assets: Uses of Funds
Liabilities: Sources of Funds

Depository Financial Institutions are a profit making enterprise. Like all firms, they transform inputs into outputs, hoping to turn a profit in the process. Banks have financial claims on both sides of the balance sheets (not much in the way of "real" assets, mostly financial assets). The books crack about how bankers are standing up when they acquire funds (the counter) and sitting down when the sell funds or loan money (loan office) is mildly entertaining.

To get a sense of what is going on inside banks, and the trends within, I have reproduced the tables in your text containing assets, liabilities, and source of income. The first set is always in billions of dollars, while the second set is always as a fraction of total assets (in the second table the fraction of total liabilities).

Assets (12.1 and 12.2 p. 220 – 221)

	1970	1980	1990	2000	1970	1980	1990	2000
Cash Assets	93	332	318	384	16.3%	17.9%	9.4%	5.4%
U.S. govt. and agency securities	71	163	427	911	12.5%	8.8%	12.6%	12.9%
State and local govt. securities	67	146	84	103	11.8%	7.9%	2.5%	1.5%
Other Securities	3	16	94	321	0.5%	0.9%	2.8%	4.5%
Business Loans	112	391	615	912	19.6%	21.1%	18.1%	12.9%
Mortgage Loans	73	269	829	2068	12.8%	14.5%	24.5%	29.2%
Consumer Loans	66	187	403	704	11.6%	10.1%	11.9%	9.9%
Other Loans	47	169	263	478	8.2%	9.1%	7.8%	6.8%
Misc. assets	38	183	356	1196	6.7%	9.9%	10.5%	16.9%
Total	570	1856	3389	7077	100%	100%	100%	100%

Government securities fluctuate depending on where we are in the business cycle due to perceived liquidity needs. Notice that mortgage loans have increased dramatically as a fraction of assets, largely at the expense of state and local government securities.

Liabilities (12.3 and 12.4 p. 222)

	1970	1980	1990	2000	1970	1980	1990	2000
Transaction Deposits	247	435	685	710	43.3%	23.4%	20.2%	10.0%
Non-Transaction Deposits	235	752	1672	3321	41.2%	40.5%	49.3%	46.9%
Foreign Deposits	1	293	294	658	0.2%	15.8%	8.7%	9.3%
Borrowed Funds	20	178	385	1171	3.5%	9.6%	11.4%	16.5%
Misc. Liabilities	26	90	135	569	4.6%	4.8%	4.0%	8.0%
Equity Capital	41	108	218	648	7.2%	5.8%	6.4%	9.2%
Total	570	1856	3389	7077	100%	100%	100%	100%

Recall that transaction deposits are simply demand deposits. Non-transaction deposits are time deposits (savings accounts, CDs). Borrowed funds can be:

Borrowing from the Federal Reserve (discount rate)
Borrowing in the Federal Funds Market from other banks (federal funds rate)
Borrowing by banks from their foreign branches, parent companies, etc.
Repurchase agreements – short term loans (more later)

Clearly there are fewer transaction deposits as time goes on and more borrowed funds. Regulation Q explains the transaction deposits. Notice the timing of the drop – between 1970 and 1980. Borrowed funds have become much more important.

Income Statement (12.5 p. 225)

	1970	1980	1990	2000	1970	1980	1990	2000
Interest on Loans	24	152	235	277	4.17	9.88	6.93	3.91
Interest on Securities and Investments	7	23	69	81	1.13	1.50	2.04	1.14
Total Interest Income	31	175	304	358	5.30	11.38	8.97	5.06
Interest Expense	13	120	205	121	2.17	7.80	6.05	1.71
Net Interest Income	18	55	99	237	3.13	3.57	2.92	3.35
Service Charges and Fees	2	8	16	30	0.35	0.49	0.47	0.42
Other Operating Income	2	8	56	142	0.38	0.53	1.65	2.01
Net Operating Income Before Expense	22	71	171	409	3.85	4.59	5.05	5.78
Salaries and Wages	8	25	52	100	1.34	1.60	1.53	1.41
Other Operating Expenses	7	26	96	181	1.28	1.72	2.83	2.56
Net Operating Income Before Expense	7	20	23	128	1.23	1.27	0.68	1.81
Securities gains (losses)	0	-1	1	6	-0.02	-0.03	0.03	0.08
Taxes	2	5	8	44	0.33	0.32	0.24	0.62
Net Income After Taxes	5	14	16	90	0.89	0.91	0.47	1.27

Notice both the increase in interest income, and increase in income expenses in the 1980s, not surprisingly, when interest rates were quite high. Also notice the spread between total interest income and interest expense (net interest income). Service charges and fees also seem to be an increasing source of revenue.

Bank Risk

To again, help understand what is going on inside of bank, it is instructive to take a look at the various types of risk that banks face.

Leverage Risk

Example of leverage, broadly speaking, would be buying share of stock "on margin", 1929. At the time, you could, with $10, borrow $90, and buy a $100 share of stock.

If stock price increases by $10 (a 10% increase in the price of the asset), you could sell the stock for $110, pay back $90, have $20 leftover, and thus have earned a 100% return on your investment, from only 10% change in asset value.

If stock price decreases by $10 (a 10% decrease in the price of the asset), you could sell the stock for $90, pay back $90, have nothing leftover, and thus lost 100% of you investment from only a 10% change in the asset value.

(Side note: can only borrow 50% currently.)

What does this have to do with banks? Banks purchase assets with equity and debt. Banks are less risky with more capital.

Leverage ratio = equity capital / total assets

Note, often you hear about is the inverse total assets / equity capital. You might see this figure for Fannie Mae / Freddie Mac. (While the nature of their guarantees make this number more difficult ton interpret, one article I read suggested 78:1 or 1.3%). It is also the case that the leverage ratio varies dramatically across banks of different sizes, with smaller banks having higher leverage ratios. We'll calculate one of these later as we work through banking reserves.

	1970	1980	1990	2000
Leverage ratio	7.2%	5.8%	6.4%	9.2%
1 / Leverage ratio	13.90	17.19	15.55	10.92

Credit Risk

Default risk. You already know the story. With a higher risk of default, a bank will require higher interest rate and larger collateral requirements. If people don't pay back their loans, the bank will lose money.

Loan charge-offs (write offs) – the amount of the loan portfolio that was "written off" during the year because lenders cold not repay their loans. This is a backward looking metric.

Write-downs are updating the market value, due to a change in market conditions. Banks also report the loans that are starting to look iffy – called non-performing loans – loans that have interest payments that are delinquent 30 days or more. This is a more forward looking metric. Your book has stats for the industry as a whole in 1980 – 2000, duplicated below. The figures you see are the percentages of loans in each category. For example, in 2000, 2.68% of loans are non-performing.

Year	1980	1990	2000
Charge offs	0.65	1.43	1.07
Nonperforming	xxxx	5.97	2.68

Interest Rate Risk

See your notes on S & Ls. This occurs when banks exhibit have a mismatch of maturity. For example, if a bank has long-term assets and short-term liabilities (or more precisely, the average maturity level of their long-term assets exceeds the average maturity of their short-term assets), and interest rate rises, the present value of the firm's (long-term) assets will decline more than the present value of the firm's (short-term) liabilities will.

Interest rate does affect the market value of both sides of the balance sheets. There are various metrics that become more complicated if the bank has floating rate assets…and there are more complicated metrics to determine what is happening in this case. Banks pay a good deal of attention to interest rate risk, and will use derivatives to hedge this risk.

Trading Risk

Not a big deal for us. Banks act as dealers (market-makers) in bonds, foreign currency, and derivatives. They buy, with the intention of selling very soon at a higher price. Occasionally, the prices fall before they get a chance (while the opposite does occur as well). This is largely a concern for the largest banks, especially on foreign currency, but also on government bonds. Recall that government bonds are traded over the counter, not in central location (hence the banks as dealers).

Liquidity Risk

Demand deposits and savings accounts balances can be withdrawn at all times (bank run?). As a result, banks typically hold short-term (highly liquid securities). A basic measure of liquidity is:

(Cash + Securities) / Assets.

See top two columns of table 12.1. Over time, there has been a shift from using government securities to serve as a source of extra liquidity to using borrowing from other banks or the Fed. More of the details when we get into the Fed funds market.

If a bank is very illiquid, and in haste, must convert its assets quickly, they may find they do so as undesirable prices. This illiquidity, a temporary problem, can lead to insolvency (assets < liabilities), a permanent problem. This was the case with the banking panics of the Great Depression in the early 1930s.

<u>More Info for the interested in the book</u>
Trends in Bank Management, Consolidation, Nontraditional Banking.

Chapter 17 – Structure of the Fed

1913 Federal Reserve Act. "To coin money and regulate the value thereof." The initial purpose: supply currency when needed, clear checks, discount facility for commercial banks. Essentially, provide liquidity during times of banking panic.

It was subsequently amended. The goals are:

The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates.

Today, the Fed is in charge of monetary policy, which basically means manipulating the money supply – implementation of national economic policy. They are also charged with, to some extent, the regulation of banks. And of course they clear checks.

Just as consumers need banking services, banks need banking services. The Fed is the bank for banks. The Fed is central banking system of the United States.

Structure of the Fed

Board of Governors of the Fed – seven members, appointed by president, subject to Senate approval. 14-year terms. Appointments are staggered, no more than two members from same Fed district. These results are designed to avoid one president packing the BOG, geographic concentration of power, and long terms are intended to make members less subject to political influence. BOG is quasi-independent. Funds come from earnings of 12 regional banks, notably interest on their large portfolio of bonds. Not subject to congressional appropriations (not on the US government budget).

Chairman of the Board of Governors – chosen from the 7 Board of Governor members by President. 4-year term. Ben Bernanke started in 2/2006. Prior to him, Alan Greenspan served five terms (1987-2006), and prior to Greenspan, Paul Volcker served two terms (1979-1987).

12 Regional Banks. Boston, New York, Philadelphia, Cleveland, Richmond, Atlanta, Chicago, St. Louis, Minneapolis, Kansas City, Dallas, San Francisco. Each member bank is owned by the member banks in each district, which the regional Fed banks are responsible for regulating. Each member banks is required to buy stock in its district Fed equal to 6% of its own capital and surplus. 3% paid in, 3% subject to call. Profits limited to 6% annual dividend on paid-in capital. This leaves operating profit left over for the Fed to fund operations.

Member banks elect 6 directors of each regional Fed, the other 3 appointed by the BOG. These 9 directors choose the President of their regional Fed, with veto power to the BOG. These directors don't have much power.

Federal Open Market Committee - Comprised of 7 members of BOG, NY Fed President, and 4 other regional Fed Presidents (rotating terms). Those non-voting Fed Presidents attend FOMC meetings and discus, but can't vote.

Execution of Monetary Policy

- Reserve Requirements – BOG, limitations imposed by Congress
- Open Market Operations – Federal Open Market Committee (FOMC)
- Discount Rates – established by directors of each regional Fed, subject to review and revision by BOG, and ultimately effectively determined by the BOG.

As was asked in class, while technically not a monetary policy tool, the Fed will be very, very interested in the federal funds rate. Open market operations will have direct effects on the federal funds rate (the Fed's chief monetary target), as will (at least symbolically), the discount rate.

Reality of Power

Chairman of the BOG at the Fed has much influence. The other 6 members of the BOG also have a good deal of influence. The president of the NY Fed is also quite important, as open market operations are conducted through the New York Fed. The staff at the Fed is said to have some power.

Independence?

14-year terms, makes them more independent. However, congress can amend the Federal Reserve Act at any time. The Fed works closely with other governmental branches that are subject to congressional oversight. The Chairman of the BOG talks regularly to President, and is currently (as this lecture was originally delivered) testifying before Congress.

There is some interesting empirical evidence presented in the textbook. The more independent the central bank, the lower the inflation rate, across countries. This seems to suggest that being subject to political influence results in a less stable price level. (Politicians, who want to be re-elected / elected now, may favor short-term economic policies that trade off increased jobs today for increased inflation in the future). The empirical evidence scores two points for independence. Smart people argue on both sides of the more independence / less independence issue.

Chapter 18 – Bank Reserves and the Money Supply

1. Sell Stock and raise $5 million to start a bank. Buy a building for $1 million.

Balance Sheet:

Assets		Liabilities & Net Worth	
Cash	$4,000,000	Net Worth	$5,000,000
Building	$1,000,000		

2. Too much cash – which of course is not earning any interest. So our bank buys $3,000,000 worth of government securities

Changes in Balance Sheet:

Assets		Liabilities & Net Worth
Cash	-$3,000,000	
Government Bonds	+$3,000,000	

3. Transfer $900,000 to our regional Federal Reserve Bank, open up a deposit at the Fed in our bank's name.

Changes in Balance Sheet:

Assets		Liabilities & Net Worth
Cash	-$900,000	
Deposit in Fed	$900,000	

4. Now, open up the bank, new deposits, $2,000,000, on checks drawn from other banks

Changes in Balance Sheet:

Assets		Liabilities & Net Worth	
Cash items in Process of Collection	+$2,000,000	Demand Deposits	+$2,000,000

Note that the demand deposit in a bank is an asset for the depositor, but a liability for the bank. It is a debt the bank is obligated to play, on demand. How do we collect the $2,000,000? We could go to every bank and ask for currency over the counter, haul it bank to the bank. This would be cumbersome, expensive, time consuming. In fact, the Federal takes care of this for us, clearing the check. In fact, every depository-institution is affiliated with one of the Fed regional banks. And the way the accounts are squared is by using the deposit each bank maintains with its regional Federal Reserve Bank.

5. Send the $2,000,000 in checks to the Fed. The Fed then increases our "Deposit in the Fed" by $2,000,000 and reduces the other banks deposits in the Fed by $2,000,000. The Fed sends a notice to the other banks letting them know their deposit at the Fed has fallen by $2,000,000.

Change in Balance Sheet (Our Bank):

Assets		Liabilities & Net Worth
Cash items in process of collection	-$2,000,000	
Deposit in Fed	$2,000,000	

Change in Balance Sheet (The Other Bank):

Assets		Liabilities & Net Worth	
Deposit in Fed	-$2,000,000	Demand Deposits	-$2,000,000

Note that when a bank receives a check drawn on another bank, it gains reserves equal to the amount of the check. The bank on which the check was drawn loses reserves of the same amount. This is important. Checks floating around do not change the total amount of reserves in the banking system, just reallocate where they are.

What if other bank was not a Fed member? They still have an account at the Fed. No problem. What if the bank is in a different Fed region? The Fed had is own Inter-District Settlement Fund. No problem.

Current Balance Sheet, thus far:

Assets		Liabilities & Net Worth	
Cash	$100,000	Demand Deposits	$2,000,000
Deposits at Fed	$2,900,000	Net Worth	$5,000,000
Government Bonds	$3,000,000		
Building	$1,000,000		

Required Reserves

By law, banks must hold part of their assets in the form of reserves. Banks are required to hold reserves – in the form of either cash or deposits at the Fed – as specified by the BOG. For simplicity, suppose banks have to hold required reserves to a flat 10% of demand deposits. That is, the required reserve ratio for demand deposits is 10%, or $r_{dd} = 0.10$. (The notation is dd for demand deposits.)

Reserves (R) = Cash + Deposits at Fed = $100,000 + $2,900,000 = $3,000,000
Demand Deposits (DD) = $2,000,000
Required Reserves = r_{dd} * DD = 0.10 * $2,000,000 = $200,000
Excess Reserves = Reserves – Required Reserves = $2,800,000

Again, reserves don't earn interest, so banks won't like to have gobs of reserves. Cash is cash, and deposits at the Fed are non-interest bearing. So what should we do? Loan out some money.

But how much?

Deposit Expansion – Single Bank

When a bank lends, they don't give out cash. Instead, they open a checking account at the bank in the name of the person or business who is taking out the loan. For the bank, the loan is an asset. The demand deposit is a liability. Both rise when the loan is issued. But notice, that the **bank literally creates a demand deposit when it lends, and therefore banks create money when they loan**.

Can we loan out 10 times our excess reserves? Could we loan out $28,000,000?

6. If we did, here is what we'd see.

Change in Balance Sheet:

Assets		Liabilities & Net Worth	
Loans	+$28,000,000	Demand Deposits	+$28,000,000

Balance Sheet:

Assets		Liabilities & Net Worth	
Cash	$100,000	Demand Deposits	$30,000,000
Deposit at Fed	$2,900,000	Net Worth	$5,000,000
Government Bonds	$3,000,000		
Loans	$28,000,000		
Building	$1,000,000		

We're legal. We've got tons of loans. Everything is great. Right? But what do borrowers do after they take out the loan? Certainly, our business person will not just sit there with a $28,000,000 checking account balance. They'll buy something and write a check, and this check will almost certainly be deposited in a different bank. If this check instantly clears, we'd have the following:

Change in Balance Sheet:

Assets		Liabilities & Net Worth	
Deposit in Fed	-$28,000,000	Demand Deposits	-$28,000,000

Balance Sheet

Assets		Liabilities & Net Worth	
Cash	$100,000	Demand Deposits	$2,000,000
Deposit at Fed	-$25,000,000	Net Worth	$5,000,000
Government Bonds	$3,000,000		
Loans	$28,000,000		
Building	$1,000,000		

That pesky -$25,000,000 balance at the Fed will be a bit of a problem. So we can't loan out 10 times our excess reserves, in fact the **largest amount we can safely loan out is our excess reserves**.

6. Let is re-do transaction 6. Only this time, the loan of $2,800,000 (the amount of our excess reserves) is made.

Change in Balance Sheet:

Assets		Liabilities & Net Worth	
Loans	+$2,800,000	Demand Deposits	+$2,800,000

Balance Sheet:

Assets		Liabilities & Net Worth	
Cash	$100,000	Demand Deposits	$4,800,000
Deposit at Fed	$2,900,000	Net Worth	$5,000,000
Government Bonds	$3,000,000		
Loans	$2,800,000		
Building	$1,000,000		

Before you go on, notice that money has been created. M1 = C + DD. Prior to this loan, ignoring stuff elsewhere in the economy, M1 = DD = $2,000,000.[1] After the loan is made and the DD created, M1 = DD = $4,800,000. **By loaning out the excess reserves, $2,800,000 worth of money has been created. Banks create money when the loan.**

7. The person with the loan writes a check for $2,800,000.

Change in Balance Sheet (our bank)

Assets		Liabilities & Net Worth	
Deposit in Fed	-$2,800,000	Demand Deposits	-$2,800,000

[1] This is where I screwed up in the notes, originally. To be included in M1, technically the currency has to be in the hands of the non-bank public. We call currency in the hands of the bank (the $100,000) reserves. So while I indicated M1 was $2,100,000, it really is $2,000,000.

Change in Balance Sheet (other bank)

Assets		Liabilities & Net Worth	
Deposit in Fed	+$2,800,000	Demand Deposits	+$2,800,000

Has the money been destroyed? At first glance, if we only look at what is happening at our bank, it appears to have, but it hasn't. While the $2,800,000 in deposits do leave our bank, they do show up in some other bank, meaning that the act of writing the check hasn't changed the money supply. Recall that we noted above that clearing a check does not change the amount of reserves, it only rearrange those reserves amongst the banking system. M1 is still $4,800,000 ($2,800,000 at the other bank and $2,000,000 at our bank).

Balance Sheet (Our Bank)

Assets		Liabilities & Net Worth	
Cash	$100,000	Demand Deposits	$2,000,000
Deposit at Fed	$100,000	Net Worth	$5,000,000
Government Bonds	$3,000,000		
Loans	$2,800,000		
Building	$1,000,000		

What are the points?

The two versions of transaction 6 is that a single bank cannot safely lend (or buy securities) in an amount greater than its excess reserves, as calculated before it makes the loan. Notice, after the loan is made, it would be unwise to expect the demand deposits will stick around -- they will be spent, and deposited elsewhere.

Second, banks create money by making loans.

Third, remember, that writing checks just pushes demand deposits and reserves around the banking system, not changing the quantities.

Deposit Expansion: The Banking System

We start just before transaction 6 in the previous notes, but following your text, to make the math easier, let us assume that our bank has excess reserves of $1000 (instead of $2,800,000).

1. A loan is made.

Change in the balance sheet:

Assets		Liabilities & Net Worth	
Loans	+$1,000	Demand Deposits	+$1,000

Notice that the money supply has increased by $1000.

2. A check is then written for $1000 and deposited at Bank B.

Change in Balance Sheet (our bank)

Assets		Liabilities & Net Worth	
Deposit in Fed	-$1,000	Demand Deposits	-$1,000

Change in Balance Sheet (Bank B):

Assets		Liabilities & Net Worth	
Deposit in Fed	+$1,000	Demand Deposits	+$1,000

No change in the money supply. But now bank B has $1000 worth of new demand deposits and $1000 worth of new reserves. They will be required to hold an additional $100 worth of required reserves, but have $1000 worth of new reserves, meaning they will have excess reserves of $900. They will make a loan of $900.

3. Bank B makes of loan of $900.

Change in Balance Sheet (Bank B):

Assets		Liabilities & Net Worth	
Loans	+$900	Demand Deposits	+$900

Notice the money supply increase by $900. But the person who borrowed the money will spend it.

4. A check is written for $900 and deposited at Bank C.

Change in Balance Sheet (Bank B):

Assets		Liabilities & Net Worth	
Deposit in Fed	-$900	Demand Deposits	-$900

Change in Balance Sheet (Bank C):

Assets		Liabilities & Net Worth	
Deposit in Fed	+$900	Demand Deposits	+$900

No change in the money supply, but now bank B has $810 worth of excess reserves? Why? It has $900 worth of new deposits, and thus $81 worth of new required reserves, but has $900 worth of new reserves. It will loan out $810….

And the process continues. At each bank, the money supply will increase by $1000, $900, $810, $729, $656… a geometric series. If this happens infinitely, we'll get to $10,000.

Why $10,000? Math jocks can do the math on the geometric series.

But another way is to remember, the banking system never loses reserves when a check is written, they merely get rearranged. Ultimately, if we start with $1000 worth of new reserve, the $1000 in new reserves can support at most $10,000 worth of demand deposits (if the process occurs infinitely). If each $10 dollars of deposit required $1 in reserves, each $1 in reserves can support $10 dollars worth of deposits.

If the requirement was 1/5, we know that $1000 could have supported $5000 increases in deposits. Gosh, if there was only a way to express this mathematically?

Demand Deposit Expansion Multiplier

The derivation:

$R = r_{dd} * DD$

where R = total reserves
DD = demand deposits
r_{dd} = required reserve ratio (for demand deposits)

Now divide the expression above by r_{dd}

$$\frac{R}{r_{dd}} = \frac{r_{dd}}{r_{dd}} * DD$$

Simply do just a pinch of rearranging:

$R * (1 / r_{dd}) = DD$
$DD = (1 / r_{dd}) * R$

Then express the relationship in "changes". For example, Δ R = the change in reserves.

Δ DD = (1 / r_{dd}) * Δ R

This one is important. It says the change in demand deposits is a multiple (1 / r_{dd}) of the original change in reserves. We of course, call (1 / r_{dd}) = demand deposit expansion multiplier

In our previous example, r_{dd} = 0.10, so the demand deposit expansion multiplier is (1 / 0.10) = 10. If r_{dd} has been 0.20, the demand deposit expansion multiplier would be (1 / 0.20) = 5.

Big picture. Previously, we saw that one bank creates money. Now we see that one bank creating money provides opportunities for other banks to create money, or that the overall change in the money supply will be a multiple of the original change. That is good to now. But even bigger picture, if the Fed has some influence on the overall quantity of reserves (they will) and further can influence r_{dd} and thus the demand deposit expansion multiplier (they can), the Fed would be able to alter the amount of demand deposits, and thus the money supply. And as we'll see, the money supply will affect interest rates, which in turn will affect the economy overall.

Deposit Contraction

Just as money in created when loans are made, money is destroyed as bank loans are repaid or securities are sold.[1] Let's see why.

1. Someone repays a loan, say $100,000.

Change in Balance Sheet:

Assets		Liabilities & Net Worth	
Loans	-$100,000	Demand Deposits	-$100,000

Note that money is destroyed, because DD are reduced.

2. If the bank sells a security, say $100,000 to one of its own customers.

Assets		Liabilities & Net Worth	
Government securities	-$100,000	Demand Deposits	-$100,000

So remember, loans create money, repaying loans or selling securities (to own our customers) destroys money.

What happens if a bank has a reserve deficiency?

Consider a reserve deficiency of $1000. That is, the bank is holding fewer reserves than required. The bank has two basic alternatives. First, they could increase reserves by $1000. The bank could achieve this by either borrowing from the Fed or selling securities. The second option would be to decrease demand deposits by $10,000. The bank could achieve this by calling a $10,000 loan.

1. Borrow $1000 from the Fed.

Assets		Liabilities & Net Worth	
Deposits in Fed	-$1000	Due to Fed	+$1000

Notice, this creates reserves. This will become important, and really is a preview of coming attraction of what the discount rate involves. In the modern day, this is the most likely alternative. If the bank were to borrow from the Fed as described above, there would be no necessary direct changes to other banks in the system.

2. Sell $1000 on bonds on the "open market", hoping they are purchased by someone who is not a depositor at their bank.[2]

Assets		Liabilities & Net Worth
Government Securities	-$1000	
Deposits at Fed	+$1000	

The reduction in government securities is easy. Because the person who purchased the security is not a customer at our bank, they will write us a check for the securities. We will then submit this check to the

[1] I don't believe I emphasized this as much as I should have in class.

[2] Why wouldn't it work out for the bank if they sold securities to one of their own depositors? If they did, government securities would fall by $1000 and demand deposits will fall by $1000. This would reduce required reserves by only $100. Given that there are many banks, it is quite likely that a bond would be sold to someone who wasn't a customer of their bank. Alternatively, and rather unlikely in the real world, the bank could sell $10,000 worth of government securities to one of its own customer. But in some regard, this is really just a sneaky way to reduce demand deposits by $10,000 (the last option discussed).

Fed, and ultimately when it clears, we will get a $1000 increase in reserves. However, we know that writing checks does not change the total amount of reserves in the monetary system. We have to think about what happens at the other bank.

Change in Balance Sheet (Other Bank):

Assets		Liabilities & Net Worth	
Deposits at Fed	-$1000	Demand Deposits	-$1000

Now, the other banks deposits have fallen by $1000, reducing their required reserves by $100. However, their reserves have fallen by $1000, meaning the bank now has a reserve deficit of $900. What must Bank B do? Either borrow from the Fed, reduce its deposits, or more likely, they too much sell government securities. If Bank B sells $900 worth of securities to someone who is not a customer of their bank, Bank C will find that its deposits and reserves fall by $900, meaning it will have an $810 reserve deficit. And round and round we go.

So government selling by one bank leads to government security selling by other banks. Ultimately, banking system wide, there will have been a $10,000 reduction in demand deposits.

3, The bank calls a $10,000 loan.

Change in Balance Sheet:

Assets		Liabilities & Net Worth	
Loans	-$10,000	Demand Deposits	-$10,000

When the bank "calls" a loan, they are contacting someone whom they have previous loaned money and asking them to pay back the loan. Because our bank is $1000 deficient in reserves, they will need to reduce deposits and loans by $10,000 to free up the necessary $1000 in reserves.

Bigger Picture

Fundamentally, there really are only two options. Either new reserves are created by the Fed, or the banking system as a whole (option 2) or an individual bank (option 3) have to reduce deposits.

Again, if the Fed can alter the total amount of reserves in the banking system, they would potentially be able to create a reserve deficiency. If so, we see above that this reserve deficiency would be a potential mechanism by which the Fed can control the amount of demand deposits, and hence the money supply. And as I keep saying, the money supply will be related to interest rates and the overall level of the economy, so this will be important. Oh, and who do you think it will be that will help impact whether banks want to pursue the option (option 1) of borrowing from the Fed? Yes, that would be the Fed.

Is there more to the deposit expansion story than the reserve requirement ration on dd?

In describing the multiple deposit expansion process, we have assumed the only drag on process was the reserve requirement ratio for demand deposits. Actually, as we have looked at this process, thus far, we really have made two or three implicit assumptions.

(1) Banks loaned out all their excess reserves.
(2) People kept their loans as deposits (not cash).
(3) There are no reserve requirement for other types of deposits (time deposits)

We were being a bit optimistic. If any of the above is incorrect, this will alter the scope of deposit expansion. I am guessing you can tell in which direction already, with just a bit of prodding.

In my Econ 212 class, I find students can easily get the intuition on what happens if people decide to hold cash instead of deposits. If we look at two people, each with $100 in "money", but who choose to hold different fractions of this money as demand deposits, it is quite obvious in which case we'd expect more deposit expansion.

Person A	Person B
M = $100	M = $100
c = $50	c = $20
dd = $50	dd = $80
c / dd = 1	c/dd = 0.25

c will stand for currency held by the general public, while the rest of the notation should be familiar.

I'd hope you'd all see that Person B is going to result in more deposit expansion, simply because it is deposits that create excess reserve that can be loaned out, and cash does not. You'll notice I've calculated the c / dd ratio in each case. Notice that where we see the smaller value of c / dd (that means people's cash holdings are small relative to their demand deposit holdings), we'd see more deposit expansion and money creation.

You book goes through an exposition trying to convince you of this. It goes something like this:

If the $r_{dd} = 0.15$, the multiple deposit expansion multiplier is (1 / 0.15) = 6.67, suggesting a $1000 change in reserves can result in a $6667 change in deposits.

If we add up everyone's balance sheet, it would look like this.

Assets		Liabilities & Net Worth	
Reserves	$1000	Demand Deposits	$6667
Loans & Securities	$5667		

Suppose someone, who has a demand deposit and wants some cash, perhaps goes to an ATM or Bank and withdraws $100 worth of cash. How does this affect the story?

Change in Balance Sheet:

Assets		Liabilities & Net Worth	
Cash	-$100	Demand Deposits	-$100

But what has happened to excess reserves? Required reserves fell by $15, but actual reserves fell by $100, meaning excess reserves fell by $85. Clearly, this is going to slow down the money expansion process.

Ok, so my way the book way, having c/dd be large will slow the process down…

We do have to make one change here. Thus far in our examples, we didn't have any currency that was being held by the general public. As a result, we could use the terms "reserves" and "monetary base interchangeably".

However, now we have to be a bit more careful. We'll call cash in the bank system (in a vault or ATM) "reserves", and we'll currency in the hands of the non-bank public "currency in the hands of the non-bank public".

Monetary Base = Currency in the hands of the non-bank public + reserves[3]

[3] Since we were basically assume currency in the hands of the non-bank public was zero, the monetary base and reserves were the same.

You book goes on to do some algebra, but in the end we get something we can use. We have to keep track of both how much deposits change, but also how much currency in the hands of the non-bank public changes. Because both are part of the money supply, ultimately we'll be interested in what happens to the monetary base (which includes both). So skipping the algebra (see the text if you want), we get:

If we started with a \$1000 change in the monetary base (reserves), and $r_{dd} = 0.15$, and c/dd = 0.30, then

$\Delta M = \Delta DD + \Delta Currency$

…

$\Delta M = ((1 + c/dd) / (r_{dd} + c/dd)) * \Delta B$

In this case, $\Delta M = 2.889 * \$1000 = \$2889$

Our expansion multiplier falls from 6.667 to 2.889.

What about time deposits?

The Fed makes banks hold a small fraction of reserves on time-deposits (savings account balances, CDs). This will further tie up reserve, meaning fewer excess reserves, less loans, and thus a smaller amount of loan expansion. Hopefully not surprisingly, the expansion multiplier will fall.

Continuing with our example, assuming the reserve requirement ratio on time deposits (r_{td}) = 0.03, and letting td represent the amount of time deposits, we have:

$\Delta M = (1 + c/dd) / (rdd + c/dd + (td/dd)r_{td}) * \Delta B$

What is important for us?

There is a multiple deposit expansion effect. Banks create money when folks deposit and ultimately banks make loans. The size of this multiple effect is negatively impacted by the reserve requirement ratio on demand deposits, the reserve requirement ratio on time deposits, and the fraction of folks' monetary wealth they hold as currency.

Bigger picture, the Fed will control the reserve requirement ration on demand deposits and time deposits, so again, they will have an impact on how bug the expansion multiplier is, and thus how big the money supply is, and so on.

Chapter 19 – The Instruments of Central Banking

Official Rules on Reserve Requirements

All depository institutions have to:

1a. Against demand deposits, hold reserves equal to 3% of the first 42.1 million of demand deposits.

1b. Against demand deposits in excess of 42.1 million, hold reserves equal to 10% of that amount. The Fed can change the reserve requirement ratio from 8% to 14% and in emergency circumstances, up to 18%.

2. Against business-owned time and savings deposits, reserves are zero. The Fed can change the reserve requirement ratio from 0 to 9.

3. However, regardless of the above, the first 6 million of reservable liabilities are exempt. This is adjusted periodically.

Changing reserve requirements

Lowering reserve requirements

This would instantly create (or increase) excess reserves in the banking system, and thus we'd expect more loans. Simply looking at the algebra, we'd see an increase in the deposit expansion multiplier, and thus, an increase in the overall money supply. **In class, I erroneously suggested that the overall level of reserves increases.**[4] In fact, it would remain constant. But do remember that the multiplier and the money supply will increase.

Raising reserve requirements

This would at the very least reduce excess reserves, and perhaps create a reserve deficiency, and thus we'd expect the deposit expansion multiplier and money supply to fall. As noted in the previous set of notes, given the reserve deficiency, options include:

a. call in loans
b. sell securities (reducing DD)
c. restricting future lending and deposit creation.

You may have noticed, compared to our previous list, we have an omission on the list above and a new entry. It is conceivable that banks could borrow from the Fed to solve the reserve deficiency. However, borrowing from the Fed is intended to be a very short tem loan.[5] As a result, the response will be one of those listed directly above. The new options is to slow the pace at which the banks loan. This will be something we do see out there in the real world.

Discounting and the Discount Rate

Discount rate – the interest rate the Fed charges banks to borrow reserves.

Suppose a bank has a $1000 reserve deficiency. It doesn't want to call in loans (this surely won't make the lenders happy) and it doesn't want to sell government securities. Suppose this bank is in CA.

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[5] A secondary issue is this – if the Fed were wishing to decrease reserve requirements, it would be doing so to decrease the money supply. It would be unlikely that they would be encouraging discount rate borrowing at the same time. However, the key is that discount rate is a short-term fix, and banks will need to make a more permanent adjustment.

Change in Balance Sheet (CA Bank)

Assets		Liabilities & Net Worth	
Deposit in Fed	+$1000	Due to Fed	+$1000

Change in Balance Sheet (Fed)

Assets		Liabilities & Net Worth	
Loan to CA Bank	+$1000	Deposit of CA Bank	+$1000

Just as when a customer or business borrows from a bank, money is created, so too when a bank borrows from the Fed, money is created. More specifically, reserves are created.

The Fed influences banks willingness to do so by changing the interest rate on loans.

A lower discount rate will make the borrowing of reserves more attractive to the bank.

A higher discount rate will make the borrowing of reserves less attractive to that bank.

It is important to note that the discount rate, as a policy tool, is limited by the fact that it does not always have an impact on reserves. There will only be an impact if banks want to borrow.

It is also important to note two factors when considering discount rate. Surely the price (the discount rate) is important. But so to is the quantity of lending.

A bit of discount rate history

The purpose of the Fed, in a practical sense, has been to provide liquidity during times of panic or illiquidity. It was born after the first widespread national banking panic occurred in 1907. As it was, the Fed wished to be the "lender of last resort". The Fed has suggested the DR should not be used too often. "A privilege, not a right." The Fed tended to check up on banks that borrow too much or too frequently. Again, the idea was that you weren't supposed to use the discount rate for profit, but rather for need. For example, the Fed didn't want to be a source of funds to buy government bonds, or to lend to other banks at a higher interest rate.

Up until 2003, they way they reduced abuse was to have a lot of surveillance and administrative stuff. To borrow using the discount rate, a bank had to show that they couldn't borrow from anyone else. Banks were reluctant to borrow for fear of the public ramifications of stating something to the effect of "nobody will loan me money." At the time, the discount rate was lower than other market interest rates. It was truly a "discount" rate.

After 2003, things have changed. Using the discount rate is routine, and not seen as a sign of financial weakness. A few million over the weekend would be relatively common. To avoid use of the "too much borrowing", the Fed no longer makes administrative and monitoring hoops to jump through. Instead, the Fed changes a "penalty" rate. The discount rate is set above other short-term interest rates. A nice feature of this fact is that if the market short-term interest rates rise above the discount rate, banks will begin to borrow from the Fed using the discount rate.

How does a change in the discount rate change market interest rates?

Check out Figure 19.1 in your textbook. It is true that discount rate moves reasonably closely with the t-bill rate. However, often the movements in the discount rate lag movements in the t-bill rate.

So how does the discount rate affect other interest rates? It is important that you understand the answer is not directly. It does alter borrowing from the Fed, therefore changing the amount of bank reserves,

changing bank lending behavior, changing the money supply, and thereby finally changes market interest rates. However, there is no single interest rate in the market that is directly linked to the discount rate.

(A preview of coming attractions…If interest rates rise, people more willing to save, and there will not be as much consumption. If interest rates rise, there will not be as much investment. Essentially, if interest rates rise, GDP will fall. When we are done figuring out how Fed changes the money supply, we will look at how their actions affect interest rates, and thus will no what is happening to the overall economy.)

It will be interesting to look at how Fed announcements of changes in the discount rate change other market interest rates. We will look at some announcement effects. They vary.

An unanticipated rise in the discount rate might expect bondholders to expect tight money and higher interest rates in the future. To avoid losing money on bonds, they sell, raising yields and interest rates today. So sometimes, the Fed announces a change, and the Fed "initiates" market changes.

On the other hand, if the public had markets had already noticed this due to other Fed actions, the announcement might have little effect. It wouldn't be uncommon for the Fed to announce an increase in the discount rate and have little market reaction. The Fed "confirms" changes.

The truth of the matter, however, is that often, the discount rate will simply be a signal of what the Fed intends to do with open market purchases. It can be more symbolic than practical.

Open Market Operations

There is $3200 billion worth of marketable (tradable) government securities outstanding, of which the Fed owns $600 billion.

If the Fed purchases government securities, this will increase bank reserves.

If the Fed sells government securities, this will decrease bank reserves.

1. Open Market Purchase – the Fed buys $1000 worth of government securities, it pays with a check drawn on itself. Say the bond is purchased by a NJ bank. The Fed writes a check (and by doing so creates reserves) and sends it to NJ. The NJ bank sends the check to its Regional Fed.

Changes in the Fed's Balance Sheet:

Assets		Liabilities & Net Worth	
Govt. Securities	+$1000	Deposit of NJ Bank	+$1000

Changes in the NJ Bank's Balance Sheet:

Assets		Liabilities & Net Worth
Deposits in Fed	+$1000	
Govt. Securities	-$1000	

What happens to excess reserves at the NJ bank? They increase by $1000. What happens to overall reserves in the banking system? They increase by $1000. What happens to the money supply? It increases by a multiple.

2. Open Market Sale – the Fed sells $1000 worth of government securities. Say the bond is sold to a NJ bank. The NJ Bank writes a check to the Fed (and by doing so destroys reserves) and sends it to the Fed. The Fed then reduces the NJ banks deposit at its regional Fed.

Changes in the Fed's Balance Sheet:

Assets		Liabilities & Net Worth	
Govt. Securities	-$1000	Deposit of NJ Bank	-$1000

Changes in the NJ Bank's Balance Sheet:

Assets		Liabilities & Net Worth
Deposits in Fed	-$1000	
Govt. Securities	+$1000	

What happens to excess reserves at the NJ bank? They fall by $1000. What happens to overall reserves in the banking system? They fall by $1000. What happens to the money supply? It decreases, by a multiple.

Some big picture stuff – it is a pretty neat system. The Fed could do this buy buying anything – it could buy bond, buy stocks, buy chainsaws, or hockey masks. Why Bonds? First off, there are no political shenanigans in deciding what to buy. Second, bonds are very liquid, and thus the transaction costs are low. Third, the interest income on the bonds helps to fund the Fed's operations.

Also, be careful that you distinguish between banks/buying selling government bonds and the Fed buying/selling government bonds. The big difference is that with Fed purchases / sales, **reserves** are literally being created or destroyed, while this is not the case when banks and customers are transacting (**demand deposits** are being created / destroyed).

Does it matter whether it's a bank or not that the Fed sells the bond to?

No.

If it was an insurance company that bought the bond, the Fed would still pay for the bonds with a check. If the check is deposited in the insurance companies bank, that bank has an increase in demand deposits of $1,000 and a $1,000 deposit at the Fed, and thus $900 worth of excess reserves. The deposit itself has increased the money supply by $1000, and the $900 in excess reserves would increase the money supply by $9,000. (Of course, we are assuming that $r_{dd} = 0.10$ and ignoring cash and time deposits)

If the Fed buys from a bank, as we see above, excess reserves increased by $1000, and ultimately, we see an increase in the money supply of $10,000 (Again assuming that $r_{dd} = 0.10$ and ignoring cash and time deposits).

In fact, the Fed has a relationship without about 20 institutions. The bonds will be sold to and purchased from these institutions. See below.

Practicalities

I should have mentioned it early, but open market purchases and open market sales are called "open market operations", and thus are done under the supervision of the Federal Open Market Committee (BOG, 4 Fed Presidents, and NY Fed President). Even though the FOMC proper is in DC, the actual sales and purchases are done by the System Open Market Account manager in New York. Of course, they do the buying and selling to satisfy the wisher of the FOMC.

Govt. Securities dealers are the purchases. The Fed has a relationship with about 20 such dealers. Read a day at the trading desk on page 384. The bonds purchased or sold are usually treasury-bills (very short-

term government instruments). The Fed calls up the dealers and asks for bids, allocating the sales or purchases appropriately.

http://www.newyorkfed.org/markets/pridealers_current.html

List of the Primary Government Securities Dealers Reporting to the Government Securities Dealers Statistics Unit of the Federal Reserve Bank of New York

BNP Paribas Securities Corp.
Banc of America Securities LLC
Barclays Capital Inc.
Bear, Stearns & Co., Inc.*
Cantor Fitzgerald & Co.
Citigroup Global Markets Inc.
Credit Suisse Securities (USA) LLC
Daiwa Securities America Inc.
Deutsche Bank Securities Inc.
Dresdner Kleinwort Securities LLC
Goldman, Sachs & Co.
Greenwich Capital Markets, Inc.
HSBC Securities (USA) Inc.
J. P. Morgan Securities Inc.*
Lehman Brothers Inc.
Merrill Lynch Government Securities Inc.
Mizuho Securities USA Inc.
Morgan Stanley & Co. Incorporated
UBS Securities LLC.

Permanent Purchases vs. Temporary Purchases

When the Fed wishes to make permanent purchases, it typically utilizes treasury bills.

However, quite often, the Fed wishes to make temporary purchases. To do so it uses repurchase agreements or reverse repos.

What is a repurchase agreement? The Fed would contract to buy a security with a dealer, but also contracts to sell the security back after a short period of time. When the fed buys, reserves are (temporarily) created, but when the Fed sells, the reserves are destroyed. The point of a repo then, is to temporarily inject reserve into the banking system.

(To help you remember which way it is going, it is called a repo from the point of view of the dealer. They are selling the security, and buy buying back later, they repossess the security)

With a reverse repo, the situation is just the opposite. The Fed would sell a security to a dealer, but also contract to purchase the security back after a short period of time. When the Fed sells, reserves are (temporarily) destroyed, but when the Fed buys the security back, the reserve as put back in place. The purpose of the reverse repo is to temporarily remove reserves from the banking system.

Exam Commentary….

1. These questions were asked in the context of risk to banks.

1a. Interest rate risk. The point here is that the worth of banks can be sensitive to changes in interest rates if there is a mismatch in maturity. This is only the case if the maturity of its assets is different than the maturity of its liabilities, as was the case during the S & L situations in the 1980s. Interest rate risk is not about the difference in the interest rate on deposits vs. the interest rate on loans, but rather is a result of changes in the interest rate.

If we were taking in deposits as 4% and loaning at 7%, we'd have an interest rate spread of 3%. If interest rates were rise in general, say to 6% and 9% respectively, this would still have serious ramifications on the net worth of the bank. This is because the value of previous loans made would fall drastically, while the value of the previous liabilities (deposits) has fallen little.

1b. Liquidity risk. A bank will not have enough reserves to be able to meet its customers' withdrawals. In their haste to become liquid, banks may sell assets at unfavorable prices and lose net worth. There evidence that this occurred during the widespread banking panics of the Great Depression.

1c. Credit risk – the possibility that the person to whom the bank has loaned money will not repay the loan.

2a. Discount Rate. Be a bit more precise. This is the interest rate the Fed changes bank to borrow reserves. Better to say reserves than money. Important to note that this is the interest rate the Fed charges banks. The interest rate that banks charge each other is called the federal funds rate.

2b. The Fed buys or sells bonds on the open market, with the intention of increasing / decreasing the supply of reserves.

2c. Reserve requirements – the fraction of deposits that the bank must legally hold as reserves (not lend out). Many of you mentioned the ratio part, but didn't specify it was the ratio of reserves to deposits. It is not adequate to state it is the amount of reserves required.

3. Went well.

4a. See question 5a.

4b. See question 5b.

5a. The larger the c / dd, the larger the fraction of folks' monetary wealth they are holding outside the banking system. Because it is deposits that create excess reserves than can then be loaned out, the multiple deposit expansion multiplier will be larger when a larger fraction of money holding is in the form of deposits, rather than currency. The flip side (and this question) is that if more money is held outside the system, the size of the multiplier will be smaller.

5b. You nailed this.

6a. The general public determines what fraction of their monetary wealth they will hold as currency, and what fraction of their wealth they will hold as demand deposits. Banks help by providing us ATMs and on-line bill paying, credit cards, etc.

6b. One minor mistake here. The Fed, subject to limits by Congress, determines the RRR. Some of you answered that the Fed, with some help from banks, determines the RRR. You may have been thinking that banks hold may excess reserves. Even so, the RRR is the legal limit, and is solely determined by the Fed.

7a. The most common mistake here was to go the wrong way. When the Fed makes a repo, they are buying the security, thereby injecting reserves into the banking system, and then sell the security back. The point is to temporarily increase the amount of reserves in the banking system. This is more of a short-term stop gap that a mechanism to truly create new loans (as it is temporary).

Recall, that the repo makes sense from the dealer's (the institution supplying the bond to the Fed) perspective. They are selling the bond to the Fed and will then buy it back, thereby "repossessing" the security they originally owned.

7b. See above.

8a. Think back to used cars. If an investor (lender) were to offer a single interest rate, say one between the interest rate appropriate to each type of borrower, they would find that they would only attract borrowers of the risky type (type B). Low risk lenders would not accept the high interest rate, while high risk lenders would accept the high interest rate. We could say that the bad borrowers will drive out the good. You may also have noted that the interest rate would tend to rise to the rate appropriate for Type B borrowers, and the only borrowers will be Type B borrowers. Of course, financial intermediaries will come along and create information, separating the types.

8b. Adverse Selection. Some of you folks talked about the fact that buyers and sellers have different sets of information. This is true, and is the asymmetric information problem. However, there are different types of asymmetric information (moral hazard, adverse selection).

9a. Moral hazard comes about when someone is insured, or better still, when one doesn't bear the full cost of their actions. By giving the VP a bonus, the VP may be inclined to choose a riskier portfolio of loans. As you know, riskier borrowers will have to pay higher interest rates. If the loans are paid back, the profits of the bank will be high, even though they have undergone substantial risk. If they are not, the VP may already have his/her bonus, may no longer work at the bank, etc. Just as a single borrower may run to Vegas with the bank's money to bet on 17 on the roulette wheel, the VP may run to Vegas so to speak with the portfolio of loans. If 17 hits, the VP gets a big bonus. If it doesn't, the bank is in more trouble than the VP.

9b. This question didn't go the way I had hoped. What I was trying to get you guys to think about was the moral hazard from the perspective of the institution that originally loans money to a homebuyer. If this loan will be resold (or ultimately guaranteed by Fannie Mae or Freddie Mac), this homebuyer does not bear the full cost of their actions when they write a loan to someone who is a huge credit risk. Would the bank be more careful if they were not planning on selling the loans to Fannie Mae / Freddie Mac / or paying a fee to get a guarantee and have the mortgage ultimately securitized? Almost certainly. This is a course issue at the center of the sub-prime mess.

10a. A common mistake was to increase the bank's cash. The Fed will pay for the bond by writing a check, and will ultimately end up as an increase in deposits at the Fed. Notice an increase in the amount of reserves in the monetary system, and thus an increase in the money supply.

10b. You nailed this one.

10c. The point here was that this transaction is rearranging of existing reserves. Our bank has fewer reserves, but some other bank has more reserves. Our banks demand deposits fall, but some other banks demand deposits rise. No change in the monetary base or the money supply.

10d. This went pretty well. As in 10a, an increase in reserves, thus an increase in the money supply.

11. If you missed transaction 1 or transaction 4, do be sure to go back and make sure this makes sense.

12. This went pretty well, except that some of you didn't quite pull the trigger on labeling stuff. I let you slide, for the most part, if you labeled the vertical axis "interest rate", but in this case we are looking a particular interest rate (the federal funds rate) and the quantity of funds being loaned (the quantity of reserves). More today.

<u>One more note:</u>

There seems to be a bit of disconnect on how changes ultimately affect the money supply.

We can write this expression:

Money Supply = Multiple Deposit Expansion Multiplier * Monetary Base

I though this was clear from our expressions where we wrote:

$$\Delta\text{Money Supply} = (1 + c / dd + r_{dd}) / ((c / dd + r_{dd} + (td / dd)r_{td})* \Delta\text{Monetary Base}$$

Also,

Monetary Base = Currency in the hands of the non-bank public + Reserves

Why do we find it convenient to do such a thing?

Because it turns out that only the Fed can impact the monetary base. Can anyone else decide how many dollars bills to print up? Can we have an open market purchase or borrowing from the Fed using the discount rate without the Fed's involvement?

We know the multiplier can be affected by Fed changes (reserve requirements) but also the choices of the general public (through c/dd and td /dd).

So, then, I hope it is clear that both open market purchases, and discount rate borrowing are going to increase the base, and thus the money supply overall. For the case of lowering the reserve requirement ratio, the base is not affected, but the money supply is affected through the money multiplier.

Chapter 21 – Monetary Policy

FOMC meetings – every six weeks or so. Discuss the state of the economy, make some projections, and decide what to do.

Read some press releases. I've stuck in a couple below. To see some more, go to the following link.

http://www.federalreserve.gov/newsevents/press/monetary/2008monetary.htm

They always state the Fed's goals. You'll usually see the phrase "sustainable economic growth and price stability". The Fed wants the economy at full-employment real GDP (aka potential real GDP, aka steady state level of real GDP), and low inflation. I the press release you'll always see a statement indicating which of inflation or growth the Fed is more worried about (unless they are equally worried by both).

It should be said that the Humphrey-Hawkins act gave the Fed three goals – sustainable growth, stable prices, and moderate long-term interest rates. But if inflation is low (stable prices), interest rates tend to be low, so the Fed can focus just on the two.

Fed Press Release #1 (1/30/2008)

The Federal Open Market Committee decided today **to lower its target for the federal funds** rate 50 basis points to 3 percent.

Financial markets remain under considerable stress, and credit has tightened further for some businesses and households. Moreover, recent information indicates a deepening of the housing contraction as well as some softening in labor markets.

The Committee expects **inflation to moderate** in coming quarters, but it will be necessary to continue to monitor inflation developments carefully.

Today's policy action, combined with those taken earlier, should help to promote moderate growth over time and to mitigate the risks to **economic activity**. However, downside risks to growth remain. The Committee will continue to assess the effects of financial and other developments on economic prospects and will act in a timely manner as needed to address those risks.

Voting for the FOMC monetary policy action were: Ben S. Bernanke, Chairman; Timothy F. Geithner, Vice Chairman; Donald L. Kohn; Randall S. Kroszner; Frederic S. Mishkin; Sandra Pianalto; Charles I. Plosser; Gary H. Stern; and Kevin M. Warsh. Voting against was Richard W. Fisher, who preferred no change in the target for the federal funds rate at this meeting.

In a related action, the Board of Governors unanimously approved a 50-basis-point **decrease in the discount rate** to 3-1/2 percent. In taking this action, the Board approved the requests submitted by the Boards of Directors of the Federal Reserve Banks of Boston, New York, Philadelphia, Cleveland, Atlanta, Chicago, St. Louis, Kansas City, and San Francisco.

Fed Press Release #2 (6/25/2008)

The Federal Open Market Committee decided today to keep its target for the federal funds rate at 2 percent.

Recent information indicates that **overall economic activity** continues to expand, partly reflecting some firming in household spending. However, labor markets have softened further and financial markets remain under considerable stress. Tight credit conditions, the ongoing housing contraction, and the rise in energy prices are likely to weigh on economic growth over the next few quarters.

> The Committee expects **inflation** to moderate later this year and next year. However, in light of the continued increases in the prices of energy and some other commodities and the elevated state of some indicators of inflation expectations, uncertainty about the inflation outlook remains high.
>
> The substantial easing of monetary policy to date, combined with ongoing measures to foster market liquidity, should help to promote moderate growth over time. **Although downside risks to growth remain, they appear to have diminished somewhat, and the upside risks to inflation and inflation expectations have increased.** The Committee will continue to monitor economic and financial developments and will act as needed to **promote sustainable economic growth and price stability**.
>
> Voting for the FOMC monetary policy action were: Ben S. Bernanke, Chairman; Timothy F. Geithner, Vice Chairman; Donald L. Kohn; Randall S. Kroszner; Frederic S. Mishkin; Sandra Pianalto; Charles I. Plosser; Gary H. Stern; and Kevin M. Warsh. Voting against was Richard W. Fisher, who preferred an increase in the target for the federal funds rate at this meeting.

The Fed could, and in the past, has chosen various different operating targets. It could try to keep some sort of money aggregate at some level (say M1, Reserves, M2, etc). Or it could target some interest rate (say, the federal funds rate). You can read in your text about the various different choices of the Fed.

What seems obvious, from reading the Fed press releases, is that the Fed seems to target the federal funds rate. This begs the question (like question 12 on your exam) about how the Fed actually pulls this off.

What is the Federal Funds Rate? How is determined?

Again, the federal funds rate is the rate of interest rate that banks charge each other for short-term (overnight) borrowing / lending of reserves. We do see overnight repos in this market, which are so closely related, that we can simply talk about "the federal funds rate" (as opposed to dealing with the federal funds rate and the interest rate on overnight repos) and get the same story.

It is very important to note that even though the Fed has a target for the federal funds rate, it is market determined. That is supply and demand curves for reserves in the FFR market. The fed sets a target for the FFR, but does not get to choose the FFR, though it will take steps to influence it.

On the vertical axis, we will put the federal funds rate, the "price" of borrowing reserves. On the horizontal axis, we will put the quantity of reserves.[1]

We know that the Fed determines the supply of reserves (only they can affect the overall quantity of reserves in the banking system), and this is not altered by the Federal Funds Rate. This means the supply curve of reserves (the overall quantity of reserves in the system) will be a vertical line.

The demand curve for reserves will be downward sloping? Why?

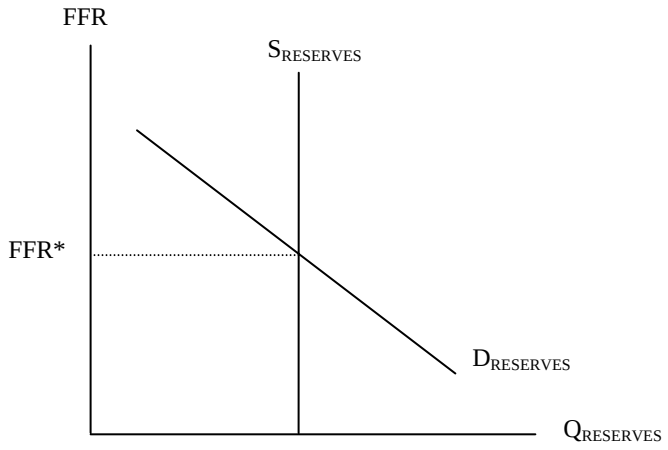
First off, to follow your textbook's story, be sure you are thinking about the demand for reserves as the overall demand for reserves. That is, how many reserves does the banking system as a whole want to hold. We are not just looking at the demand for reserves that might change hands between banks, but are including all reserves (including those that are unlikely to change hands in the federal funds market).

As the federal funds rate rise, businesses will wish to hold lower checking account balances. This is because demand deposits earn no interest, and business will wish to economize on their balances. With fewer checking account balances, there will be less of a need for reserves in the banking system. So as the federal funds rate increases, the quantity of reserves demanded falls.

[1] This should bring back bad flashbacks to the supply and demand for "loanable funds".

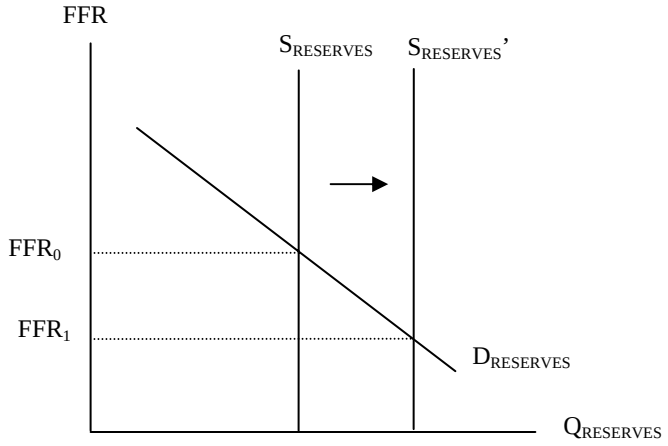
Second, as the federal funds rate rises, banks will wish to hold as few reserves as possible – they will wish to cut back reserve to the bare legal minimum requirement. As a result, they two will wish to hold fewer reserves. Again, as the federal funds rate increases, the quantity of reserves demanded falls.

Putting the two together, we can determine the equilibrium federal funds rate. See below.



Now, let's say the Fed thought the FFR was getting a bit too far away from its target. Say the Fed's target was 4.5% and the FFR was creeping up past 5%. What could the Fed do? Clearly, it could take some action that would increase the supply of reserves.

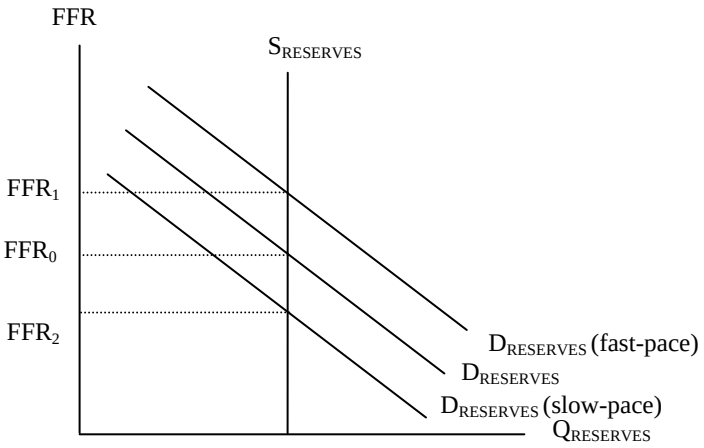
After the increase in supply, at the original interest rate of 5%, there would be an imbalance of supply and demand for reserves. The FFR would have to fall.



Hey, by the way, if the Fed wanted to such a thing, what might they do? There are two major possibilities. First, the Fed could lower the discount rate, increasing the supply of reserves. Note, that this alone would do the trick. Remember in our press release that when the Fed wanted to lower the FFR, it also lowered the discount rate?

What else does the Fed have at its disposal? The Fed could make some open market purchases of bonds. This too would increase the supply of reserves and lower the target the federal funds rate. Why not discuss the reserve requirement ratio? See the footnote.[2]

Still seems like a pretty easy job. What if the demand curve for reserves isn't stable? Suppose there are various "paces of the economy". In a "fast-paced" economy, business will be planning on making many transactions, and thus they will require liquidity and hence demand deposits. This results in a higher demand for reserves. In a "slow-paced" economy, businesses will be planning on making fewer transactions, and thus need fewer demand deposits, leading to a lower demand for reserves. Then, depending on the pace of the economy, the FFR might be moving around. The Fed may choose to react to these changes.



So, there can be volatility in the federal funds rate market depending on the "pace of economic activity".

What if the Fed though there might be a temporary increase in the demand for reserves, say due to Y2K. What could the Fed do, to keep the FFR from changing dramatically? They could take some action to counteract the change. For instance, if the Fed anticipated an increase in demand for reserves (anticipating customer withdrawals), the Fed could take an offsetting action increasing the supply of reserves. Draw the picture. Notice how, absent Fed action, the FFR would increase, but the Fed's action causes the FFR to fall back towards the FFR target.

The open market desk in NY is literally trying to figure out what will happen in this market daily, and responding by attempting to keep the FFR near its target. Sometimes it will get it wrong, but can try to get it right the next day. In fact, there are well known day-of-the-week, day-of-the-month, and seasonal changes that the Fed reacts to. Many of these very short-term changes would be tackled by repos, but the longer-term changes (new targets for the federal funds rate) will result in changes of a more permanent nature.

[2] As noted on the last exam, lowering the reserve requirement ratio wouldn't change the overall supply of reserves in the banking system, and thus wouldn't affect the supply of reserves. However, we could model this change as a decrease in the demand for reserves, as banks would now need fewer reserves to meet their legal requirement. As we have previously noted, changes in reserve requirements are used sparingly as they are typically quite dramatic, so the "action" will occur through open market operations and the discount rate.

Why does the Fed target the FFR?

At its heart, the goal of the Fed is to stabilize overall economic activity. If something is happening that the causes the economy, say to have unusually high inflation, the Fed can take action to reduce inflation. If something is happening that causes the economy, say to have unusually lower real GDP, the Fed can take action. The idea is to smooth out the business cycles. It turns out, that the Fed can reliably change the "pace of economic activity" by altering the federal funds rate. As a result, the Fed has a mechanism that it can reliably smooth the performance of the economy.

We'll talk more about it later (I swear), but it is the case that the federal funds rate and other short-term interests rate change in the same direction, usually. There is often a nearly direct correspondence.

If the FFR were to fall, it would reasonable to expect other short-term interest rates to fall. Treasury bond rates, CD rates, the prime rate, and perhaps even your credit card rate might adjust. Also true is that when interest rates tend to fall, this promotes increases in economic activity.

The flip side is that if the FFR were to rise, so too would short-term interest rates, and thus the overall level of economic activity would decline.

Therefore, if the Fed thinks the level of economic activity is too high, it will take action to increase the FFR.

If the Fed things the level of economic activity is too low, it will take actions to decrease the FFR.

Some Preliminary Evidence on the Fed's Stabilizing

You don't believe me? Fair enough. An economist and treasury official named John Taylor came up with a summary of the Fed's policy. Taylor is not suggesting the Fed is following this rule, but that it is a good summary of what the Fed is up to. Here is the "Taylor Rule".

$$FFR\ target = 2.5 + Inflation + 0.5(Inflation - Inflation^*) + 0.5\left(\frac{Real\ GDP - Real\ GDP^*}{Real\ GDP^*}\right)$$

Inflation is the calculated inflation rate.
Inflation* is the Fed's target level for inflation.
Real GDP is the calculated level of real GDP.
Real GDP* is the full employment level of real GDP. (What the economy could produce at full employment – neither a boom nor recession.)

Don't' let the last term scare you. It is just a percentage gap between actual real GDP and full employment real GDP.

What does it all suggest?

- First, if inflation (in and of itself) affects the FFR target. For every one percent increase in inflation, the Fed FFR target rate tends to increase by one percent. Remember back in the day when we talked about how expectations of inflation altered nominal interest rates? This should ring a bell.[3]

[3] A question at the end of class was asked about what the average level of the FFR would be. On average, Real GDP = Real GDP*, and Inflation = Inflation*, so the average level of the FFR would be equal to 2.5 + Inflation according to the Taylor Rule. You can also get a sense from the picture on page 422 of your textbook.

- Second, it says that when inflation is higher than the target for inflation (Inflation > Inflation*), the Fed tends to increase the target for the FFR. In fact, for every one percent increase in inflation above the target for inflation, the Fed tends to increase the target for the FFR by ½ percent. Recall the goals of price stability and the comments about concerns about inflation in the press release? Its jives. The Fed will tend to attempt to slow economic activity if inflation gets above the Fed's target.

- Third, it tells you that of real GDP is above potential real GDP, the FFR tends to increase. In fact, for every one percent real GDP is above its full employment level, the Fed tends to increase the FFR by half a point. This again suggests that the Fed tends to attempt to slow economic activity if real GDP is above the full employment level.

If Taylor is right, then the FFR target rate should closely follow this expression. Check out page 422 on your textbook for the answer.

View the Taylor rule as a nice summary of what the Fed is up to. In the biggest picture, the Fed is worried about economic activity, trying to make it more stable that it otherwise would be. The data suggests they do just that.

You should work through, according to the Taylor rule, what the Fed would do if the level of real GDP was below the full employment level of real GDP. You should recall comments in the Fed press releases about what you'd expect. Would the Fed raise or lower the FFR target? Based on what you know about interest rates, is the direction of interest rates consistent with what we'd expect that Fed to want to happen to the pace of economic activity?[4]

You should work through, according to the Taylor rule, what the Fed would do if inflation was below the Fed's target level for inflation. Would the Fed raise of lower the FFR target?[5]

Finally, note a very good comment pointed made at the end of class. Even though the picture on page 422 suggests that the Taylor rule does a very good job of summarizing of what the Fed is doing with the target for the federal funds rate, it is a simplification and doesn't include all contingencies. Your textbook discusses that the Taylor rule did a poor job predicting the target FFR around 9/11, and it would not be doing a good job right now. The Taylor rule is an approximation – it cannot anticipate the sub-prime lending, nor can it anticipate the unusual situation we have where food and energy prices are fueling inflation. However, it can handle run-of-the-mill economic slow downs and economic accelerations.

[4] The Fed would lower the target for the FFR. Short-term interest rates would decrease, increasing the amount of economic activity, pushing real GDP towards its full employment level.
[5] It would again, lower the target for the FFR.

Chapter 22

First, let's start with a bit of organization and jargon.

We'll begin working on a view of the economy called the "Classical Model" a view espoused by "Classical Economists".

It will be based on two main items: **Say's Law** and the **Quantity Theory of Money**. Together, they'll give us a view of what is happening in the overall economy. It may not be a pretty view, but a view nonetheless. All that follows in this set of notes concerns the Classical Model.

Say's Law

We start with Say's Law. "Supply creates its own demand".

According to Say's Law, the economy will never have unemployment. It will always operate at the level of output called "full employment". Total spending (demand for goods) will always be sufficient to justify production at full employment (supply of goods).

At the most fundamental level, the amount of production in the economy is determined by the level of technology, the amount of capital, and the amount of labor.

According to Say's law, there would never be any reason why people who wanted to work were unemployed. Why? If a worker were to become unemployed, the worker would lower their wage request, and instantly be hired by another firm. Basically, it has been assumed that wages will adjust quickly.

Goods would never pile up on the shelves. If they were, an entrepreneur would reduce the price of the goods until equilibrium is established. Basically, it has been assumed that the price of goods will adjust quickly.

As noted above, the key to the story is that both wages and product prices are very flexible. Markets always "clear".

There are some economist types who disagree – we'll talk about them more later. They think that while supply (production) will create enough income to buy all the output produced – there is nothing *requiring* that income to be spent on the goods produced. They are worried about scenarios in which folks desire to save more than firms desire to invest, and thus worry that some of the good will remain unsold. More in the next set of notes.

But this set of notes is about what the classical economists think, and they are not worried about this problem. They say that saving will be channeled to people who want to invest (and thus spend). In fact, the interest rate will adjust to ensure that the amount of income people want to save is just equal to the amount that firms want to invest.

Thus, indeed, supply will create its own demand, and the economy will always operate at its full employment level.

The Classical Model – the market for loans

We need to draw a picture of the market that involves savings and investment. It should ring a bell.

Watch out on the terminology. I'll use the term real GDP. But if I slip up, the terms output, income, and real GDP are all the same thing.

When we discuss the interest rate, we are using it as a proxy for all interest rates.

When we talk about **investment**, we are talking about spending to create new capital, not financial transactions like buying bonds and stock.

What we need to so is come up with a market for loans. A supply and demand for loans. A market that relates savings to investment. It is not that hard.

It seems sensible that **Savings** is a function of the interest rate. People will be more willing to save (forgo current consumption) if there is a larger reward for doing so. Therefore, as the interest rate rises, the quantity of savings will increase. This means the supply curve of loans (savings) is upward sloping. Think of savings as coming from households.

Investment is undertaken to increase goods and services for sale. A business firm will undergo an investment project if the expected rate of return exceeds the rate of interest on the borrowed funds.

Project	Cost Today	Future Revenue
A	$1000	$1300
B	$1000	$1200
C	$1000	$1100

At an interest rate of 25%, how many projects are profitable?[1] Only Project A.
At an interest rate of 15%, how many projects are profitable? Projects A and B.
At an interest rate of 5%, how many projects are profitable? Projects A, B, and C.

Notice as the interest rate falls, more projects are profitable, and thus firms will borrow money to spend on creating new capital. That is, as the interest rate falls, the quantity of investment increases. The demand curve for loans (investment) is downward sloping. Think of the demand curve for loans as coming from investment.

Now we put the supply and demand curve for loans together. See the picture below.

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[1] For those of you guys who are versed in project evaluation, you know there are many different ways to determine the profitability of a project.

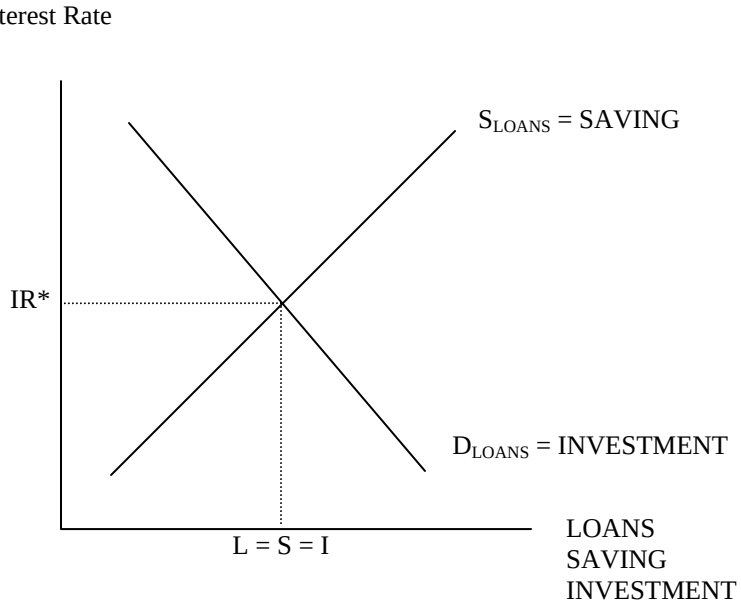
Alternative 1 would be to calculate the present value of the cash inflows associated with each project and compare them to present value of the cash outflow, which is $1000. At an interest rate of 25%, the present values of the inflows are $1040, 960, and $880 respectively, for each project. Because the value of the inflow is larger than the outflow for project A is profitable, while project B and C are not. The exercise would then be repeated at interest rates of 15% and 5%.

Alternative 2 would be to calculate the net present value of each project (which is of course, is really the same process). The net present value values are $40, -$40, and -$120, respectively, when the interest rate is 25%. Repeat for interest rates of 15% and 5%.

Alternative 3 would be to calculate the internal rate of return on the projects, and compare them to the market interest rate (cost of capital). If so, the IRR values would be 30%, 20%, and 10%.

No matter how you slice it, 1 project is profitable at any interest rate between 20% and 30%, 2 projects are profitable at any interest rate between 10% and 20%, and 3 projects are profitable at interest rates less than 10%.

The point is, more projects are profitable at lower interest rates, and thus at lower interest rates there is a larger quantity of investment (demanded). The demand for loans (investment) curve is downward sloping.

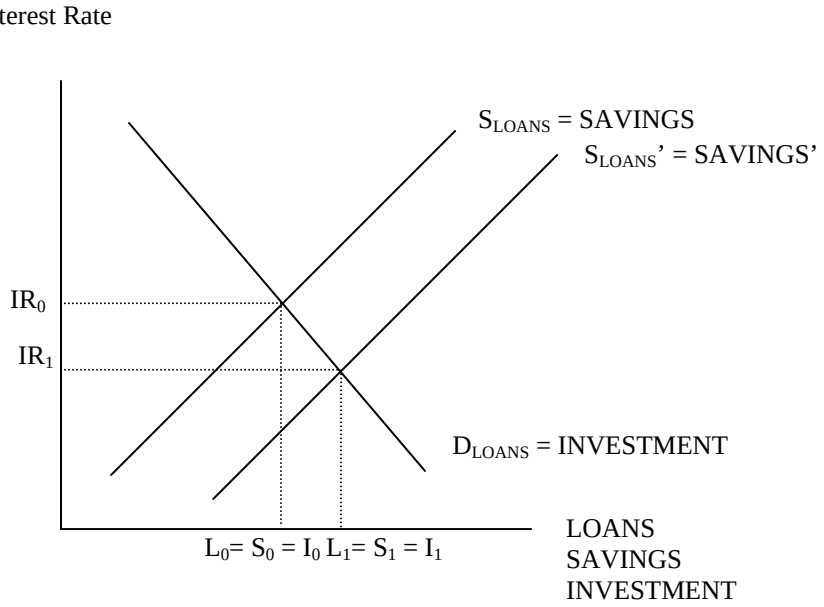


The beauty of this market for our classical economists is that at the equilibrium interest rate, the amount of savings by households is equal to the amount of investment by firms.

What if something shifts?

Suppose households get nervous, or just somehow want to save more. This would increase the supply of savings. Is there a problem?

Here is where the critics of the classical economists would be worried we have a problem. Could it be, they worry, that the demand for goods (spending) couldn't keep up with production (supply)? Could Say's law not work? They'd be worried that households want to save more than firms want to invest, causing spending to fall, and goods to be unsold.



At the original interest rate (IR_0), there would be an imbalance. Households would wish to save more than firms wished to invest. However, there would be downward pressure on the interest rates. We'd expect the new equilibrium to occur at IR_1. But as we see, as the interest rate falls from IR_0 to IR_1, this induces additional investment by firms. Once again, at the new equilibrium interest rate just at it was with the old, investment is equal to savings. The amount "not spent" by households will be funneled to firms who will spend on investment. Say's Law still holds.

Some Algebra

Some people find the algebra instructive. The point here is that you can view GDP as income and also look at GDP as output. The total value of goods produced will be equal to the total income of households. Let's ignore changes in price levels for a moment, so we don't have to worry about GDP vs. real GDP.

There are two things you can do with your income. You can consume it or save it.

$Y = C + S$

C = consumption, S = savings.

There are two things we can do with output. We can make consumption goods or we can make investment goods.

$Y = C + I$

But Y = Y, and therefore

$C + I = C + S$, and thus

$I = S$.

This is what we see when we draw the supply and demand curve for loans. The equilibrium interest rate is the one where the quantity of investment is equal to the quantity of saving.

What ultimately determines the equilibrium interest rate in the classical model is the profitability of investment projects and household willingness to save. Importantly, it is not determined by money.

What about money? Working towards the Quantity Theory of Money

We haven't talked about money in the classical economists' world, yet. But we will now.

First off, a famous equation, called the **Equation of Exchange.**

$MV = PY$

This is not the quantity theory of money, but rather a definition. A truism. An identity.

M = Money Supply
V = Velocity of Money (the number of times a dollar turns over in a year)
P = Price Level (overall price level in the economy)
Y = Real GDP (total output of goods)
PY = Nominal GDP (dollar value of all transactions)

Example:

P = 1.5, Y = $1000, PY = $1500
M = $300
V = 5

The new thing here is velocity. If the example above, if the price level is 1.5 and real GDP = $1000 (made up numbers) we know that nominal GDP is $1500. The total amount of transactions in the economy is $1500. If we have had $1500 worth of transactions, and the money supply is only $300, it must be the case that each dollar was involved in 5 transactions, hence velocity of 5. Velocity is the number of times each unit of money is involved in a transaction in a given year.

However, we'll find it a bit easier to make one change. Rather than think about the velocity of money, we can instead think about the equation of exchange by substituting in the inverse of the velocity of money.

Basically, if a dollar bill is being used 5 times a year in a transaction, at any one time, we are holding 1/5 of GDP as money. We call the inverse of the velocity k. $k = 1 / V$.

Let's let k be the fraction of overall spending that consumers want to have command over in the form of money balances. Think of k as the transactions demand for money, aka money demand, aka the desired cash balance ratio.

If we stuck this in the equation of exchange and did some algebra, we could write

$M = kPY$ (cash-balance version of the equation of exchange).

It is still a definition, a truism, not a theory.

Here comes the theory – the Quantity Theory of Money

(1) Assume that the quantity of real GDP is fixed at full employment level (ala Say's Law)
(2) Assume that k is constant (or equivalently that V is constant)

Then we have the quantity theory of money.

$M = kPY$

What does it suggest?

It suggests that any increase in the money supply leads to a proportional increase in the price level. If the money supply doubles the price level doubles. If the money supply falls by 10%, the price level falls by 10%.

About the adjustment process

Start out in equilibrium. Everyone is satisfied with the liquidity of their portfolio. Everyone has the right level of cash balances for their level of income. They have the right amount of cash to conduct the transactions they are planning on conducting.

Assume the Fed doubles the money supply. Liquidity has doubled. If people were previously satisfied with their money balances (they were holding the "right" fraction of their income as money), they now have "too much" money. How do you get rid of these excess money balances? Spend more. This increases the demand for goods and services, and thus leads to rising prices. But real GDP can not expand (it is stuck at its full employment level). The left side of the equation has doubled, thus the right side of the equation must double too. But k and Y are fixed. Therefore, it must be the case that P doubles. In the end, we will find that the price level has doubled, nominal GDP had doubled, real GDP is unchanged, and k is unchanged.

You may get a better feel with a numerical example.

Before we get started, let's give the economy a value of k = ¼, and simply note how much money the economy wants to hold at various level so nominal GDP.

Suppose PY (nominal GDP) is $400. In this case, the economy will wish to hold $100 in money balances.

Suppose PY (nominal GDP) is $600. In this case, the economy will wish to hold $150 in money balances.

Suppose PY (nominal GDP) is $800. In this case, the economy will wish to hold $200 in money balances.

Suppose PY (nominal GDP) is $1000. In this case, the economy will wish to hold $250 in money balances.

Now, let's start of the economy in equilibrium.

Let's suppose P = 1, Y = $400, making PY = $400. Also, we'll suppose as noted above that k = ¼. Finally, let's suppose M = $100.

We can confirm this is an equilibrium by noticing that at level of nominal GDP (PY) of $400, and a k of ¼, folks want to hold $100 in money balances, which is equal to the quantity of money supplied, M.

Now, let's again go back to the Fed doubling the money supply (to $200). What must happen so people will willingly hold $200 in money?

Notice that the only way people will be willing to hold more in cash balances is if the level of transactions (GDP) increases. It must be the case that PY increases to $800, because only then will the economy willingly hold $200 in money.

Since Y can't change (from $400), for PY to increase to $800, it must be the case that P = 2. The price level has doubled. Again, the same answer. People will spend, prices will rise, until the price level had doubled and nominal GDP has doubled, and only then will a new equilibrium occur.

Where does k come from?

- Frequency of receipts and expenditures

  If you were paid weekly, $1000, your average cash balance holdings might be near $500. Perhaps $1000 at the beginning of the week, $0 at the end of the week, for an average near $500.

  If you had the same income, but instead were paid monthly ($4000), your average cash balance holdings might be $2000.

- The ease with which you can get credit will impact k.

  If you could quickly get credit, you would likely hold less money. You wouldn't need to hold extra cash – as you could quickly access funds if necessary.

- Expectations about future conditions

  If you are anticipating being unemployed, you might hold more money.

There is a complementary way to view what is going on that may or may not help

In the original situation, M = $100, P = 1, and so the real value of people's money holdings was $100. That is, people wanted to have a certain purchasing power.

If the new situation, M = $200, P = 2, as so again the real value of people's money holdings was $200.

M = $100, P = 1, M / P = $100

M = $200, P = 2, M / P = $100

One could view this whole adjustment process as one by which people are really attempting to keep their real value of the monetary holdings (real money balances) constant. When M changes, people spend and the price level increase until the value of M / P returns to its original level. Note sure that adds much.

Aggregate Demand / Aggregate Supply

It does some good to convert this whole conversation into an aggregate demand / aggregate supply framework.

You can think of the aggregate supply curve as showing us the total quantity of goods and services produced (supplied) in the economy.

You can think of the aggregate demand curve as showing us the total quantity of goods and services demanded in the economy.

We actually know that these curves should look like.

First, the aggregate supply curve. According to Say's Law, the aggregate supply curve will be vertical – fixed at the full employment level of real GDP output, which we'll label Y_{FE}. The idea is that this is determined by population, technology, and capital. Real quantities, nothing to do with nominal variables, the price level, or money supply.

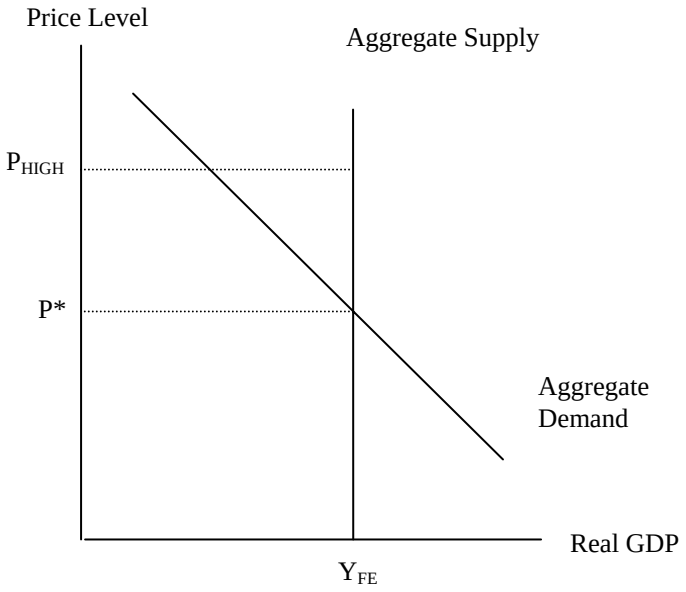
Aggregate Demand Curve – think of this as the total quantity of goods and services demanded in the economy. Important: it is drawn for a given level of the money supply. It does depend on the price level. Why?

Consider a certain quantity of money in the economy. If the price level is high, how many good will consumer wish to purchase? With a high price level, the purchasing power of the money balances of the economy is low. They will wish to purchase few goods.

If the price level is low, however, consumers will wish to purchase a larger quantity of goods. The purchasing power of their money balances is high.

Putting this together, we have a downward sloping aggregate demand curve.

Finally, we draw a picture with the aggregate supply curve and the aggregate demand curve together. On the vertical axis the price level (P), on the horizontal axis, real GDP (Y).



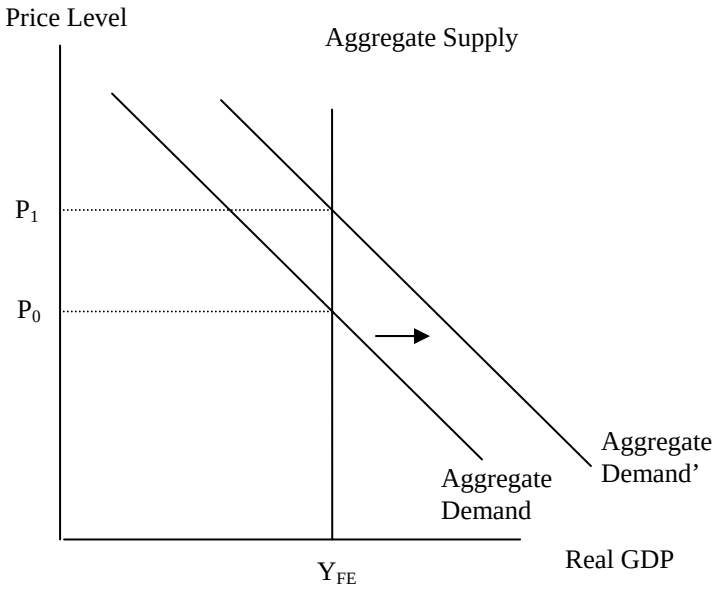
Consider P_{HIGH} for a second. Is it an equilibrium? The answer, of course, is no. At P_{HIGH}, the overall demand for goods and services (aggregate demand) in the economy is much less than the overall output of goods and services (aggregate supply). Firms would have a hard time selling their goods at these prices, and will quickly adjust the price of their goods downward, causing the price level to fall.

In fact, the equilibrium is found by finding where the Aggregate Demand curve intersects the Aggregate Supply curve. That is the spot, for a given level of the money supply, where the price level is just right so that the value of the amount of money being held (the money supply) will buy just enough to buy the quantity of goods that is the quantity of good actually produced.

What shifts the AD curve?

What if there is a larger money supply? Consider for a second, the old equilibrium price level. With more money, and the same price level, people will wish to purchase more goods and services. Thus, at P_0, the new aggregate demand curve will be further to the right than the old demand curve. By increasing the money supply, the aggregate demand curve will increase, shifting to the right.

Notice that after we shift the aggregate demand curve, the graph shows us the price level will increase, just as we saw when we did the algebra.



A decrease in the aggregate demand curve would be caused by a decrease in the money supply.

What is the role of the Fed in the Classical Economy

Not much. They can impact the money supply by way of their policy tools, which will have an effect on the price level in the economy, but doesn't do much else.

What about interest rates?

We saw previously, that the "interest rate" was determined by the interaction of savers (households) and firms (investment) in the market for loans. In fact, this was the real interest rate that was being modeled.

We also have discussed previously that lenders are going to demand compensation for inflation.

Way back in the day we looked at a $1000 bond that pays $50 in interest, resulting in an interest rate of 5%. But we expected prices to rise by 2%; we know that $20 of that interest was going towards compensation for inflation, resulting in $30 representing "real interest". We then concluded:

Real interest rate = Nominal interest – expected inflation

and then talked about ex-ante and ex-post real interest rates. If we rearrange, we get what is called the Fisher equation:

Nominal Interest Rate = Real Interest Rate + Inflation

So in the classical view, the real interest rate is determined by investment projects and households willingness to save, and then compensation for inflation is tacked on.

What is missing?

There are some pretty strong assumptions going on here. We do see deviations in the economy from full employment output levels. Prices don't always adjust as quickly as we have assumed. We do see the Fed seemingly important, while in this model they are not. People may change their value of k depending on the nominal interest rate. And it is kind of boring. Stay tuned….

Chapter 23, Keynesian Model, Big Picture

Broadly speaking, three decisions that will be made in the economy:

(1) Households will decide how much to save / consume
(2) Business decide how much to invest
(3) Households make decisions about their portfolios of financial assets

There are also two big differences between the Classical Model and the Keynesian Model.

When we talked about the Classical Model, we suggested that if an entrepreneur noticed they were having a hard time selling all the goods the produced, they would quickly lower the price and be able to sell their goods. In addition, if a person was unemployed, they quickly lowered their wage demands, and thus were quickly able find a job. Keynesians disagree. They believe in the cases above, wages and product prices are unlikely to decrease.[1] They think good prices and wages are sticky – slow to adjust – particularly during economic downturns.

In the Classical Model, we noted that the interest rate would adjust quickly to ensure that savings and investment were equal. In the Keynesian model, we will have to be more carefully about savings and investment. In the Keynesian model, there is more focus on what is going on with investment. They point out there really are two forms of investment. The first is spending to create new capital – forklifts, assembly lines, tools, machines. But a second form on investment is changes in inventories. If a firm would be to increase its inventory level by $100, this is viewed as a $100 increase in investment. If a firm were to decrease its inventory level by $100, this is viewed as a $100 decrease investment.

These changes in inventory levels might be planned by firms, or unplanned. This will be important in determining the equilibrium level of output in a moment. Let's look at some simple relationships that show the change in inventories.

Suppose businesses find that production > sales. In this case inventories must be rising. Suppose businesses find that production < sales. In this case, inventories must be falling.

How about a numerical example? Suppose entrepreneurs decide they are going to produce $1000 worth of stuff. They are planning on producing $800 worth of goods that will be purchased by households (consumption) and planning to produce $200 worth of goods that will be purchased by firms (investment). However, suppose after producing the $1000 worth of goods, households only purchase $700 worth of goods.

In this case, actual investment has actually turned out to be $300, while planned investment was only $200. Inventories have increased by $100. Again, this increase in inventories was unplanned investment. Can this be an equilibrium situation? Would firms like to change their production decisions? They would. This is not an equilibrium.

So ultimately, the economy will be an in an equilibrium when the following condition occurs:

Planned Expenditures = Output (Output = Income = Real GDP)

Planned Expenditures = Consumption (C) + Planned investment (I)

Output = Y

In equilibrium, then, $Y = C + I$

[1] It will turn out that Keynesians agree with Classical economists in that as the economy gets above the full employment level, prices and wages will be quick to adjust. The disagreement is mostly based on what occurs when the economy is below its full employment level.

Let's go back to the story, with the only difference being now that we are telling the story using the notation we will be using going forward

Y > C + I, inventories are expanding, and firms are making unplanned investment
Y < C + I, inventories are falling, and firms have unplanned disinvestment
Y = C + I, inventories are constant, investment is equal to planned investment, no unplanned investment

Expenditures

We start with the **consumption function.** What determines how much household consume? Surely part of the story is going to be their income level. As we increase the income of households, they will consume more. But what would happen if we increased the income of households by $100 – would households increase their consumption by more than $100? Exactly $100? Probably not, as we'd expect households to save a fraction of their income. This is the idea of the consumption function.

$$C = a + b\,Y$$

C = consumption
a = autonomous level of consumption
b = marginal propensity to consume (MPC)
Y = output, income, real GDP

The marginal propensity to consume tells us, for each one dollar increase in income, how much household will increase their consumption. It is a number, greater than zero, but less than one. For example if the marginal propensity to consume is 0.8, for each $1 increase in income, consumption will increase by $0.80, meaning the household will increase savings by $0.20.[2]

Now, the **investment function**. We know that this function really ought to have a bunch to do with the profitability of potential investment projects and very importantly, the interest rate. I'm sure you recall in the past that when we discussed the "demand for loanable funds" we looked at how the rate of return on our projects compared to the interest rate. But let us put that aside for the moment and suggest that firms choose to invest some set amount. We call this level **autonomous investment**. This is planned investment.

What is the equilibrium level of income (output)?

Let's start with a numerical example, and see if we can't figure out what the equilibrium level of income (output) is in the economy.

We will be looking for a spot where there planned investment is equal to actual investment – a situation in which there are no unplanned changes in inventories.

What we'll do is try out different levels of income until we find one that fits the bill.

Suppose C = 100 + 0.75, I = 25

[2] Your textbook talks about the marginal propensity to save (MPS), which is simply 1 minus the marginal propensity to consume (MPC). That is, MPS = 1 – MPC. The point is that anything that is not consumed is saved.

Output Income Real GDP	Consumption	Planned Investment	Expenditures	Unplanned Inventory Changes	Equilibrium
0	100	25	125	-125	No
100	175	25	200	-100	No
200	250	25	275	-75	No
300	325	25	350	-50	No
400	400	25	425	-25	No
500	475	25	500	0	Yes
600	550	25	575	25	No
700	625	25	650	50	No
800	700	25	725	75	No

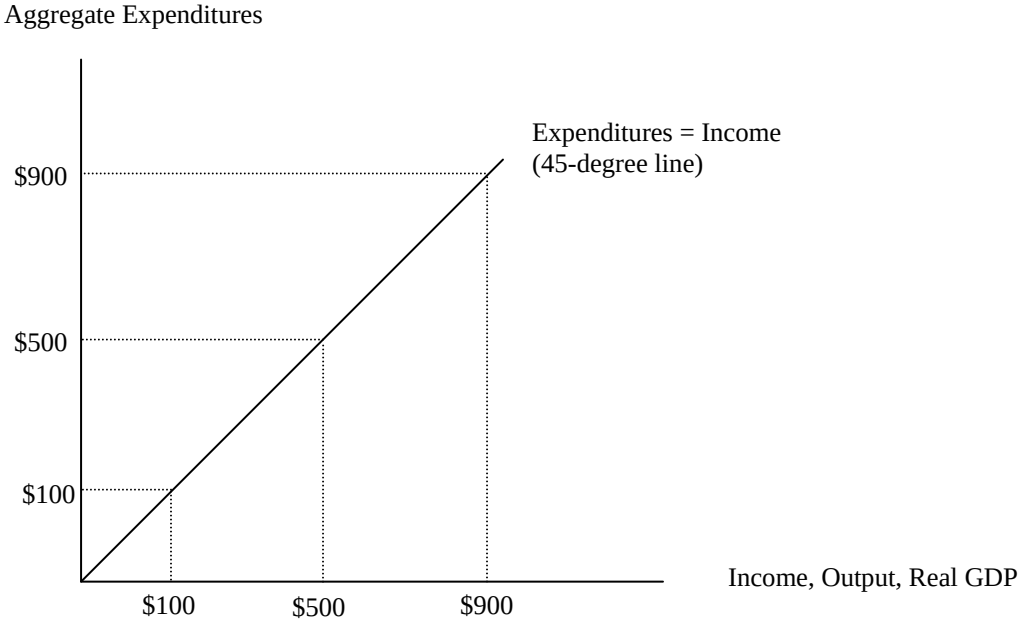
When we know income, we can calculate consumption from the consumption function. Those figures are in the second column. We then add planned investment of $25 in the third column. Expenditures = C + I and are in the fourth column. Finally, we compare output to expenditures, and determine what happens to inventories.

As we see from the chart above, the level of income where planned expenditure equal income (output) is at an income (output) level of $500. This is the equilibrium level of income (output) in the economy.

Can we find the equilibrium graphically?

Indeed. We'll be looking for a spot where planned expenditures are equal to income (output). So we'll put income (output) on the horizontal axis and planned expenditures on the vertical axis. Before we do this, we want to work on how we are going to find the equilibrium graphically.

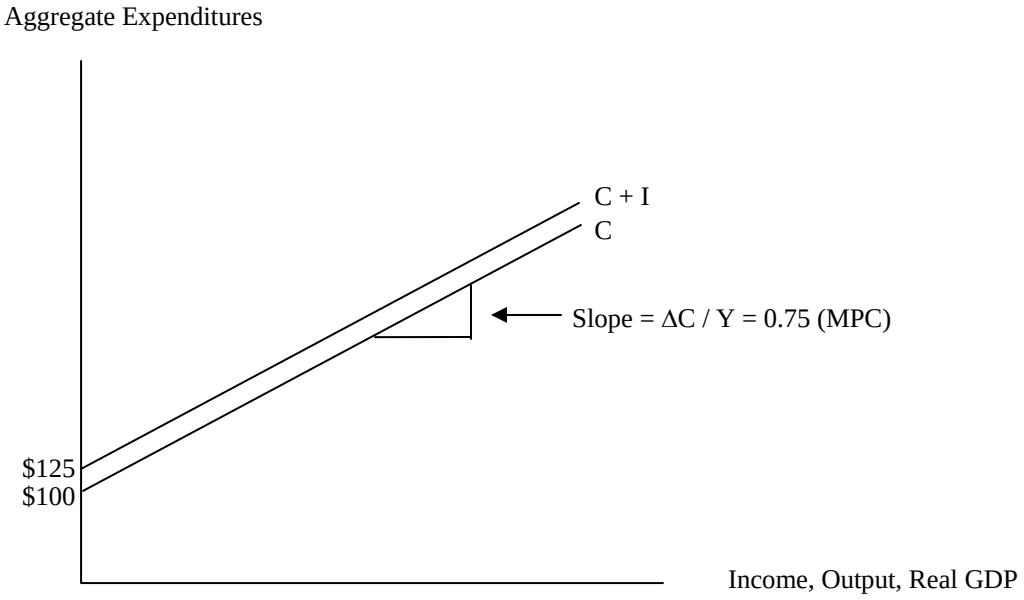
If income = $100, and we'll have an equilibrium, expenditures will have to be $100. If income = $500, and we have an equilibrium, expenditures will have to be $500. If we stick these potential equilibrium on a graph (and a few more), we'll find that they all lie on a line with a 45-degree angle. This will come in handy in just a few seconds.



Now we start the process (for our current example) by plotting our consumption function. Because the marginal propensity to consume is 0.75, every one dollar increase income leads to a $0.75 increase in consumption. This means the slope of the consumption function is 0.75, and also means it will be flatter than our 45-degree line (which we will add in a moment.) See the graph below.[3]

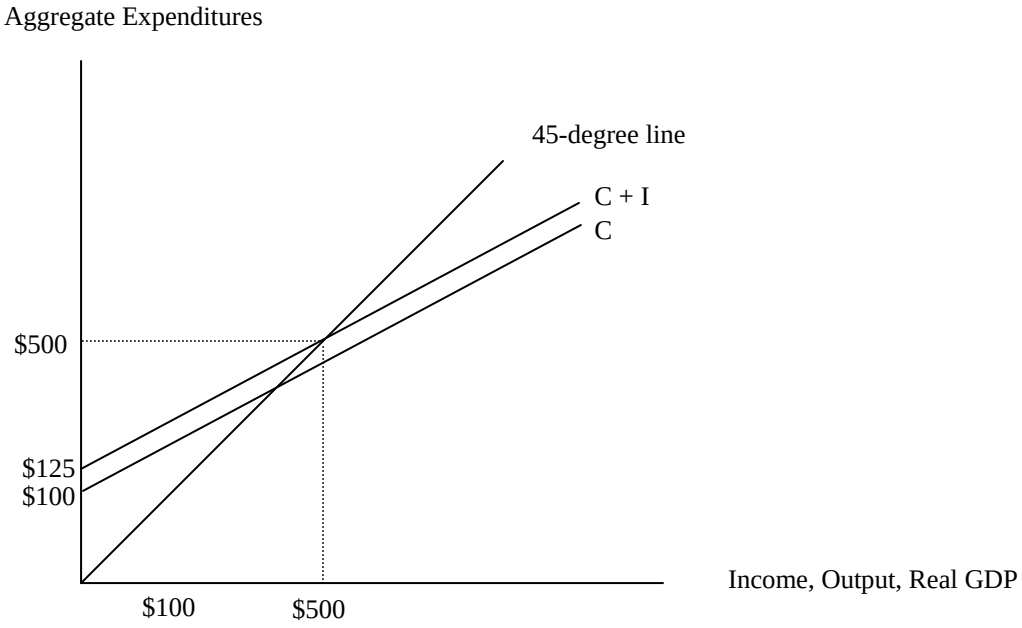
We start with income = 0, and consumption = $75. We increase income by say $100, and consumption increases to $150. We're really just plotting C = a + bY – see the chart above.

Once we draw the consumption function, we add investment (in this case $25). Because we are adding $25 at each income level, this simply results in a vertical shift of $25. We label the resulting curve C + I. See the graph below.



Finally, we throw in the 45-degree line and look for the level of income that will represent an equilibrium. Again, this is the level of income where planned expenditures (C + I) are equal to income. It is the one that is on the 45-degree line. See below.

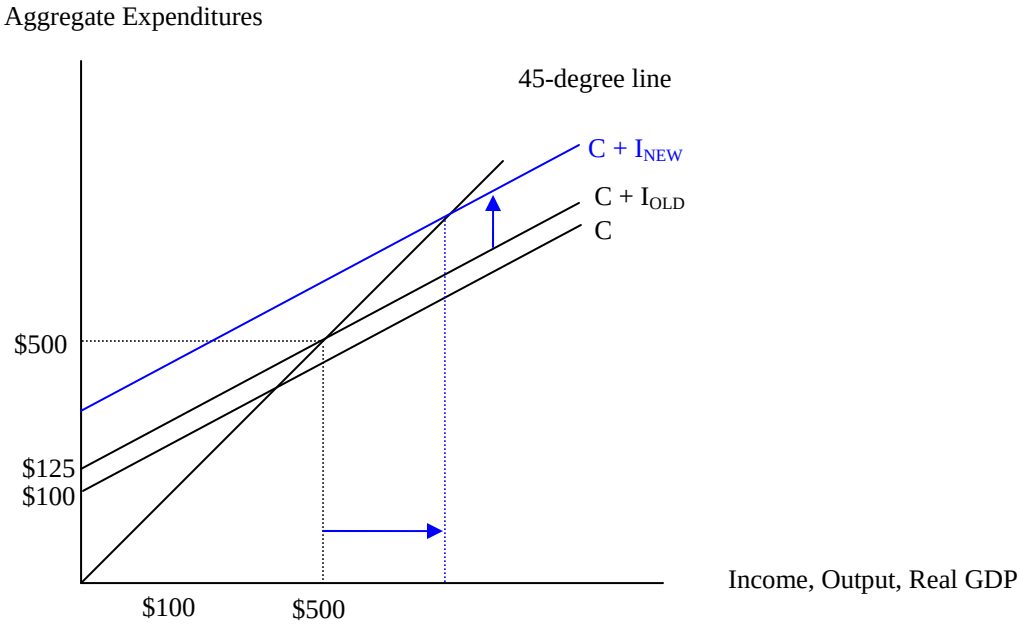
[3] Because the MPC will always be less than one, the consumption function will be flatter than the 45-degree line in all cases, not just our present example.



What happens if investment changes?

First off, we notice that the C + I increases (shifts up). From the graph, we see that the equilibrium level of income changes, and not surprisingly, it increases. But also notice that the increase in income is larger in size than the increase in investment. Check out the size of the arrows.

Why is this? Say investment increased by $100. When investment increases $100, this increases the income of households by $100. But when households' incomes increase by $100, this means households increase their consumption by $80. But when consumption increases by $80, this creates $80 more income or the economy, which then leads to $64 more consumption in the next wrong. And so on. We have a **multiplier effect**. The ultimate change in income in the economy is larger than the original change. We'll do some algebra below.



Can we have solved theses problem using algebra?

Yes. We know our equilibrium condition is:

$$Y = C + I$$

But we also know that consumption is given by:

$$C = a + bY$$

So start with the equilibrium condition, and then substitute the consumption function in for C

$$Y = C + I$$
$$Y = a + bY + I$$

Now just do some algebra, rearrange, and solve for Y:

$$Y - bY = a + I$$
$$Y(1-b) = a + I$$

The end result is an important equation:

$$Y = \frac{1}{1-b}(a + I)$$

This equation allows us to solve for the equilibrium level of income (output).

If we go back to the original example, a = 100, b = 0.75, I = $25

$$Y = \frac{1}{1-b}(a + I) = \frac{1}{1-0.75}(\$100 + \$25) = \frac{1}{0.25}(\$125) = 4(125) = \$500$$

Which is the same answer we got from our chart, and would be the same answer we would have gotten if we had drawn our graph carefully (say on a piece of graph paper).

Is there an easy way to determine how much Y changes when a or I change?

There sure is. Also, note we could express the change in Y as a change in a or I.

Because:

$$Y = \left(\frac{1}{1-b}\right)(a + I)$$

We can do some math and come up with the following expressions:

$$\Delta Y = \left(\frac{1}{1-b}\right)\Delta a$$

$$\Delta Y = \left(\frac{1}{1-b}\right)\Delta I$$

Notice, our example of increasing investment of $100 would result in a change of $400 in income.[4]

We call $\left(\frac{1}{1-b}\right)$ the **multiplier**. If, as in our example, b = 0.75, we found that the multiplier was 4. If say, b = 0.5, we'd find the multiplier would be only 2. The point here again is that changes in a or I lead to changes in income (output) in the economy that are a multiple of the original change.

What about Money

Here the Keynesian are going to be a bit different. They are going to suggest there are two types of things people can do with their financial wealth.

Option 1 is money. Money has a fixed rate of return. If we ignore the possibility of checking account balances that earn interest, the rate of return on holding money is 0%. It earns no interest. But money is safe. The value of money does not change when the interest rate changes.

Option 2 is "bonds". The way the Keynesians think about "bonds" is any financial asset that earns interest or a rate of return that is not money. So while a bond would be part of "bonds", so too would be a share of stock. For our purposes, let's think of "bonds" as actual bonds. Bonds earn a higher rate of return than money, but they are riskier. As we know, a change in the interest rate will change the price of bonds. Bonds offer a higher rate of interest but are risky. In fact, because they are riskier, investors will require a higher rate of return to hold bonds (instead of money).

So in this model, people will get to decide how much of their financial wealth to hold as bonds and how much to hold as money. As we'll see, they'll change the composition of their financial portfolios from time to time.

[4] Don't believe me? Do the math for the equilibrium level of income if a = $100, b = 0.75, and I = $125. If you do so, you'll find the answer is $900, which is precisely $400 more than our original income level of $500.

Back to money. The Keynesian model contains a **demand for money** that they call **liquidity preference**. What we have to figure out is how this demand for money or liquidity preference changes as the interest rate changes. Basically, what happens to the quantity of money folks want to hold as the interest rate changes. We'll consider a decrease in the interest rate.

Why is the case that the money demand curve (liquidity preference) curve is downward sloping?

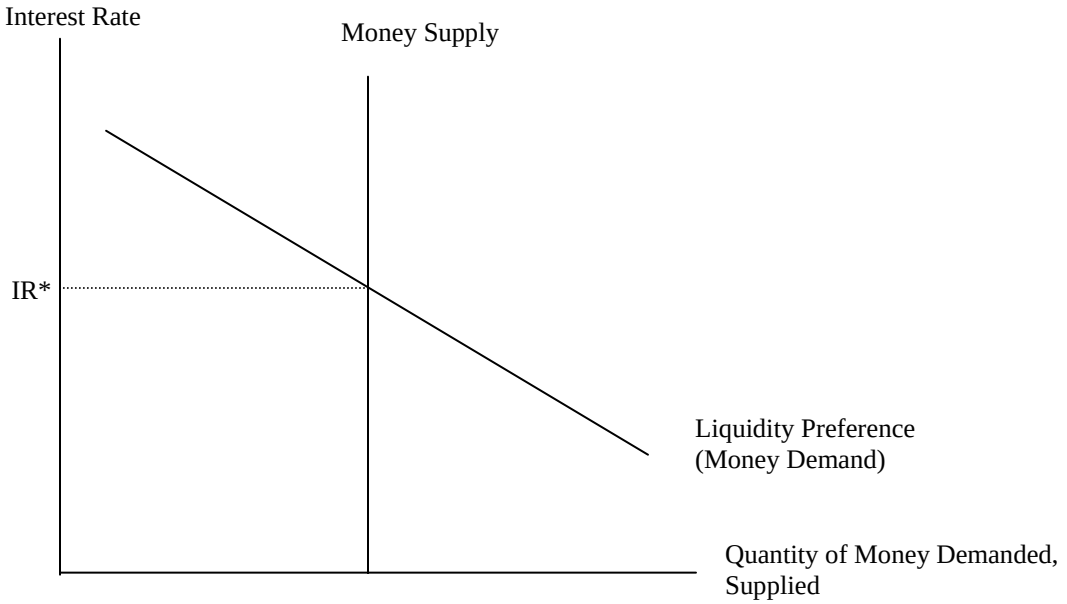
Suppose there is a decrease in the interest rate. If the interest rate is "very low", people will expect interest rates to rise in the future. And if interest rates rise in the future, this will cause the value of bonds to falls. Because the value of bonds is expected to fall, people will wish to hold fewer bonds. They will switch their financial wealth from bonds to money (which will not be affected by changes in the interest rate). Therefore, as the interest rate decreases, people will wish to hold more money.

A second reason why people might hold less money as the interest rate decreases is a simple opportunity cost story. When the interest rate is high, the cost of holding money (the foregone interest) is high, and thus people will wish to hold a small quantity of money. When the interest rate is low, the cost of holding money is low, and people will wish to hold a larger quantity of money. Again, as the interest rates falls, the quantity of money demanded will fall.

This story describes a downward sloping demand curve for money.

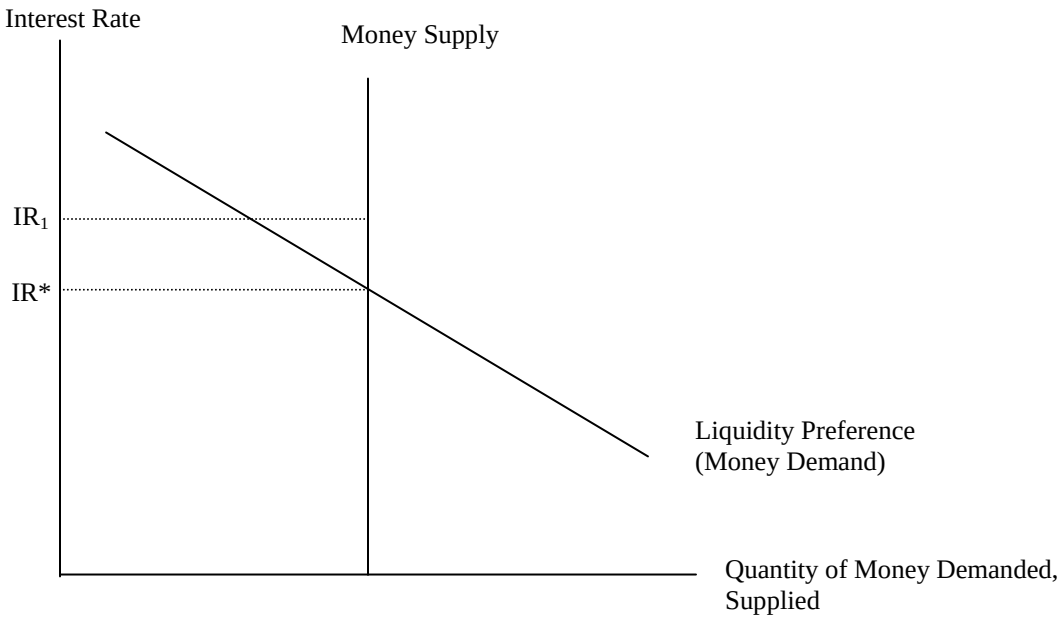
We'll assume the quantity of money is controlled by the Fed.

Thus we have an upward sloping demand curve and a vertical supply curve. We can then notice that the equilibrium interest rate is determined by the supply and demand for money. See below.



Suppose, somehow we weren't in equilibrium. How would we get there?

Consider what is happening at IR_1. Ignore for a second how we got there – perhaps momentarily, the market is out of equilibrium – an accident of some sort. What would the adjustment process look like?



First off, people would be holding too much money at IR_1. This always confuses students. As I tried to show you in class with the crumpled up $20 bill on the floor, even if the money demand function suggest that people only want to hold a certain quantity of money, all money supplied will be held. Someone always picks up the $20.

If people are holding more money than the prefer at IR_1, they will have too much money. They will get rid of their excess money by buying bonds. With everyone buying bonds, the price of bonds will rise, and with the price of bonds rising, the yield on these bonds (interest rates) will fall. Therefore, the excess money held will lead to a reduction in the interest rate. Only when the interest rate falls to IR* will there be no more pressure on the interest rate to fall.

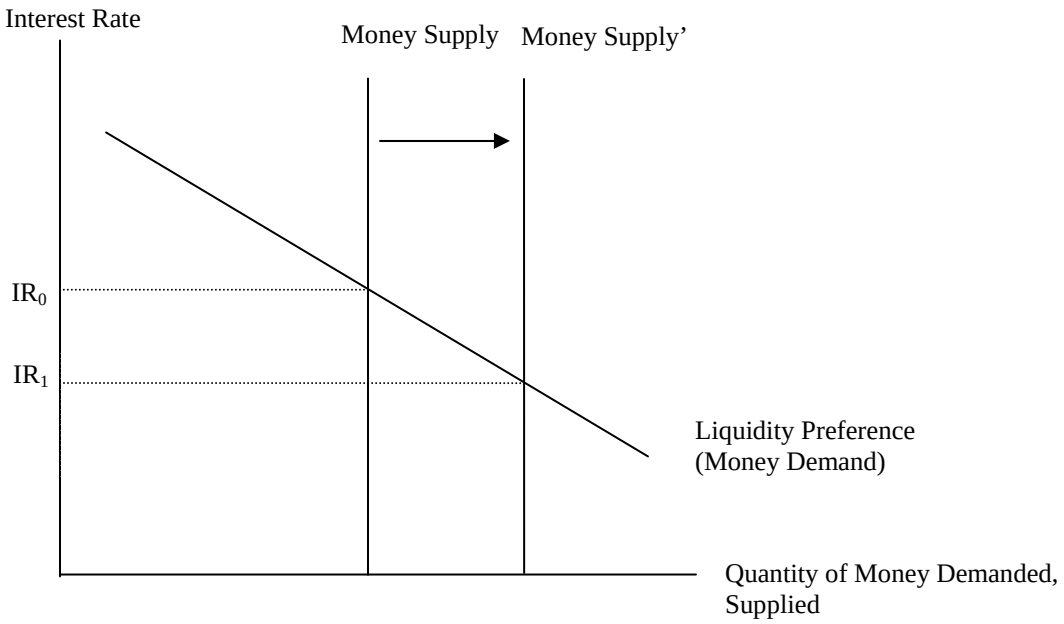
By the way, what would happen if the interest rate was below the equilibrium level?[5] Of course, the interest rate will rise.

What about Fed Monetary Policy?

Suppose the Fed increases the money supply. What happens to interest rates? The story should be getting repetitive. At the old rate of interest, people will be holding too much money. Households will get rid of their excess money by buying bonds, driving their price up, and lowering the interest rate. Just as we would have expected form our study of the FFR market, an increase in the money supply lowers the interest rate here. See the picture below.

You should work through the logic of a decrease in the money supply.

[5] People will be holding less money than the prefer. In order to hold more money, households will sell their bonds. Selling bonds will drive their price down, raising interest rates.



Liquidity Trap

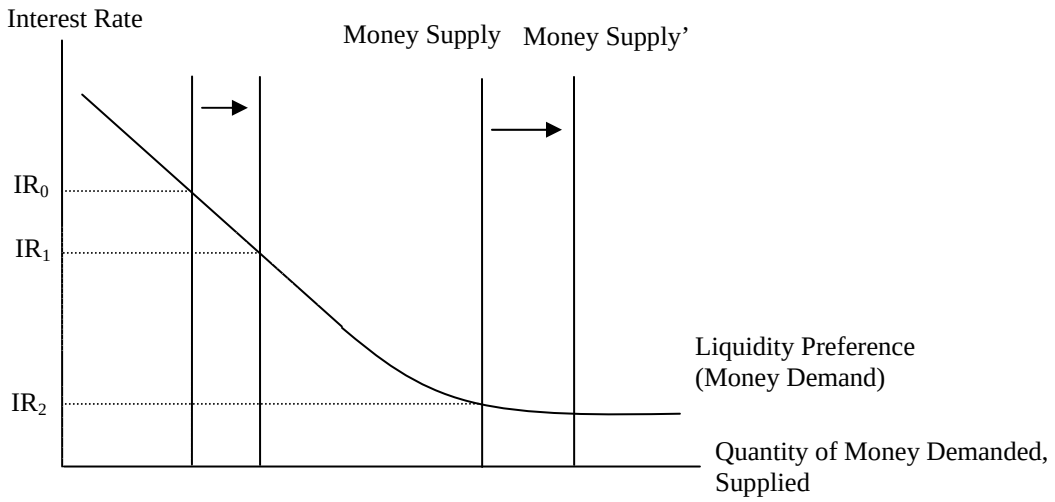
There is a limit to monetary policy that we haven't quite addressed. The liquidity preference (money demand) curve is believed to get very flat at low interest rates. If this is true, an increase in the money supply might not affect interest rates much, if at all. This idea is called the **liquidity trap**.

Why? Consider again an increase in the money supply. The story is, after the change in the money supply, people hold too much money, thus buy bonds, driving up the prices of bonds, and driving down interest rates.

But if the interest rate was already very low, people might be quite reluctant to switch from holding money to holding bonds? Why? Bonds are risky. If interest rates were very low, people would expect interest rates to rise in the future, which will cause reductions in the price of the bonds. There is a good deal of downside risk to holding the bonds. And because the interest rate is low to begin with, the return (advantage) of holding bonds is very small. Thus, people might simply hold onto the money.

Check out the picture below. If we started at IR_0 and increase the money supply, we get the usual story. But is we start at IR_2 and increase the money supply, little, if anything, happens to the interest rate.

We'd be said to be suffering from the liquidity trap at IR_2, or more generally, on the flat part of the liquidity preference (money demand) curve. Monetary policy would be ineffective – at least in that it wouldn't change interest rates.



What would happen if Fed policy was anticipated?

What if everyone knew the Fed was going to decrease the money supply in a few weeks what would happen?

People would anticipate the interest rates were going to rise after the Fed made the change. Thus, they would also anticipate that the price of bonds would fall after the Fed made the change. Therefore, some folks, trying to avoid the future capital losses on bond will begin to sell bonds before the Fed makes the change. This selling pressure will reduce the price of bonds and increase interest rates before the Fed actually makes the change.

The point is that if people anticipate Fed policy, the interest rate will react before the Fed makes the change. It is quite possible that the day the Fed announces the change, if completely anticipated, that the interest rates in markets will not change at all. This does not mean the Fed' policy that is being announced doesn't affect the economy, only that the impact has already been "priced in" to the market.

The upshot is that the Fed can announce big FFR target changes, and in some cases interest rate changes react a bunch (unanticipated), while in others interest rates react show little or no reaction (anticipated). The market movement on announcement day depends on how actual Fed policy differs from what was expected.

You should work through what would happen if it was anticipated the Fed was going to increase the money supply in a few weeks.

The final missing part of the puzzle

We need a way that Fed policy impacts the level of income (output, real GDP) in the economy. And we have one.

We've beat to death above that increases in the money supply lead to a reduction in interest rates. Are there any changes in consumption or investment that occur because of a reduction in interest rates? The answer is yes. Changes in interest rates will affect consumption, investment, and net exports.

Consumption. We know that households hold bonds. A decrease in the interest rate increases the price of these bonds, making households wealthier. Therefore, they will consume more. They way we would

include this in our model would be in increase in a, autonomous consumption. We know from above that this will lead to a change in AD.

Investment. We know that the amount of investment from firms will depend on the interest rate. At a lower interest rate, more investment projects will have a rate of return that exceeds the market interest rate, and thus more investment projects will be profitable. Firms will spend more on investment with the interest rate is low. This would be a change in I, and we know from above this would lead to a change in AD.

Net Exports. Net exports? Where did that come from? In our quest to simplify this model, we have assumed expenditures are Y = C + I. In a full model, Y = C + I + G + NX. We have been ignoring government spending and expenditures (thank goodness) and also NX, which stands for net exports.

Net Exports = Exports – Imports.

It is time for a bad flashback to our discussion of foreign exchange rate markets. When the interest rate deceases, foreign investors will find investing in the US will be less desirable. Recall we modeled the amount of foreign currency provided in the market as the supply curve of foreign currency. With fewer foreign investors supplying foreign currency (because they don't want as many dollars) in the market, the supply curve of foreign currency will decrease, the exchange rate will rise, and thus the dollar will become less valuable.

We also say when the exchange rate rises (say as it has between the $ and the Euro), that this has made US goods attractive to Europeans and European goods less attractive to US consumers. Therefore, US exports increase, US imports decrease, NX increases, and the equilibrium level of the economy increase.

You should focus on the C and I stories, but the NX story is good to know.[6]

A summary:

If interest rates decreases, C increases, I increases, NX increases, and therefore the overall level of income (output, real GDP) in the economy rises.

If interest rates decrease, C decreases, I increases, NX decreases, and therefore the overall level of income (output, real GDP) in the economy falls.

Interest rates are the missing link!

<u>What happened to price levels?</u>

We'll save this, and aggregate demand and aggregate supply until after the test.

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[6] In a model that includes NX, $Y = \frac{1}{1-b}(a + I + NX)$. The multiplier on NX would be the same as the multipler on a or I.

Some commentary on the test

1. Some of you are having a small issue with the jargon. The Fed broadly increases or decreases the money supply. When we talk about the Fed's policy tools we mean the devices they use to change the money supply. Thus, the policy tools are the discount rate, reserve requirements, and open market operations. When we talk about open market operations, we mean open market purchases, open market sales, repos, and reverse repos. The discount rate, while a Fed tool, is not considered an open market operation.

2. See below about the various different pictures we have drawn describing interest rates. The basic idea was there for many of you, but some of you jumbled up the markets.

3. Since this is short-term, you'd expect the Fed to use repos, rather than permanent open market purchases.

4. Real money balances are the value of people's money holding. Technically, M / P. We are basically describing what happens as we move along an aggregate demand curve (why the aggregate demand curve is downward sloping).

5. Nailed it.

6. Some of you gave me the Keynesian story. See the comparison below. This one is coming back on the final exam.

7. Some of you didn't know where to start. Check the solutions. The point here is that if there is too much or too little inflation, it is because there is too much or too little money. A direct link between monetary policy and inflation.

8. It cost you a couple of points if you didn't solve the for the price level.

9. Some of you have me the Classical story. See the comparison below. This one is coming back on the final exam.

10. Nailed it.

11. As a group, not as great on part (b) and part (d). This one is coming back on the final exam.

12. Pretty good. The only problem was that some of you guys didn't quite match up your verbal story (a flat money demand curve that gets very flat) with the picture, which should have depicted a money demand curve that got very flat.

13. Nailed it.

Classical Model	**Keynesian Model**
AD curve shape: Downward Sloping	**AD curve shape:** Downward sloping
Reason for AD curve shape: Holding M constant, a decrease in P increases real money balances (the value of the money held). People respond by spending more money directly.	**Reason for AD curve shape:** Holding M constant, a decrease in P increases real money balances (the value of the money held). People respond by buying more bonds, driving bond prices up, and reducing interest rates. This reduction in interest rates induces increases in C, I, and NX, and thus an increase in aggregate demand.
AS curve shape: Vertical	**AS curve shape:** Horizontal below full employment level and vertical at full employment level.
Reason for AS curve shape: Say's Law. Prices are flexible. Determined by level of population, technology, and capital.	**Reason for AS curve shape:** For the horizontal section, prices are assumed to be completely inflexible. Any change in spending therefore directly increases real GDP. For the vertical section, the story is the same as with the classical model (prices are only inflexible below full employment – prices are flexible upwards above).
More story: An entrepreneur who has difficult selling goods will quickly lower prices, but all good will be sold. A person who is for the moment unemployed will lower their wage demands and quickly find a job.	**More story:** An entrepreneur who has difficulty in selling goods will not lower prices, and will sell fewer goods. A person who is unemployed will not lower their wage demands (and will remain unemployed).
Response to a decrease in investment: Here we can imagine a decrease in the demand for loans (investment). At the current interest rate, the amount of savings would be larger than the amount of investment. The interest rate will fall, reducing the quantity of savings. Consumption will increase. According to Say's Law, overall real GDP is unchanged. No change in AD.	**Response to a decrease in investment:** There is no necessary offsetting increase in consumption. The C+I curve will shift down (or do algebra) and aggregate demand decreases.
What changes AD: Money Supply	**What changes AD:** Money Supply Household Wealth (home prices, stock prices) Optimism / Expectations of Businesses (through I)
Monetary Policy: Fed increase / decreases money, which directly impacts aggregate demand. Because of AS curve, changes affect only inflation, hence Milton Friedman's quote.	**Monetary Policy:** Fed increases / decrease money supply. This impacts the interest rate through the money market, causing people to change bond holdings, leading to interest rate changes, and thus C, I, and NX changes.