Topic 6: The Asset Market, Money and Prices

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Chapter Outline

- Define money, discuss its functions, and describe how it is measured in the U.S.
- Discuss the factors that affect portfolio allocation and the demand for assets.
- Examine macro variables that affect the demand for money.
- Discuss the fundamentals of asset market equilibrium.
- Discuss the relationship between money growth and inflation.

The asset market

- Asset market: the entire set of markets in which people buy and sell real and financial assets, including gold, houses, stocks, bonds, and money.
- Money is the economist's term for assets that can be used in making payments, such as cash and checking accounts.
- One reason that money is important is that most prices are expressed in units of money, such as dollars, GBP, and euros.
- Because prices are measured in money terms, understanding money is key to understand the price level and the inflation rate.
- The amount of money may also affect real macro variables such as output and employment.

The functions of money

- Money: assets that are widely used and accepted as payment. Three functions of money:
- Medium of exchange.
  - Barter is inefficient – double coincidence of wants.
  - Money allows people to trade their labour for money, then use the money to buy goods and services in separate transactions.
  - Money thus permits people to trade with less cost in time and effort.
  - Money allows specialization, so people don't have to produce their own food, clothing, and shelter.

Ancient Egyptian Money

Ancient Money in Rome

Ancient Money in China

- Unit of account.
  - Money is basic unit for measuring economic value.
  - Simplifies comparisons of prices, wages, and incomes.
  - The unit-of-account function is closely linked with the medium-of-exchange function.
  - Countries with very high inflation may use a different unit of account, so they don't have to constantly change prices.
- Store of value.
  - Money can be used to hold wealth.
  - Most people use money only as a store of value for a short period and for small amounts, because it earns less interest than money in the bank.
  - As other types of assets (stocks, bonds, or real estate) can also be a store of value and normally pay the holder a higher return than money does, why do people still use money as a store of value. Answer: money's usefulness as a medium of exchange.

Types of money

- **Commodity money**: A commodity with some intrinsic value for money.
- **Fiat money**: Money that has no intrinsic value.
- Private Money: Money not issued by central bank. (e.g. Myki card)

Measuring money – the monetary aggregates (1 of 3)

- Distinguishing what is money from what isn't money is sometimes difficult:
  - For example, MMMFs (money market mutual funds, sell shares to the public and invest the proceeds in short-term gov. and corp. bonds) allow check-writing, but give a higher return than bank checking accounts: Are they money? No definitive answer.
  - There's no single best measure of the money stock.

Measuring money – the monetary aggregates (2 of 3)

There are two main official measures of money stock, called monetary aggregates.

- The $M1$ monetary aggregate (the most narrowly defined official money measure):
  - Currency and traveler's checks held by the public.
  - Transaction accounts on which checks may be drawn (i.e. checking account).
  - All components of $M1$ are used in making payments, so $M1$ is the closest money measure to our theoretical description of money.
- The $M2$ monetary aggregate
  - $M2 = M1 +$ less money like assets
- Additional assets in $M2$:
  - savings deposits.
  - small ($< \$100,00$) time deposits. Time deposits bear interest and have a fixed term (substantial penalty for early withdrawal).

Measuring money – the monetary aggregates (3 of 3)

- noninstitutional MMMF balances. They invest in very short-term securities and allow limited checkwriting.
- money-market deposit accounts (MMDAs) are offered by banks as a competitor to MMMFs.

U.S. Monetary Aggregates (April 2012)

M1	**2261.0**
Currency	1038.4
Travelers' checks	4.1
Transaction accounts	1218.5
M2	**9892.8**
Components of M1	2261.0
Savings deposits, including MMDAs	6279.0
Small-denomination time deposits	717.3
MMMFs (noninstitutional)	635.4

Note: Numbers may not add to totals shown owing to rounding.
Source: Federal Reserve Statistical Release H.6, June 7, 2012.
Data are not seasonally adjusted.

In Touch with Data and Research: Where have all the dollars gone?

- In 2012, U.S. currency averaged about $3300 per person, but surveys show people only hold about $100.
- Some is held by businesses and the underground economy, but most is held abroad. In some countries, dollarization reaches a level of 70% (e.g. Hong Kong).
- Foreigners hold dollars because of inflation in their local currency and political instability.

Where have all the dollars gone?

- Since currency is $1/2$ of $M1$ and over half of currency is held abroad, foreigners hold over $1/4$ of $M1$.
- The data show large fluctuations in $M1$ when major events occur abroad, like military conflicts.
- The U.S. benefits from foreign holdings of our currency, since they essentially get an interest-free loan (i.e. seigniorage).

Seigniorage

- The revenue raised by the printing of money is called **seigniorage**.
- A government can finance its spending in three ways:
    - tax (main source)
    - selling government bonds
    - print money

The money supply (1 of 2)

- The money supply
  - Money supply = money stock = amount of money available in the economy.
- Money supply is determined by the central bank.

  such as Federal Reserve in the U.S., RBA in Australia through monetary policy
  - Open market operations
  - Change the reserve ratio (China 2011-2016)

The money supply (2 of 2)

- How does the central bank of a country increase the money supply?
  - Use newly printed money to buy financial assets from the public – an open-market purchase.
  - To reduce the money supply, sell financial assets to the public to remove money from circulation – an open-market sale.
  - Open-market purchases and sales are called *open-market operations*.
  - Could also buy newly issued government bonds directly from the government (i.e. the Treasury).
  - This is the same as the government financing its expenditures directly by printing money.
  - This happens frequently in some countries (though is forbidden by law in the U.S.). I.e. independence of central bank.
- This topic focuses on open market operation as it is a key tool used by central bank in the implementation of monetary policy.

How do people allocate their wealth among various assets? Expected return

- How people determine the amount of money they choose to hold? We begin by considering a broader question: How do people allocate their wealth among various assets?
- Rate of return = an asset's increase in value per unit of time.
  - Bank account: Rate of return = interest rate.
  - Corporate stock: Rate of return = dividend yield + percent increase in stock price.
- Investors want assets with the highest expected return (other things equal).
- Returns not known in advance, so people estimate their expected return.

Risk

- Risk is the degree of uncertainty in an asset's return.
- People don't like risk, so they prefer assets with low risk (other things equal).
- Risk premium: the amount by which the expected return on a risky asset exceeds the return on an otherwise comparable safe asset.

Liquidity

- Liquidity: the ease and quickness with which an asset can be traded.
- Money is very liquid.
- Assets like automobiles and houses are very illiquid – long time and large transaction costs to trade them.
- Stocks and bonds are fairly liquid.
- Investors prefer liquid assets (other things equal).

Time to maturity

- Time to maturity: the amount of time until a financial security matures and the investor is repaid the principal.
- Expectations theory of the term structure of interest rates: Investors compare the returns on bonds with differing times to maturity to see which is expected to give them the highest return.
- "Term structure" refers to the fact that the theory explains why bonds that are similar in all respects except their terms to maturity have different rates of return.
- The idea that investors compare returns on bonds with differing times to maturity.
- In equilibrium, holding different types of bonds over the same period yields the same expected return.
- Because long-term interest rates usually exceed short-term interest rates, a risk premium exists: the compensation to an investor for bearing the risk of holding a long-term bond.

Types of assets and their characteristics (1 of 2)

- People hold many different assets, including money, bonds, stocks, houses, and consumer durable goods:
  - Money has a low return (or a zero return for currency), but low risk and high liquidity (the most liquid asset).
  - Bonds have a higher return than money, but have more risk and less liquidity.
  - Stocks pay dividends and can have capital gains and losses, and are much more risky than money.
  - Ownership of a small business is very risky and not liquid at all, but may pay a very high return.
  - Housing provides housing services and the potential for capital gains (almost sure in mainland China and HK), but is quite illiquid.

Types of assets and their characteristics (2 of 2)

- Households must consider what mix of assets they wish to own.
- The following table shows the mix in 2006, 2009, and 2012.
- The table illustrates the large declines in the value of stocks and housing in the financial crisis:
    - The value of housing has remained low.
    - The value of stocks has rebounded from 2009 to 2012.

Household Assets, 2006, 2009, and 2012

	Amounts in trillions of dollars			Percentages of total assets		
	2006:Q4	2009:Q1	2012:Q1	2006:Q4	2009:Q1	2012:Q1
Real estate	25.0	18.9	18.6	31.7	29.1	24.4
Consumer durables	4.3	4.6	4.8	5.4	7.0	6.3
Currency and checkable deposits	0.2	0.3	0.7	0.3	0.5	0.9
Time, savings, and other deposits	6.6	7.8	8.0	8.4	11.9	10.5
Bonds	5.1	6.1	5.9	6.4	9.3	7.7
Stocks	13.8	8.2	14.5	17.5	12.6	19.0
Proprietors' investment in unincorporated businesses	9.2	7.3	7.4	11.6	11.3	9.8
Pension funds	12.8	9.9	14.0	16.1	15.2	18.3
Other assets	1.9	2.1	2.4	2.5	3.2	3.2
Total Assets	79.0	65.2	76.3	100.0	100.0	100.0

Note: Numbers may not add to totals owing to rounding.
Source: Federal Reserve Flow of Funds Accounts of the United States, Statistical Release Z.1, June 7, 2012.

In touch with data and research: the housing crisis that began in 2007

- People gained tremendous wealth in their houses in the 2000s.
- As house prices rose, houses became increasingly unaffordable, leading mortgage lenders to create subprime loans for people who wouldn't normally qualify to buy houses.
- Most subprime loans had adjustable interest rates, with a low initial interest rate that would later rise in a process known as mortgage reset.

In touch with data and research: the housing crisis that began in 2007

- The housing crisis that began in 2007:
  - As long as housing prices kept rising, both lenders and borrowers thought the subprime loans would work out, as the borrowers could always sell their houses to pay off the loans.
  - But housing prices stopped rising as much, leading more subprime borrowers to default (i.e. strategic default), so banks began to tighten their lending standards, reducing the demand for housing and leading housing prices to start falling.
  - Many homeowners lost their homes and financial institutions lost hundreds of billions of dollars because of mortgage loan defaults.
  - Fannie Mae and Freddie Mac.
  - Because many mortgage loans had been securitized and were parts of mortgage-backed securities, the increased default rate on mortgages led to a financial crisis in Fall 2008, as many investors simultaneously tried to sell risky assets, including mortgage-backed securities and stocks.

Increase in home prices from one year earlier, 1976-2012
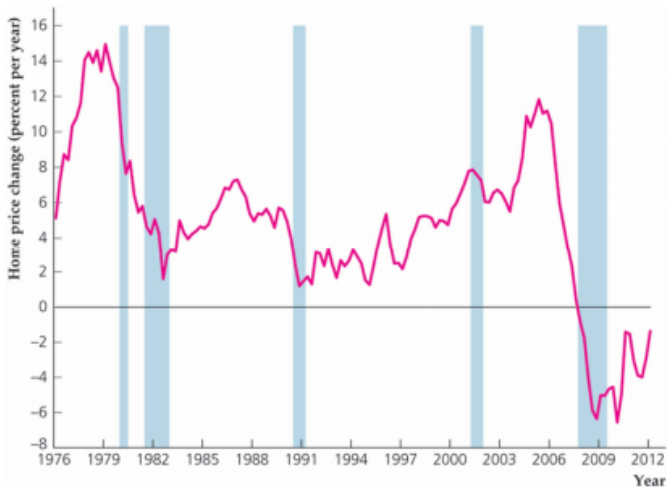
Source: Federal Housing Finance Agency, www.fhfa.gov.

Asset Demands

- Trade-off among expected return, risk, liquidity, and time to maturity.
- Assets with low risk and high liquidity, like checking accounts, have low expected returns.
- Investors consider diversification: spreading out investments in different assets to reduce risk.
- The amount a wealth holder wants of an asset is his or her demand for that asset.
- The sum of asset demands equals total wealth.

The Demand for Money

- The demand for money is the quantity of monetary assets people want to hold in their portfolios:
  - Money demand depends on expected return, risk, and liquidity.
  - Money is the most liquid asset.
  - Money pays a low return.
- People's money-holding decisions depend on how much they value liquidity against the low return on money.
- Nominal money demand: in terms of dollars.
- Real money demand: in terms of goods it can buy.
- Assume all assets can be grouped into two categories
  - Money
  - Nonmonetary assets (which are interest-bearing assets such as shares and bonds)

Key macroeconomic variables that affect money demand

- Price level:
    - The higher the price level, the more money you need for transactions.
    - Prices are 10 times as high today as in 1935, so it takes 10 times as much money for equivalent transactions.
    - Nominal money demand is thus proportional to the price level.

Key macroeconomic variables that affect money demand

- Real income:
  - The more transactions you conduct, the more money you need.
  - Real income is a prime determinant of the number of transactions you conduct.
  - So money demand rises as real income rises.
  - But money demand isn't proportional to real income, since higher-income individuals use money more efficiently, and since a country's financial sophistication grows as its income rises (use of credit and more sophisticated assets).
  - Result: Money demand rises less than 1-to-1 with a rise in real income.

Key macroeconomic variables that affect money demand

- Interest rates:
  - An increase in the interest rate or return on nonmonetary assets decreases the demand for money.
  - An increase in the interest rate on money increases money demand.
  - This occurs as people trade off liquidity for return.
  - Though there are many nonmonetary assets with many different interest rates, because they often move together we assume that for nonmonetary assets there's just one nominal interest rate, i.

The money demand function

- The nominal money demand function:
$$M^d = P \times L(Y, i)$$
where M^d is nominal money demand (aggregate), P is the price level, L is the real money demand function (independent of P), Y is real income or output, and i is the nominal interest rate on nonmonetary assets.

- Nominal money demand is proportional to the price level. A rise in Y increases money demand; a rise in i reduces money demand. We exclude i^m from this function since it doesn't vary much.

- Alternative expression:
$$M^d = P \times L(Y, r + \pi^e)$$
A rise in r or π^e reduces money demand.

Real money demand

- Real money demand function

$$\frac{M^d}{P} = L(Y, i)$$

Change in P does not affect real money demand $L(Y, i)$.

- Real income (Y):
  - The higher the real income, the more transactions you conduct and so, the more money you want.
  - So money demand rises as real income rises.
- Nominal interest rates on nonmonetary assets (i):
  - A rise in i (a rise in r or π^e) on non-money asset decreases money demand because holders of assets switch from money to higher-return non-money asset.

Other factors affecting money demand

- Wealth: A rise in wealth may increase money demand, but not by much.
- Risk:
  - Increased riskiness in the economy may increase money demand.
  - Times of erratic inflation bring increased risk to money, so money demand declines.
- Liquidity of alternative assets: Deregulation, competition, and innovation have given other assets more liquidity, reducing the demand for money.
- Payment technologies: Credit cards, ATMs, and other financial innovations reduce money demand.

Elasticities of money demand

- How strong are the various effects on money demand?
- Statistical studies on the money demand function show results in elasticities.
- Elasticity: The percent change in money demand caused by a one percent change in some factor.
- Income elasticity of money demand
  - Positive: Higher income increases money demand.
  - Less than one: Higher income increases money demand less than proportionately.
  - Goldfeld's results: income elasticity $= 2/3$.
- Interest elasticity of money demand
  - Small and negative: Higher interest rate on nonmonetary assets reduces money demand slightly.
- Price elasticity of money demand is unitary, so money demand is proportional to the price level.
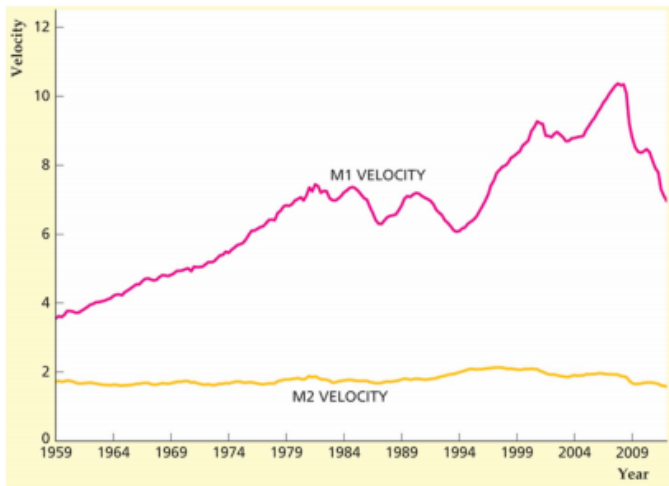
Velocity and the quantity theory of money

- Velocity (V) measures how much money "turns over" each period.
- V = nominal GDP/nominal money stock = $\frac{PY}{M}$
- Plot of velocities for $M1$ and $M2$ shows fairly stable velocity for $M2$, erratic velocity for $M1$ beginning in early 1980s.
- Plot of money growth shows that instability in velocity translates into erratic movements in money growth.
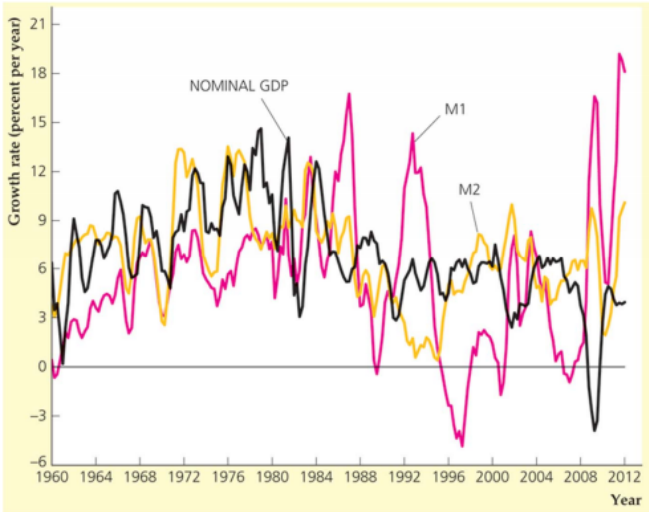- Quantity theory of money: Real money demand is proportional to real income. If so,

$$M^d/P = kY$$

Assumes constant velocity, where velocity isn't affected by income or interest rates.

Velocity of M1 and M2, 1959-2012

Growth rates of M1 and M2, 1960-2012

Velocity and the quantity theory of money

- But velocity of $M1$ is not constant; it rose steadily from 1960 to 1980 and has been erratic since then.
  - Part of the change in velocity is due to changes in interest rates in the 1980s.
  - Financial innovations also played a role in velocity's decline in the early 1980s.
- $M2$ velocity is closer to being a constant, but not over short periods.

Asset market equilibrium – an aggregation assumption

- Assume that all assets can be grouped into two categories, money and nonmonetary assets:
  - Money includes currency and checking accounts. Pays interest rate i^m. Supply is fixed at M.
- Nonmonetary assets include stocks, bonds, land, etc.
  - Pays interest rate $i = r + \pi^e$.
  - Supply is fixed at NM.

Asset market equilibrium – an aggregation assumption

- Asset market equilibrium occurs when quantity of money supplied equals quantity of money demanded:
  - $m^d + nm^d$ = total nominal wealth of an individual.
  - $M^d + NM^d$ = aggregate nominal wealth. (from adding up individual wealth)
- $M + NM$ = aggregate nominal wealth. (supply of assets)
- Combining the two equations gives:

$$(M^d - M) + (NM^d - NM) = 0$$

  which means that excess demand for money ($M^d - M$) plus excess demand for nonmonetary assets ($NM^d - NM$) equals 0.
- So if money supply equals money demand, nonmonetary asset supply must equal nonmonetary asset demand; then entire asset market is in equilibrium.

Asset market equilibrium – an aggregation assumption

- The asset market equilibrium condition:

$$M/P = L(Y, r + \pi^e)$$

which means that real money supply = real money demand.

  - M is determined by the central bank.
  - π^e is fixed (for now).
  - The labour market determines the level of employment; using employment in the production function determines Y.

- Given Y, the goods market equilibrium condition determines r.

Asset market equilibrium – an aggregation assumption

- With all the other variables in the last equation determined, the asset market equilibrium condition determines the price level:

$$P = M/L(Y, r + \pi^e)$$

where the price level is the ratio of nominal money supply to real money demand.

- For example, doubling the money supply would double the price level.

Money Growth and Inflation (1 of 3)

- The inflation rate (growth rate of the price level) is closely related to the growth rate of the money supply.

- Rewrite the last equation in growth-rate terms:

$$\Delta P/P = \Delta M/M - \Delta L(Y, r + \pi^e)/L(Y, r + \pi^e)$$

- If the asset market is in equilibrium, the inflation rate equals the growth rate of the nominal money supply minus the growth rate of real money demand.

Money Growth and Inflation (2 of 3)

- To predict inflation we must forecast both money supply growth and real money demand growth:
- From the last equation, we have:

$$\pi = \frac{\Delta M}{M} - \eta_Y \frac{\Delta Y}{Y} - \eta_i \frac{\Delta i}{i}$$

η_Y: elasticity of money demand with respect to income (between 0 and 1)

η_i: elasticity of money demand with respect to nominal interest rate (a small negative value)

Money Growth and Inflation (3 of 3)

- Both the growth rates of money demand and money supply affect inflation, but (in cases of high inflation) usually growth of nominal money supply is the most important factor because
  - η_Y is less than one, and η_i is small, money demand doesn't vary much, no matter how well or poorly an economy is doing.
  - But nominal money supply growth differs across countries by hundreds of percentage points, so large inflation differences must be due to money supply, not money demand.
  - The following figure shows the link between money growth and inflation in these countries; inflation is clearly positively associated with money growth.

The relationship between money growth and inflation
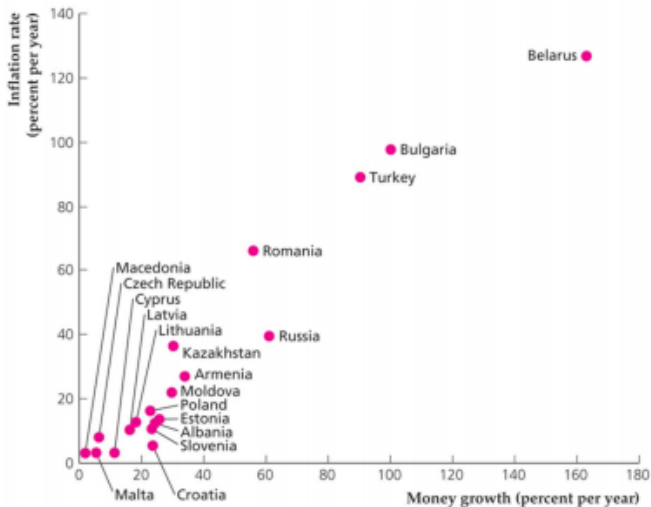
Application: money growth and inflation in the European countries in transition

- Though the countries of Eastern Europe are becoming more market-oriented, Russia and some others have high inflation because of rapid money growth.
- So why do countries allow money supplies to grow quickly, if they know it will cause inflation?
  - In practice, government can finance its spending in three ways.
    - Raise taxes
    - Borrow from the public
    - Print money: seigniorage
  - They sometimes find that printing money is the only way to finance government expenditures.
    - Central bank prints money to buy newly issued government bonds from the government itself.
  - This is especially true for very poor countries, or countries in political crisis.

The expected inflation rate and the nominal interest rate

- For a given real interest rate (r), expected inflation (π^e) determines the nominal interest rate ($i = r + \pi^e$).
- What factors determine expected inflation?
  - People could use the last equation, relating inflation to the growth rates of the nominal money supply and real income.
  - If people expect an increase in money growth, they would then expect a commensurate increase in the inflation rate.
  - The expected inflation rate would equal the current inflation rate if money growth and income growth were stable.

The expected inflation rate and the nominal interest rate

- Expectations can't be observed directly
  - They can be measured roughly by surveys.
  - If real interest rates are stable, expected inflation can be inferred from nominal interest rates.
  - Policy actions that cause expected inflation to rise should cause nominal interest rates to rise.

The expected inflation rate and the nominal interest rate

- The following figure plots U.S. inflation and nominal interest rates:
  - Inflation and nominal interest rates have tended to move together.
  - But the real interest rate is clearly not constant.
  - The real interest rate was negative in the mid-1970s, then became much higher and positive in the late-1970s to early-1980s.
  - The real interest rate turned negative again following the financial crisis that began in 2008.

Inflation and the nominal interest rate in the United States, 1960-2012
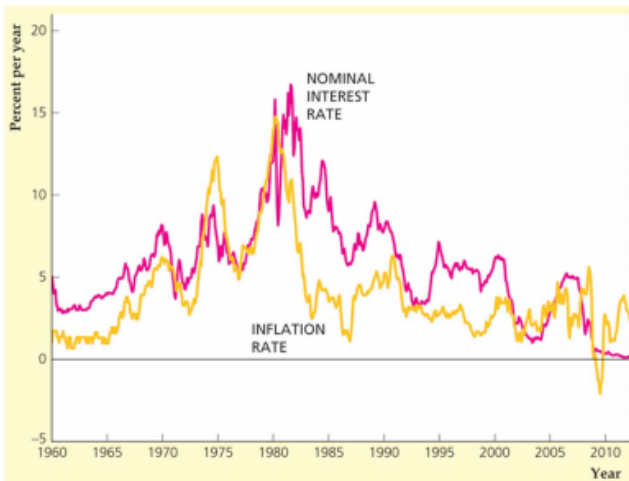
Application: measuring inflation expectations (1 of 3)

- How do we find out people's expectations of inflation?
  - We could look at surveys.
  - But a better way is to observe implicit expectations from bond interest rates.
- The U.S. government issues nominal bonds and Treasury Inflation Protected Securities (TIPS)
  - TIPS bonds make real interest payments by adjusting interest and principal for inflation.
  - Compare nominal interest rate with real interest rate (the next figure).

# Interest rates on nominal and TIPS ten-year notes, 1997-2012
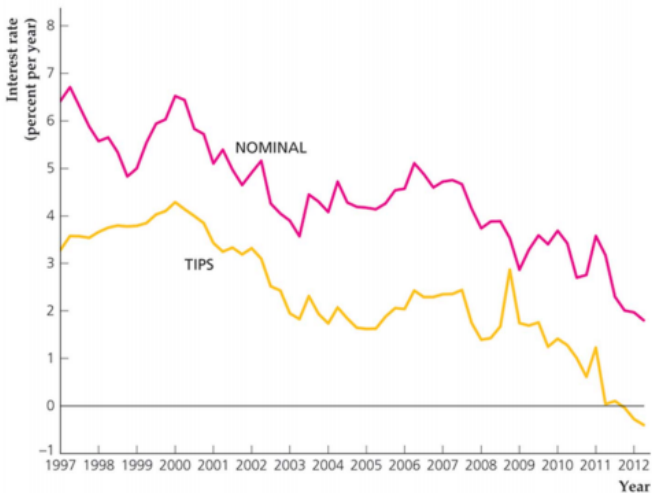
Application: measuring inflation expectations (2 of 3)

- The interest rate differential: interest rate on nominal bonds minus real interest rate on TIPS bonds.
  - The interest rate differential is a rough measure of expected inflation.
  - TIPS bonds have lower inflation risk, so the measure of expected inflation may be too high.
  - TIPS bonds do not have as liquid of a market, so the measure of expected inflation may be too low.
  - The net effect of the two effects is likely to be small, so the measure of expected inflation may be about right.

Application: measuring inflation expectations (3 of 3)

- The data show fluctuations in the expected inflation rate based on the interest rate differential (the next figure):
  - In contrast, the rate of expected inflation measured in surveys has been fairly constant.
  - Either bond market participants have very different inflation expectations than forecasters, or else the degree of inflation risk and liquidity on TIPS bonds varied substantially from 1998 to 2009.

Alternative measures of expected inflation, 1997-2012
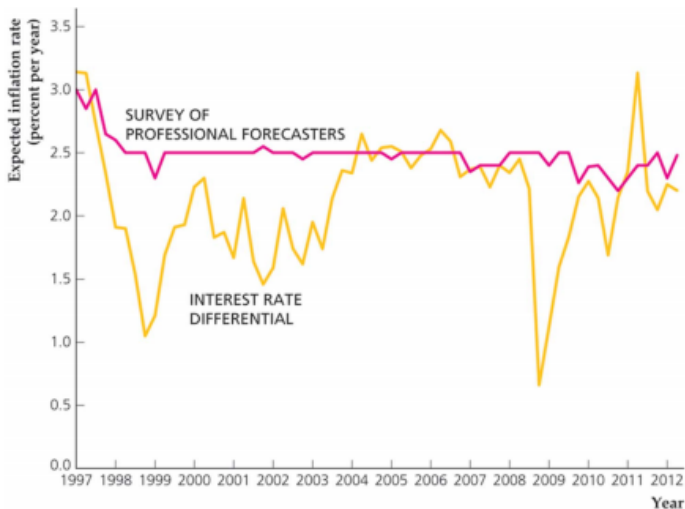
Inflation

- Government policies are to keep price stable (and maintain full employment, achieve long-run growth).
- A little bit of inflation (say, 2% or 3%) are not regarded as harmful.
- But high inflation such as hyperinflation (sometimes defined as 30% or more inflation in a year) can be harmful:
    - Menu costs (cost of changing price by printing new menus, catalog, etc) become large during hyperinflation.
    - Highly volatile and rapidly rising prices bring uncertainty about the relative prices and can alter consumption behavior.
    - Hyperinflation makes the economy run less efficiently.