

Lecture Notes for Chapter 4 of
MACROECONOMICS:
An Introduction

The Cost of Living
and Living With Inflation

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In this chapter we will discuss:

- ◆ How to measure the cost of living.
- ◆ The Consumer Price Index
- ◆ What is your *real* income.
- ◆ What is inflation, and U.S. experience.
- ◆ The inflation game. Who wins? Loses?
- ◆ The *real* interest rate, what is it?
- ◆ Relation of inflation to interest rates.

You got a raise, but did your
income really go up?

- ◆ Depends on change in the “cost of living,”
- ◆ If it rose slower than your income,
your standard of living improved.
- ◆ If it rose faster, your standard of living fell.
- ◆ US cost of living rose about 4% in 2007.
- ◆ In 2008, hardly at all!

How do we measure the cost of living?

- ◆ Using the Consumer Price Index or CPI
- ◆ Announced monthly by
- ◆ Dept. of Labor's Bureau of Labor Statistics

What is an index?

- ◆ An index is expressed as a percentage of the value in a base period.
- ◆ CPI measures cost of living *relative* to a base period.
- ◆ CPI is 100 in base period 1982-84.
- ◆ In Dec 2008 it was about 212, meaning...
- ◆ it rose 112% since 1982-84, it doubled!

How is the CPI constructed?

- ◆ Cost of "market basket" of goods and services purchased by a "representative" urban household in base period.
- ◆ BLS re-prices the market basket monthly.
- ◆ CPI is the cost today divided by cost in 1982-84.

How “representative” is the CPI?

- ◆ Actual purchases vary with
 - family size,
 - income,
 - region,
 - age,
- ◆ But CPI indicates important changes.

Biases in the CPI

- ◆ Three sources:
- ◆ Assumes market basket fixed, but in reality consumers will substitute for costly goods.
- ◆ Slow to recognize new products.
- ◆ Hard to measure quality improvements
- ◆ Effect of these is upward bias in CPI.
- ◆ Boskin Commission estimated 1.1%/ year.

CPI for December 2007

- ◆ BLS went test shopping,
- ◆ priced items in the market basket, added up,
- ◆ divided by cost in base period 1982-84,
- ◆ and got 211.16, or 211.16%.
- ◆ So CPI was 211.16 in Dec. 2007.

Did your salary really rise in '07?

- ◆ CPI: 202.80 in Dec. 2006, vs. 211.16 in Dec. '07.
- ◆ An increase of 4.1%.
- ◆ If your salary rose 6%, you have a higher standard of living.
- ◆ But not 6% higher.

To see how much higher -

- ◆ Concept: *real income*.
- ◆ The purchasing power of your income
- ◆ How many market baskets it can buy?
- ◆ Divide your salary by the CPI
- ◆ result is your *real income*.
- ◆ Called “deflating”

Your salary was \$100,000 in Dec. '06, \$106,000 in '07

- ◆ Deflate each to get real income in each year:
- ◆ '06 real salary: $\$100,000/2.028 = \$49,310$
- ◆ '07 real salary: $\$106,000/2.1116 = \$50,199$.
- ◆ What kind of \$\$\$ are these?
- ◆ Constant dollars of 1982-84.
- ◆ Big dollars, little salary number!!

What are they in today's dollar?

- ◆ To convert constant dollars of any base year to the dollars of another year, multiply by the index value in that year.
- ◆ Example: what was your 2006 salary in the dollars of Dec 2007?
- ◆ It was 2.1116 times \$49,310 = \$104,123.
- ◆ That is your 2006 in 2007 dollars, more!?

Economists distinguish between

- ◆ *current dollar* or *nominal* income
- and
- ◆ *real* income.

How fast did your salary grow in real terms in 2007?

- ◆ Take the change in real salary:
- ◆ $(\$50,199 - \$49,310) = \$889$
- ◆ Divide by your 2006 real salary:
- ◆ $\$889 / \$49,310 = .018 = 1.8\%$
- ◆ Good news: your real income did grow,
- ◆ Bad news: by less than nominal growth.

Notice please:

- ◆ 1.8% change in real income is roughly 6% change in nominal income minus 4.1% change in the CPI.
- ◆ This is no coincidence!

Nice approximation is:

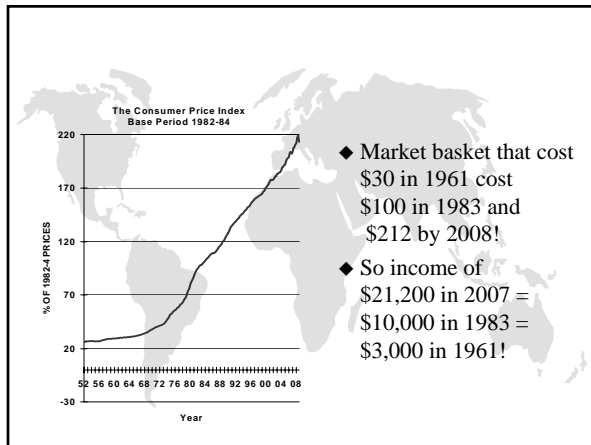
- ◆ %Change Real =
- ◆ %Change Nominal *minus* %Change CPI
- ◆approximately!

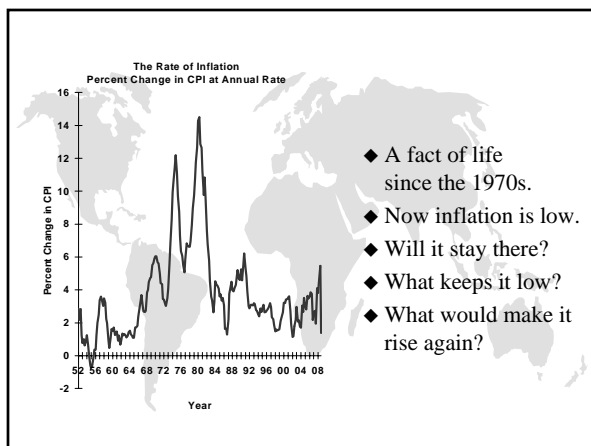
Reason it works:

- ◆ Nominal = Real • CPI. Why?
- ◆ Let Nominal increase by fraction n , CPI by c , and Real by r ,
- ◆ $\text{Nominal} \cdot (1+n) = \text{Real} \cdot (1+r) \cdot \text{CPI} \cdot (1+c)$
- ◆ Dividing the second equation by the first,
- ◆ $1+n = (1+r) \cdot (1+c) = 1 + r + c + rc$
- ◆ If r and c are small, rc is *very* small,
- ◆ so $n = r + c$
- ◆ and $r = n - c$

Convenient rules of thumb:

- ◆ The % increase in nominal income =
% increase in real income
plus the % change in the CPI
- ◆ The % increase in real income =
% increase in nominal income
minus the CPI % change.





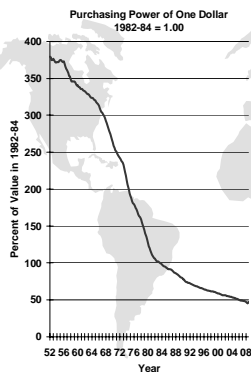
The politics of inflation

- ◆ Inflation under Jimmy Carter contributed to his defeat by Reagan in 1980.
- ◆ Anti-inflation policy by the Federal Reserve under chair Paul Volcker.
- ◆ Continued by Fed chair Alan Greenspan.
- ◆ By 1992 inflation subsided to levels not seen for three decades!
- ◆ But in 2008 election it was again an issue.

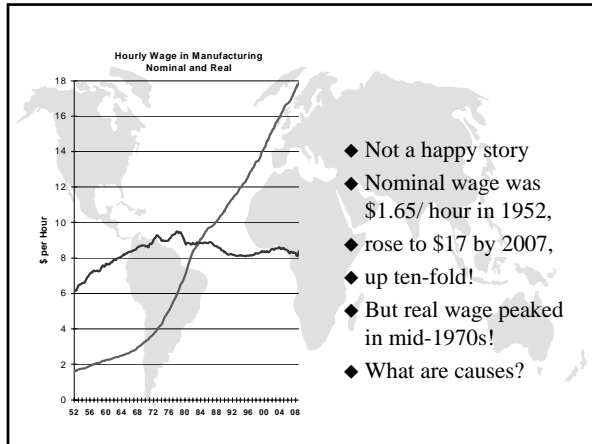
Purchasing power of a dollar:

- ◆ As cost of living rises, purchasing power falls.
- ◆ How many pizzas will a dollar buy?
 $1 / \text{price of a pizza.}$
- ◆ A broader measure of purchasing power:

$$= 1 / \text{CPI.}$$



- ◆ Expressed as % of purchasing power of \$1 in 1982-84.
- ◆ \$1 in 1952 had the purchasing power of \$3.75 1982-4 dollars.
- ◆ By 2008 purchasing power had fallen to 49¢!
- ◆ Over the past half century, purchasing power has fallen 87%!



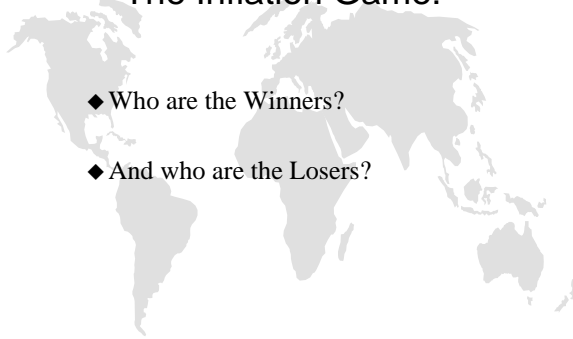
**Inflation is not cause
of wage stagnation**

- ◆ Only by adjusting for inflation can we see changes in the standard of living,
- ◆ Why have real wages stagnated?
- ◆ Reduced the demand for unskilled labor due to
 - changes in technology,
 - global competition
 - deregulation
- ◆ Industrial unions much less powerful

How about that stock gain?

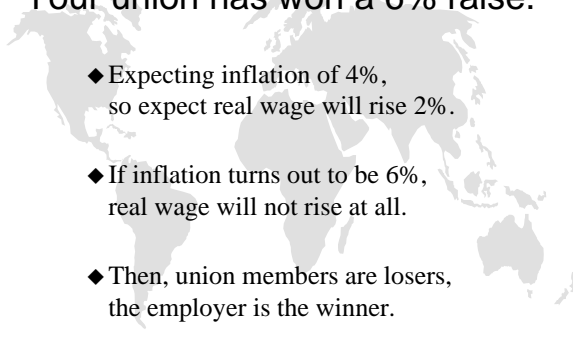
- ◆ You just sold a stock for \$60 that you purchased 20 years ago for \$30.
- ◆ Big gain right???
- ◆ Wrong!
- ◆ How much did you really gain?
- ◆ How will IRS affect your gain?

The Inflation Game:



- ◆ Who are the Winners?
- ◆ And who are the Losers?

Your union has won a 6% raise.




- ◆ Expecting inflation of 4%,
so expect real wage will rise 2%.
- ◆ If inflation turns out to be 6%,
real wage will not rise at all.
- ◆ Then, union members are losers,
the employer is the winner.

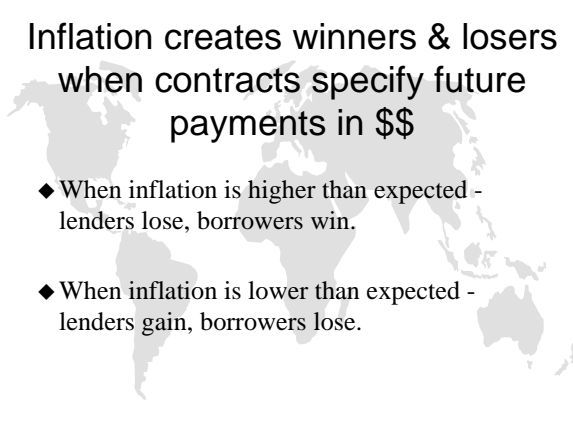
**What if inflation slows to 1%,
unexpectedly?**



- ◆ Who wins?
- ◆ Who loses?

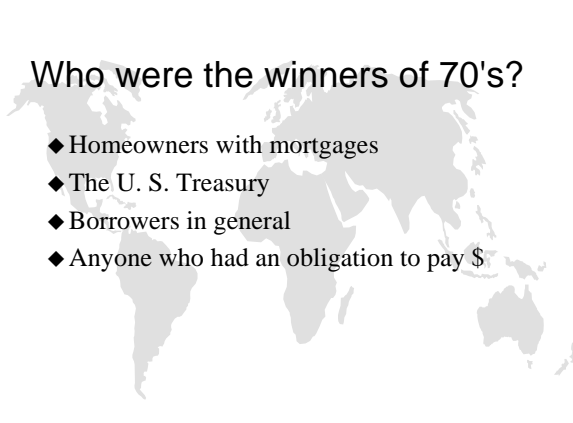


This is the inflation game we all must play!



Inflation creates winners & losers when contracts specify future payments in \$\$

- ◆ When inflation is higher than expected - lenders lose, borrowers win.
- ◆ When inflation is lower than expected - lenders gain, borrowers lose.



Who were the winners of 70's?

- ◆ Homeowners with mortgages
- ◆ The U. S. Treasury
- ◆ Borrowers in general
- ◆ Anyone who had an obligation to pay \$

For every winner in the inflation game there is a loser:

- ◆ The big losers in the 70s were lenders
- ◆ Savings and Loans
- ◆ Banks
- ◆ Owners of US Treasury bonds
- ◆ Those on fixed pensions.
- ◆ Anyone entitled to fixed payments,

There would be no inflation game if we could anticipate future inflation accurately.

Then parties could agree on payments that increase with inflation.

Indexation is one answer.

- ◆ A contract stating that payments be adjusted regularly depending on future changes in the CPI.

Examples -

- ◆ Social Security payments are indexed.
- ◆ Wage contracts that have cost of living adjustment, or COLA, based on the CPI.
- ◆ Leases on commercial property often adjust rent based on CPI.
- ◆ ARMs indexed to the short interest rate.
- ◆ Income tax brackets adjusted annually.
- ◆ TIPS Treasury Inflation Protected Securities

If CPI inflation was revised down by Boskin's 1.1%:

- ◆ COLA clauses affected.
- ◆ Tax brackets adjusted more slowly.
- ◆ Baby Boomers would receive much smaller Social Security checks.
- ◆ 1.1% compounded for 20 years is 25%!
- ◆ Big politics here!

Real and Nominal Interest Rates

- ◆ If you purchase bond yielding 6%, and inflation is 6%, your purchasing power gain is zero.
- ◆ In that case, we say the *real* yield is zero.
- ◆ If inflation < 6%, you gain in real terms.
- ◆ If inflation > 6%, you lose in real terms.
- ◆ Stated yield is the *nominal* interest rate.

How to calculate the real yield:

- ◆ Deflate amount *invested* by CPI year ago.
- ◆ Deflate amount *received* by CPI today.
- ◆ Percentage gain is the *real rate of interest*.
- ◆ The real rate is approximately the nominal rate *minus* the inflation rate.
- ◆ Why?

Again,

- ◆ % change in real terms is approximately nominal % change *minus* CPI % change.
- ◆ Applied to interest rates:
Real Interest Rate =
Nominal Rate *minus* Rate of Inflation
- ◆ Works well only if rates of interest and inflation are small!

But when you purchased the bond you didn't know what the inflation rate would be.

- ◆ Lenders and borrowers do not know what the real interest rate will be.
- ◆ But they have an *expectation* of it, based on their expectation of inflation.

So we distinguish between

- ◆ the *expected* or *ex ante* real interest rate = nominal interest rate - *expected* inflation
- ◆ the *realized* or *ex post* real interest rate = nominal interest rate - *actual* inflation

The *ex ante* real interest rate is:

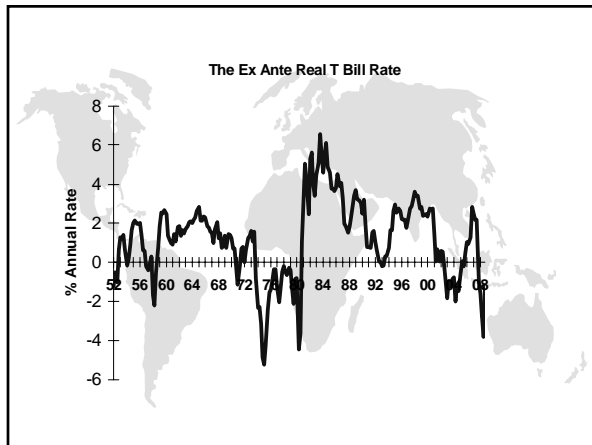
- ◆ A forecast, different across individuals
- ◆ Invariably wrong, *ex post*!
- ◆ If you expect the CPI to rise 3%, your *ex ante* real rate is $6\% - 3\% = 3\%$.
- ◆ If inflation turns out to be 5%, your *ex post* real rate is only 1%.

When you borrow or lend you play the inflation game.

- ◆ What matters is the real interest rate.
- ◆ If inflation is higher than expected, bond holders lose, borrowers win;
- ◆ and vice versa.

What is the *ex ante* real one year interest rate today?

- ◆ How to measure expected inflation?
- ◆ Inflation over past year is a “rule of thumb”
- ◆ and is a pretty reasonable forecast.
- ◆ Using that measure, the real T bill yield is:



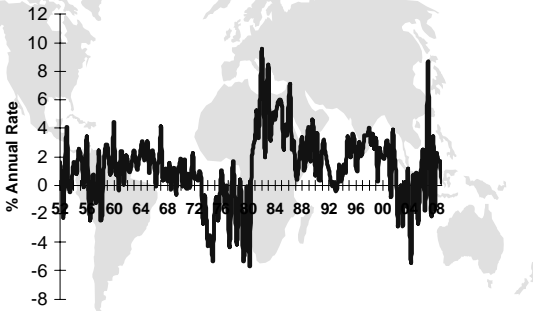
Notice that real interest rate..

- ◆ was fairly steady during the 60s,
- ◆ at about 1%. Not much!
- ◆ Mid 70s-1980 very low and even negative.
- ◆ 1980s real rates higher high, then declining.
- ◆ In 2004 and again in 2008 it is negative!

The ex post real rate....

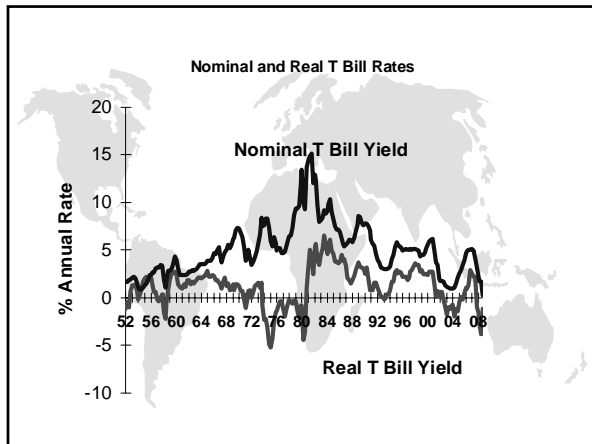
- ◆ is the real rate you actually got,
- ◆ it differs from ex ante by unexpected inflation.
- ◆ Unexpected inflation is random noise,
- ◆ it cannot be predicted.
- ◆ So ex post inflation looks noisier>>>>

The Ex Post Real T Bill Rate



How different are...

- ◆ nominal and real interest rates?
- ◆ Is one higher than the other?
- ◆ Do they move together?
- ◆ Do they move in different directions?
- ◆ Here they are plotted together>>>>



The new *indexed* T bonds – Treasury Inflation Protected Securities, or ‘TIPS’

- ◆ First issued Jan 97.
- ◆ Maturity range out to 2032.
- ◆ Payments are indexed to the CPI.
- ◆ The yield is a real interest rate.
- ◆ Quoted in the WSJ table, denoted “i”.
- ◆ Enables us to observe *ex ante* real rate.
- ◆ What is it now??

On Inauguration Day 2009>>

- ◆ Long term nominal bond yield = 3.01%
- ◆ Long term TIPS yield = 2.09%
- ◆ What inflation rate does the market expect?
- ◆ How much inflation do you expect?
- ◆ Which should you buy?
- ◆ Market expectation useful as benchmark!

How is the real rate determined?

- ◆ By supply and demand, of course.
- ◆ Savers *supply* loans
- ◆ The higher the real rate, the greater the supply from households and ROW.
- ◆ Issuers of bonds *demand* loans:
- ◆ The higher the real rate, the lower the demand.
- ◆ The equilibrium real interest rate equates the supply of loans with the demand.

A shift in demand for loans causes the real rate to change.

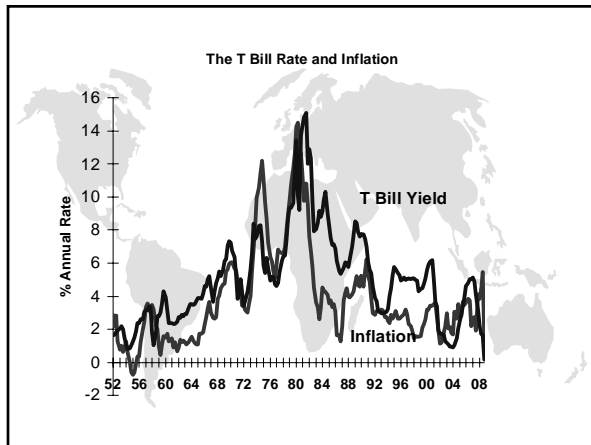
- ◆ Large federal deficits required large loans.
- ◆ That helped push real rates up in 1980s.
- ◆ What would happen to real interest rates if Congress balanced the budget?
- ◆ Balanced budget in late 1990s, and real rates fell.
- ◆ Will large deficits now push real rate up?

A shift in supply of loans will also change the real interest rate:

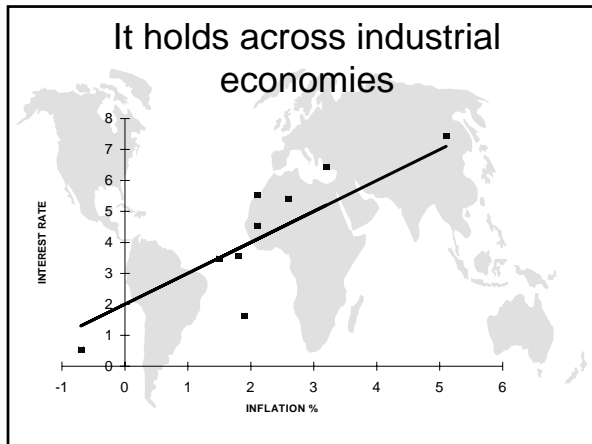
- ◆ Yuppies of the 80's now middle aged savers.
- ◆ Helping lower real interest rate
- ◆ The Fed buys and sells T bonds, so the Fed can move the real rate too.
- ◆ “Tight money policy” of the early 80's, a factor in high real interest rates.
- ◆ Fed pushed rates down sharply after 9/11!

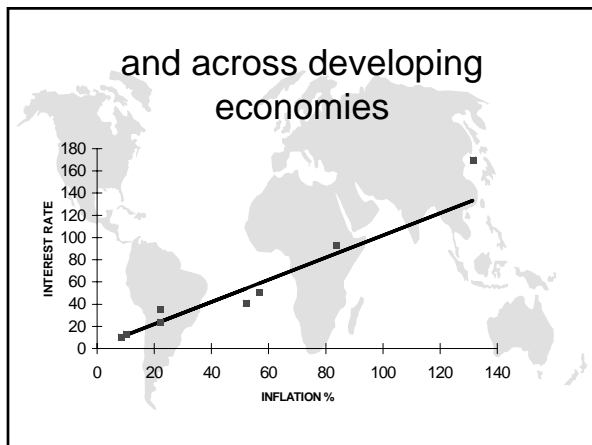
The (Irving) Fisher Hypothesis

- ◆ Nominal rate = real rate + expected inflation (the “Fisher equation”)
- ◆ Variables affecting real rate change slowly, like demographics,
- ◆ but inflation rates vary widely.
- ◆ So, *variation in the nominal rate reflects mainly variation in inflation.*
- ◆ Does it?>>>>>>>>>>



This relationship holds over long periods of history and across countries.





Does Congress understand real interest rates?

- ◆ Nominal interest income is taxed.
- ◆ In 1980 T bill yield was about 12% and so was inflation.
- ◆ What was the real rate?
- ◆ Before taxes it was zero, $12\% - 12\% = 0\%$!
- ◆ Good for borrowers, bad for lenders!

But *after tax* yield depends on lender's tax rate

- ◆ Call the tax rate "t" so
after tax nominal yield = $12\% \cdot (1-t)$
- ◆ But now we subtract inflation rate of 12%!
- ◆ After tax real yield =
 $12\% \cdot (1-t) - 12\% = -t \cdot 12\%$
- ◆ For someone in the 50% tax bracket,
after tax yield was negative 6%!

Did the U. S. Treasury like inflation?

- ◆ You bet!
- ◆ Not only did it pay a zero real rate,
it collected half of it back in taxes!
- ◆ It made 6% on money it borrowed!
- ◆ How could the tax law be fixed?

Capital gains tax is not for real

- ◆ Capital gain = sale price - cost.
- ◆ You bought Widgets Inc. stock in 1983
Cost \$100/ share, sold today for \$212
Taxable gain is \$112 per share.
- ◆ What is the real gain?
- ◆ What is the real gain after taxes?
- ◆ What would fix this distortion?

