Lecture 10: A Theory of Investment Demand, An Expanded Loanable Funds Model

We start by thinking about an individual company. We calculate *the internal rates of return* (IRR) of each potential project that the company is contemplating. Recall that the *net present value* (NPV) calculates the current value of a project's expected future cash flows for a given discount rate. The IRR calculates the discount rate that results in a value of "ZERO" for the project's NPV. Ergo, if the company's cost of capital—their borrowing rate—is below the project's IRR, the company will begin work on the project.

Engineering Economics at its finest

In theory, we can collect IRR for all projects in the economy. The chart, depicted above, a marginal efficiency of capital curve, provides us with an idealized version of the IRRs for the overall economy. It provides a measure of aggregate investment for the overall economy, a function of changing levels for the cost of capital. We can specify a cost of Capital r_0, and we have determined investment.

What is the problem with thinking in *engineering* terms? The cash flow projections for any project are **EXPECTED** cash flows. They are not engineering calculations because they depend upon how the future unfolds. If business disappoints, cash flows may well come up short. And that means, in turn, that expectations about cash flows and IRRs for investment opportunities are hostage, in part, to overall expectations. In a bullish phase for the economy, high expectations will justify aggressive investment for a given interest rate. A fall for overall expectations, in turn will elicit substantially less investment, given the same interest rate in place.

Hostage to expectations
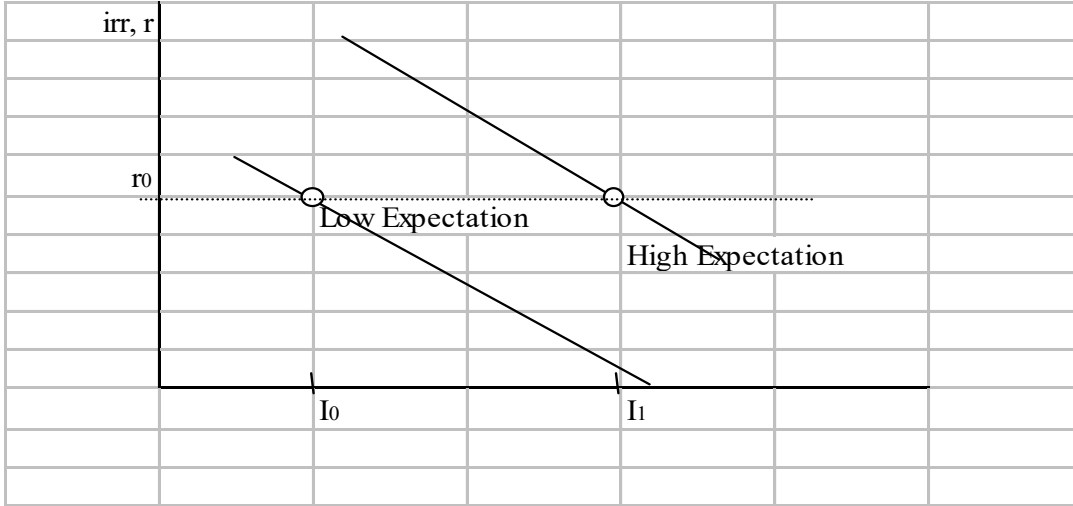
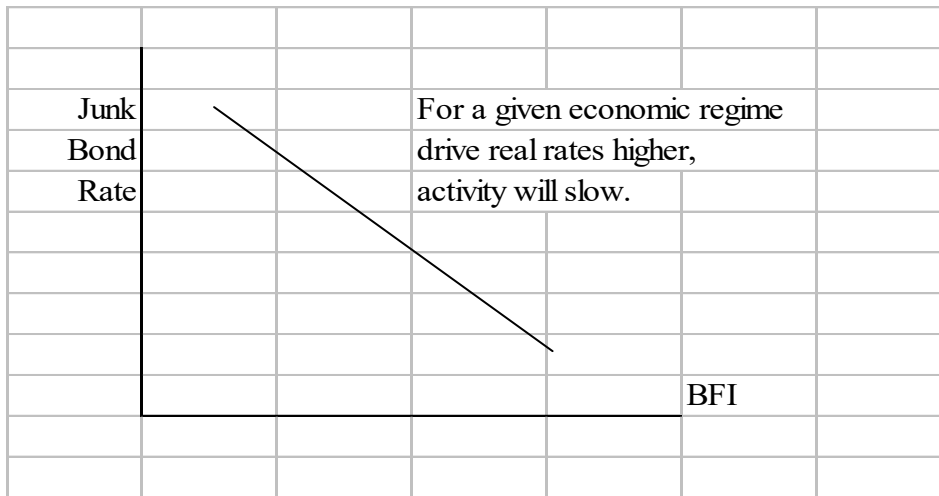$r_0 \longrightarrow I_0$ Amid recessionary expectations

$r_0 \longrightarrow I_1$ Amid Boom expectations
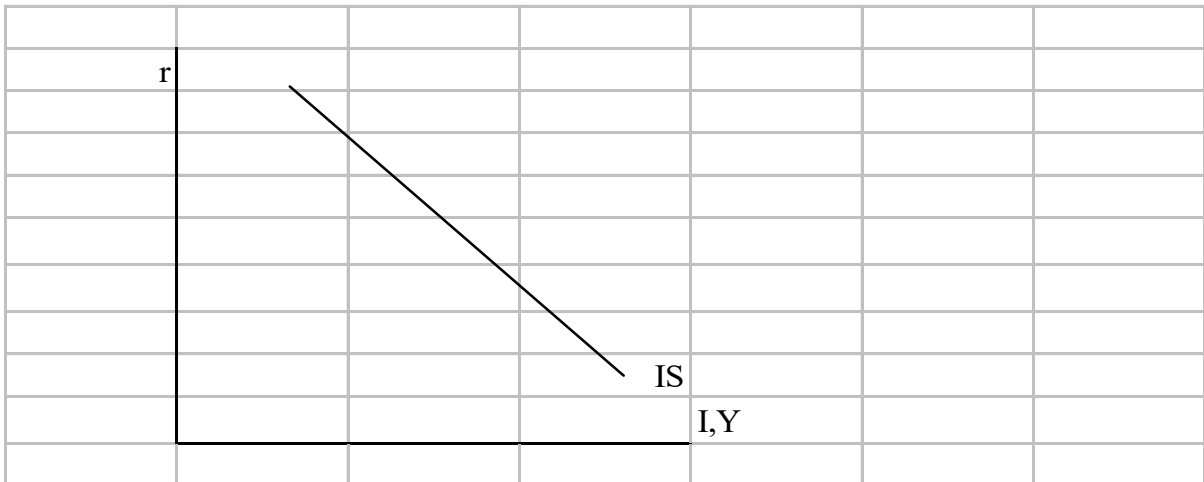
When we draw as IS Curve, from standard macro theory it is not an MEC Curve. It is not an engineering calculation. It is a set of investment and output levels for a given interest rate that depends upon expectations. Thus it reflects the opinions of entrepreneurs, investors, bankers, and speculators.

Macro Notion #1: A Downward Sloping IS Curve.

Expectations, we insist are of paramount importance. Nonetheless, a downward sloping IS curve is a powerful macroeconomic notion. Fed policymakers and macro forecasters depend upon it, most of the time.

Junk			For a given economic regime			
Bond			drive real rates higher,			
Rate			activity will slow.			
				BFI		

Essentially, economic practitioners operate under the assumption that a decision by the central bank to change the economy's key interest rates, will affect the economy's level of investment and its overall growth rate. The chart above makes this explicit for business fixed investment. We can interpret the chart as follows. For a given expectational regime the level of business fixed investment will move up and down with the borrowing rate that businesses confront. Alan Blinder, in the article in your readings, reminds us that econometric results find rate changes more likely to explain housing and car purchases than business investment. But the overall result—a big move for rates will elicit a change in overall investment and real GDP growth is a central tenet for central banks and forecasters.

Housing and the Crisis of 2008-2009:
The User Cost of Capital and House Price Expectations.

How might we think about U.S. housing investment in the just past cycle? More specifically, what is the appropriate way to calculate the real interest rate that drives potential buyers of homes? Fred Mishkin while he was at the FRB in Washington suggested we consider the *user cost of capital* (UCC) for a potential home buyer. Here is a simplified version of his equation:

$$UCC = IR - HpeR$$

UCC is real user cost of capital, IR is the inflation adjusted mortgage interest rate, HpeR are real house price expectations.

The home buyer borrows money at a given real interest rate (mortgage rate minus expected inflation rate). Shehe wants to adjust that real cost of money by comparing it to the real change in the value of the house over the borrowing period (expected change in house prices minus expected inflation rate over the period).

Suppose the mortgage rate is 6%/yr the buyer expects house prices to rise by 4%/yr and expected inflation is 2%/yr. Then the buyer views their user cost of capital as 0%.

Let's now assume that inflation expectations remain constant at 2%. Then changes in the UCC are a function of changes in the mortgage rate and changes in house price expectations. Mortgage interest rates, of course are easy to identify. But what about house prices? These are expectations, after all, not historical developments.

The point Mishkin makes is that house price expectations are very much influenced by historical house price performances. In the boom of 2002-2006 strong house price increases, following twenty years of good gains, led people to raise their expectations about house prices. But the swoon for housing today is pushing house prices and long term house price expectations lower. Consider the following table:

| Year	Real U.C.C.	Real Rate	Real House Price Expectation	Housing Starts (millions)
2003	0	4	4	1.8
2005	-2	4	6	2.1
2007	2	4	2	1.3
2009	6	3	-3	0.5
2010	5.6	2.6	-3	0.6
2013:Q1	1	1	0	0.9

What we present in the table above is a stylized look at U.S. housing using the Mishkin insights. The graph below converts the numbers in the table to an approximation of an investment schedule for U.S. housing. What we see is that the boom in housing owed much to the growing conviction about rising house prices and the consequent decline in the UCC. Conversely falling confidence in house price appreciation raises the UCC. Indeed, if people actually begin to believe that housing prices will fall for the foreseeable future, then no change in mortgage rates will be able to restore a low UCC. Thus Mishkin was telling us that the 2008 housing crisis was a race between the Fed's ability to drive rates lower and the public's stepwise lowering of house price expectations. The Fed lost the race.

Consider the table below. The first column displays the year-on-year change in house prices, using the Case-Shiller 20-City house price index. We have emphasized in this class that 'yesterday profoundly influences opinions about tomorrow'. We can create a 4-year weighted average of house price performance, the second column, subtract inflation expectations, and we have an adaptive expectations view of house prices. We then sprinkle in a bit of rationality and we can justify the real house price expectations embedded in the UCC table.

|	Case Shiller House-Price (Year-on-Year)	4-year weighted average (Year-on-Year)	Federal Reserve 5-Year Breakeven Inflation	real house price appreciation expectations (F-G)
2001	8		2.7	
2002	12		2.6	
2003	11		3.1	
2004	16	12	2.9	9
2005	16	14	2.4	11
2006	0	11	2.5	8
2007	-9	6	2.7	3
2008	-19	-3	2.1	-5
2009	-3	-8	3.2	-11
2010	-2	-8	3	-11
2011	-4	-7	2.4	-9
2012	7	-1	2.8	-3
2013	13	4	2.7	1
2014	6	6	2.5	3

An example of the power that changing expectations can have on investment attitudes.

(Note: here is a handy app for deciding on whether to buy or rent: http://www.nytimes.com/interactive/business/buy-rent-calculator.html)
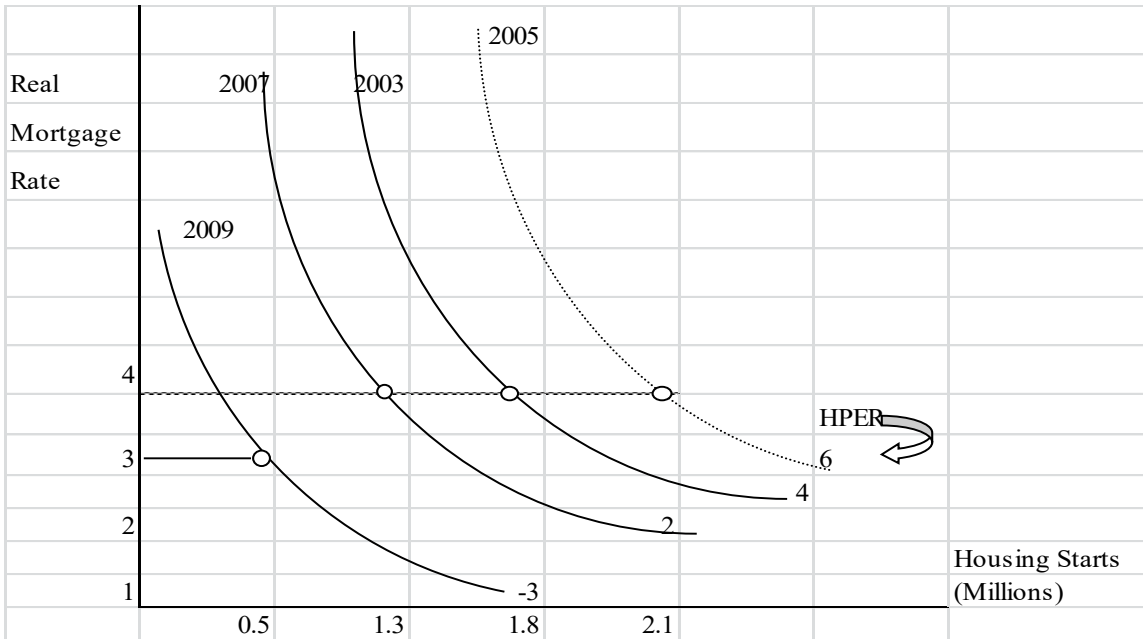
Make sure to read: **Housing and the Monetary Transmission Mechanism, Frederic S. Mishkin** *[*]–Member Board of Governors of the Federal Reserve System,* August 2007
http://www.federalreserve.gov/pubs/feds/2007/200740/index.html

HOUSING INVESTMENT AS A SHARE OF GDP:
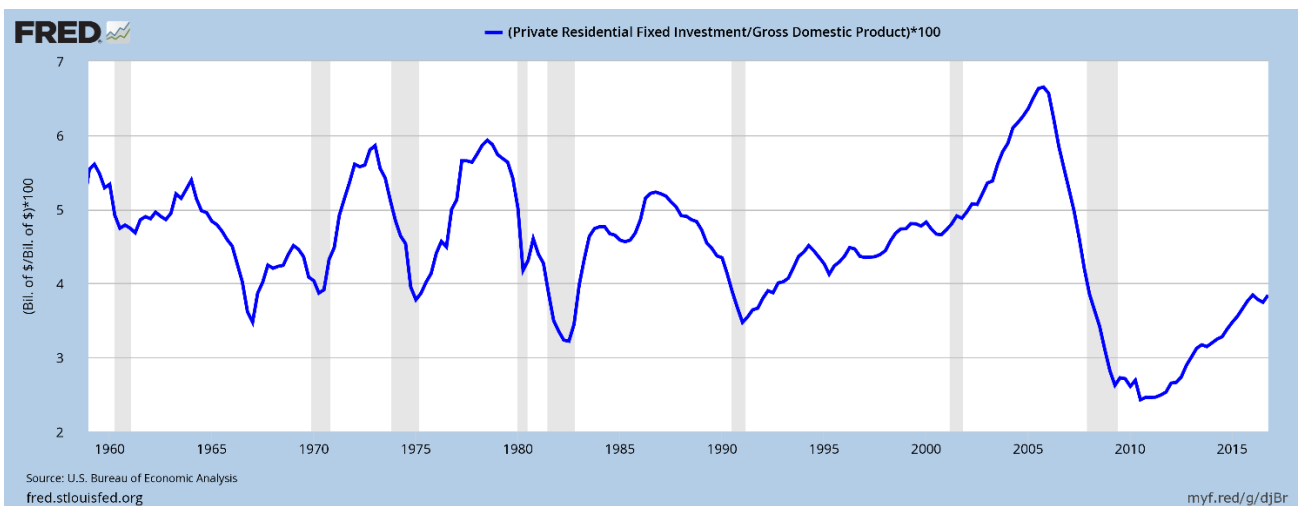
The Basic Loanable funds Model and Wicksell's Natural Rate

Imagine a world without a central bank. We would expect that interest rates in this universe would be driven by the sources and uses of credit. A loanable funds model looks at the supply of credit and the demand for credit, across term and risk structures.

r

Interest
Rates
(Price of Credit)

Supply Of Credit

Demand Of Credit

Volume of
Credit Issued
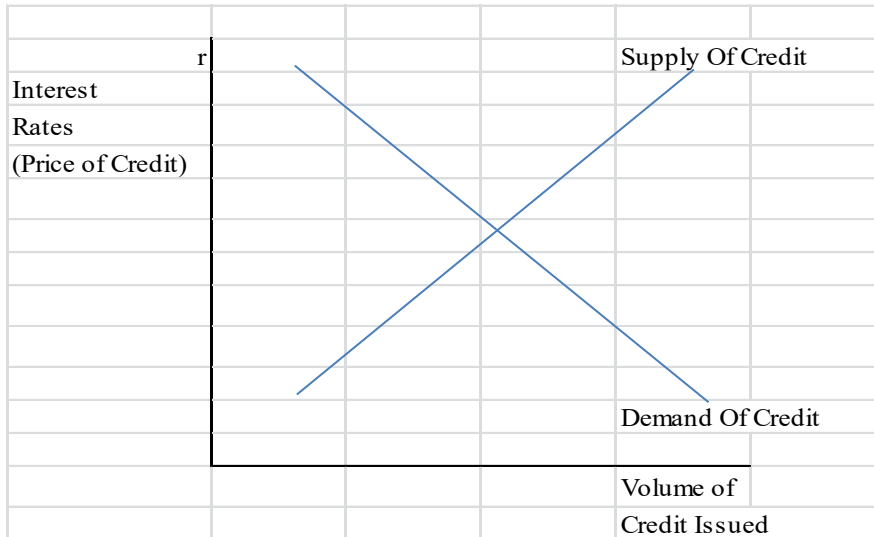
We can posit that there is a "natural rate of interest" that will just match the economy's marginal product of capital (MPC= the extra yield that one collects for an additional dollar of capital invested). When the economy's interest rate is at the natural rate, investment and overall growth and economy will avoid any inflationary or deflation price pressures. Knut Wicksell, at the turn of the 20th century, built a model of monetary policy based upon just such a "natural rate" concept. The Federal Reserve Bank of St. Louis described his model as follows:

> "Wicksell based his theory on a comparison of the marginal product of capital with the cost of borrowing money. If the money rate of interest was below the natural rate of return on capital, entrepreneurs would borrow at the money rate to purchase capital (equipment and buildings), thereby increasing demand for all types of resources and their prices; the converse would be true if the money rate was greater than the natural rate of return on capital. (Wicksell did not distinguish real from nominal interest rates because, under the gold standard of the time, sustained inflation was unlikely. Here, all interest rates and rates of return should be interpreted as real rates.) So long as the money rate of interest

persisted below the natural rate of return on capital, upward price pressures would continue. In Wicksell's theory price pressure could arise even if new credit were extended only against increases in production, that is, against "real bills". "Price stability would result only when the money rate of interest and the natural rate of return on capital-the marginal product of capital-were equal."

Source: Monetary Trends, 3/05, FRB St. Louis, "Wicksell's Natural Rate".

The loanable funds model, expanded to three interest rates:

We now embrace the idea of a downward sloping IS curve. We assume that risky long term interest rates are the rates that intersect with IS curves, and thereby influence the pace of investment and in turn the overall growth rate for the economy. We now need to think about how interest rates are determined. In our simplified Carlin/Soskice model the central bank exogenously determines the interest rate. This renders the monetary authorities immense power. Life, however, is not nearly so neat. We now will work with an expanded loanable funds model, one that marries Fed policy moves to supply/demand and expectational considerations in bill and bond markets.

We create a model with three interest rates:

r_c **the real long term borrowing rate for corporations**

r_g **the real long-term borrowing rate for the government**

Fed monetary policy is tied to a third interest rate:

r_f **the real short term interest rate: the real fed funds rate.**

Fed policy targets the real fed funds rate r_f. The real fed funds rate influences the real long term government rate r_g. The Fed policy rate and government long rate influence the borrowing rate for corporations: r_c

CORPORATE BONDS | GOVERNMENT BONDS | GOVERNMENT F-BILLS
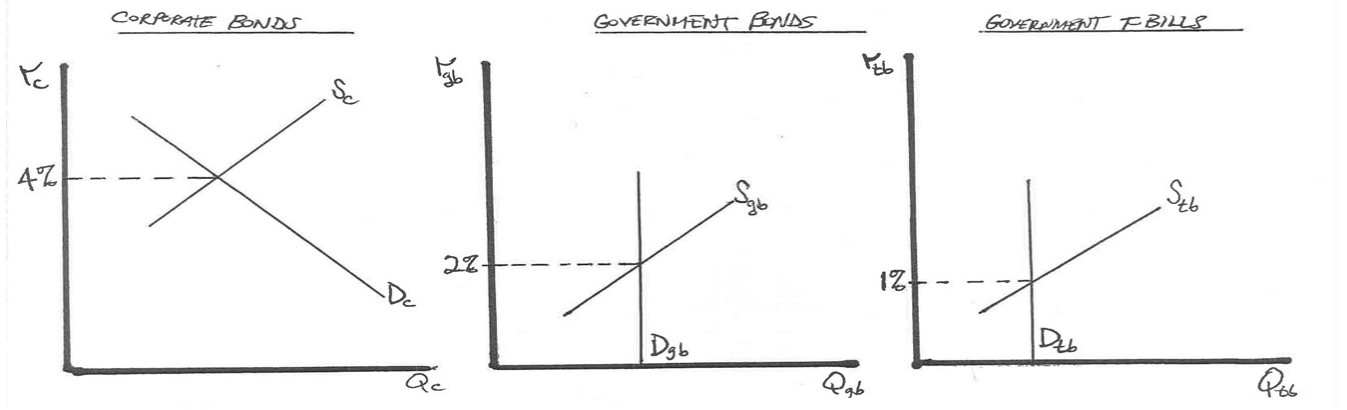
Four Actors: Households, Government, Federal Reserve, Corporations.
Three Interest Rates : $r_f \ r_g \ r_c$

The Expanded Loanable Funds Model:
The Actions of Key Actors

- Federal Reserve **sales** or **purchases** of treasury bills, shifts net government demand for household funds in the treasury bill market:

  FR^t_{tb} ≡ Federal Reserve t-bill transactions, add/subtract to net demand for household funds

  FR^p_{tb} ≡ Federal Reserve purchases t-bills, reducing the net government demand for household funds

  FR^s_{tb} ≡ Federal Reserve sells t-bills, adding to the net government demand for household loanable funds

  $$FR^t_{tb} \equiv FR^p_{tb} \ OR \ FR^s_{tb}$$

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- Corporations demand funds in the corporate bond market:

  $D_c \equiv$ demand of Corporations' for funds in the corporate bond market

- Government demand for funds: **TOTAL vs. PRIVATE**
  Federal Reserve Buys and Sells Government Debt
  Government's Private Demand for funds:
  Net of **Federal Reserve Transactions**.

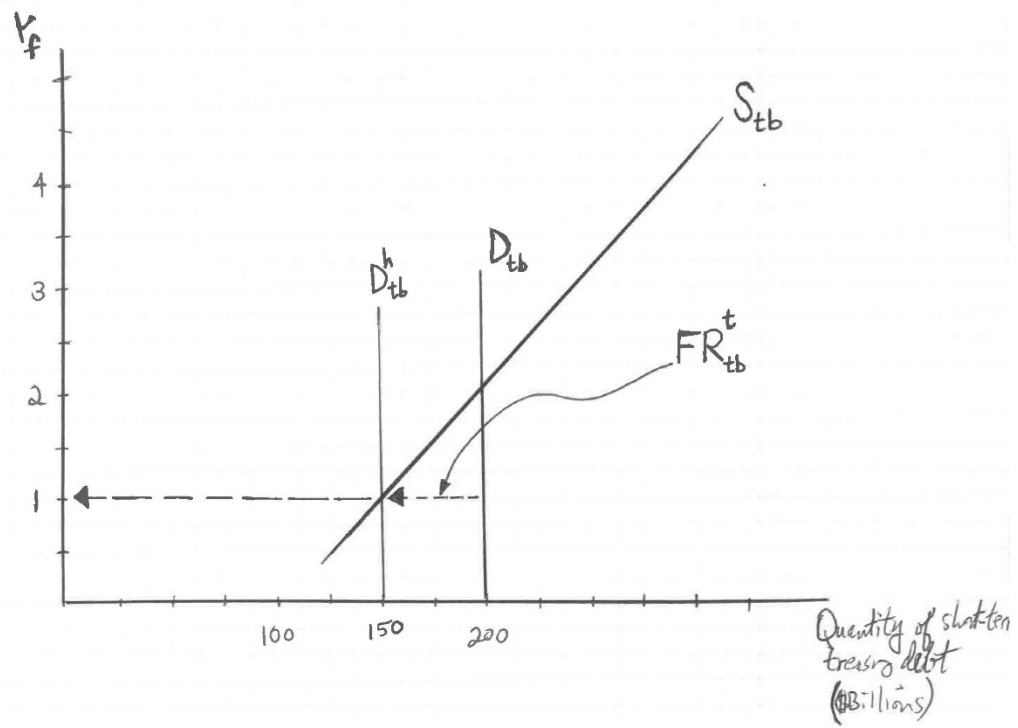$D_g^h \equiv$ government demand for loanable funds

$D_g^h \equiv$ government demand for household funds

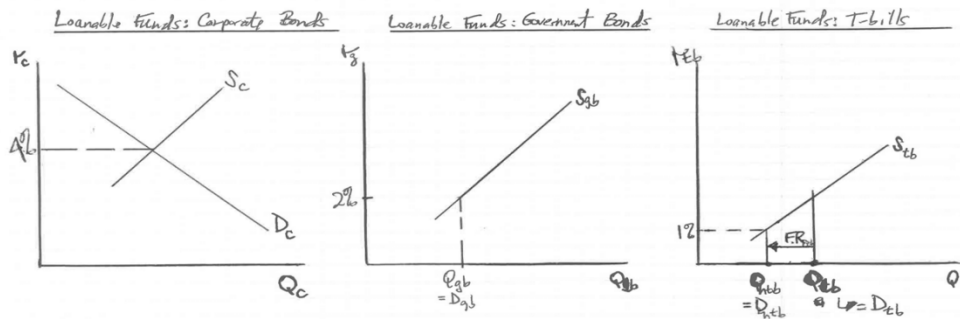$FR_{tb}^t \equiv$ Federal Reserve net provision of funds

$$D_g = D_g + FR_g^t$$

$$D_g = D_g - FR_g^t$$

The Fed buys t-bills and establishes
a 1% real fed funds rate.

The Fed sets the short rate. It influences other rates. It attempts to influence output and inflation, by changing interest rates that households and businesses confront.
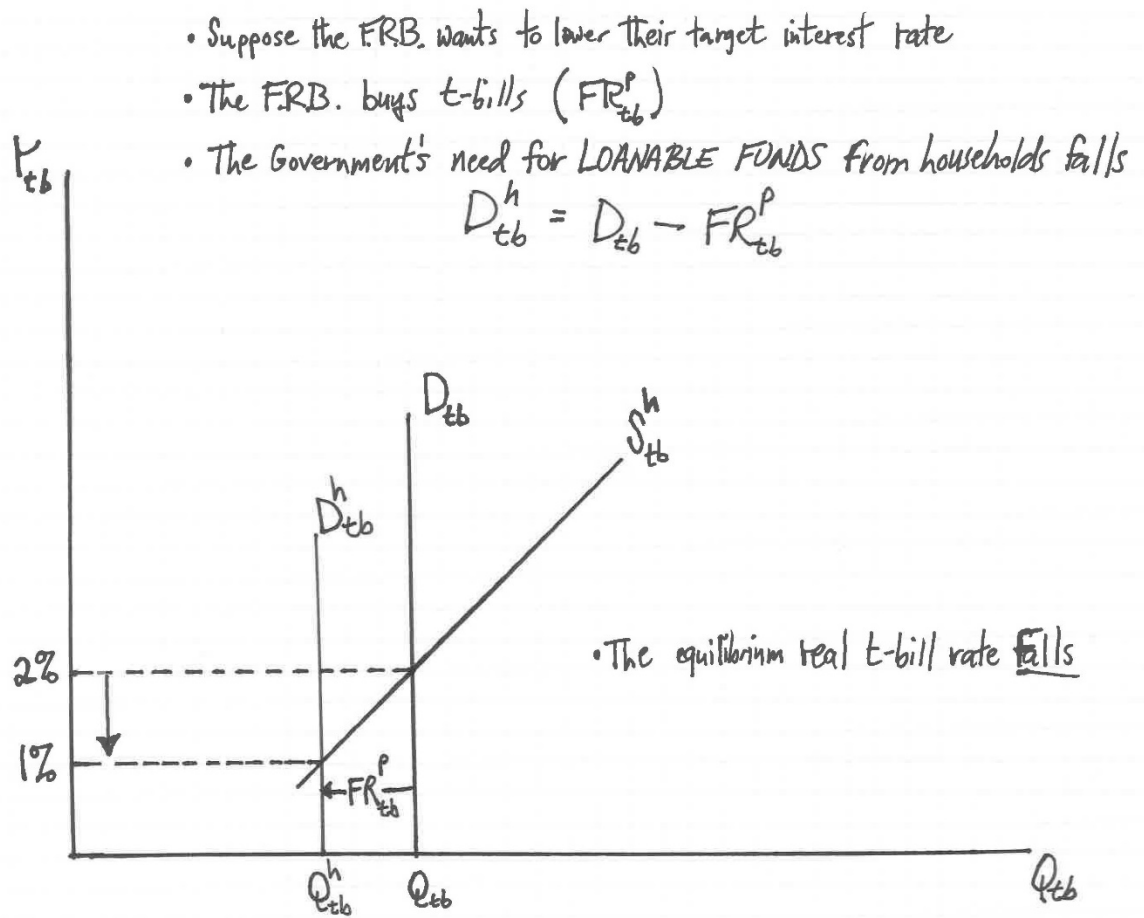
Monetary Policy in a Three Asset Market Framework:

Suppose the Federal government runs a $400 billion deficit. Suppose further, that they finance this deficit half in t-bills and half in t-bonds. The Government borrows $200 billion in the t-bill market (D_{tb} = $200).
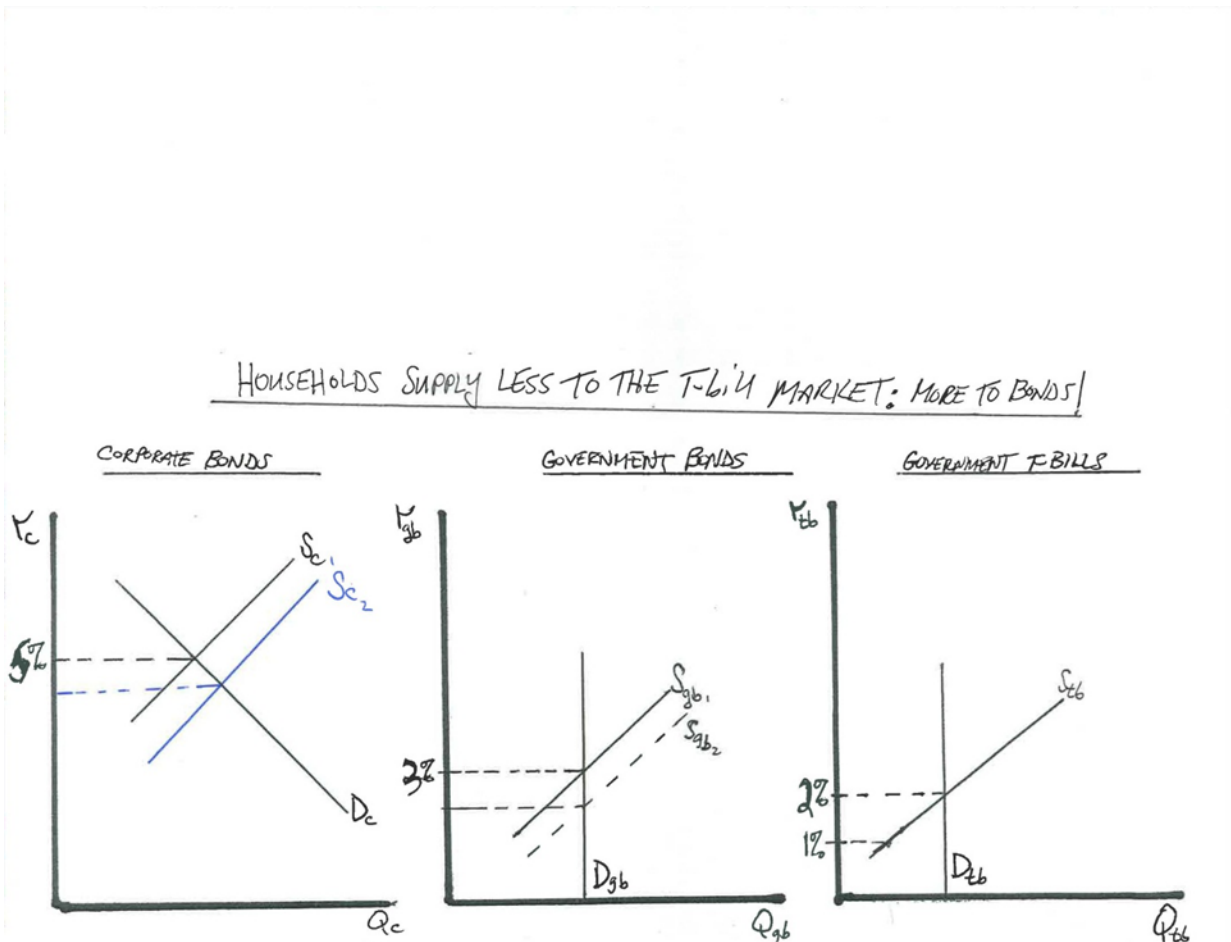
We find that households are willing to supply $200 billion in loanable funds (S_{tb} = $200) They receive 4% interest.   Why 4%?   π = 2%i = 4% r = 2%

Now we imagine that the monetary authorities want to ease policy.

- Suppose the F.R.B. wants to lower their target interest rate
- The F.R.B. buys t-bills (FR_{tb}^p)
- The Government's need for LOANABLE FUNDS from households falls

$$D_{tb}^h = D_{tb} - FR_{tb}^p$$

- The equilibrium real t-bill rate falls

How does an easing of the fed funds rate lower the risk rate?
We need to remember what happens to the price of substitute, when the price rises for the item in question:

WE TRAVEL ALONG THE HOUSEHOLD SUPPLY CURVE FOR T-BILLS
THE EQUILIBRIUM T-BILL RATE FALLS (T-bill prices rise)
THIS SHIFTS THE HOUSEHOLD SUPPLY CURVE FOR T-BONDS
LOWER RISK-FREE RATES SHIFTS THE HOUSEHOLD SUPPLY CURVE FOR RISKY BONDS
THE CORPORATE (RISKY) REAL BORROWING RATE, r_c DECLINES

HOUSEHOLDS SUPPLY LESS TO THE T-bill MARKET: MORE TO BONDS

CORPORATE BONDS

GOVERNMENT BONDS

GOVERNMENT T-BILLS

Think of an individual investor. She has an opinion about how much risk to take:

> 2% risk-free bills, she commits 20% of her funds
>
> 3% risk-free bonds, she commits 30% of her funds
>
> 5% risky bonds, she commits 50% of her funds

Now the rate on t-bills has been pushed down to 1%, via Fed open market operations.

She will likely supply less in the t-bill market, given this lower rate of return. We see this as a movement along households' supply curve for t-bills. Now money previously invested in t-bills shifts, and is invested in the t-bond and corporate bond market. Thus we have an outward shift for the bond market supply curves.

Monetary Policy Amid the Zero Bound

How can the Fed get long term real rates lower, if it can't lower fed funds?

	Nominal	π	real
• Fed funds:	0%	2%	-2%
• 10-year t-bond:	2%	2%	0%
• Baa bond:	5%	2%	3%

Quantitative easing is one way to continue to ease amid zero fed funds. The Fed can directly provide funds. The Fed usually buys t-bills to peg the fed funds rate. It can buy t-bonds, to try to directly lower bond rates. It can do this in one of two ways. It can announce a quantity target:

> The Fed bought $85 billion per month, in 2013 and 2014

Alternatively, it could announce a target interest rate for a long bond:

> We will buy the 10-year till its yield equals 1%