An Introduction to Finance

Teachers' Workshop 2008

Michael T. Owyang

Federal Reserve Bank of St. Louis

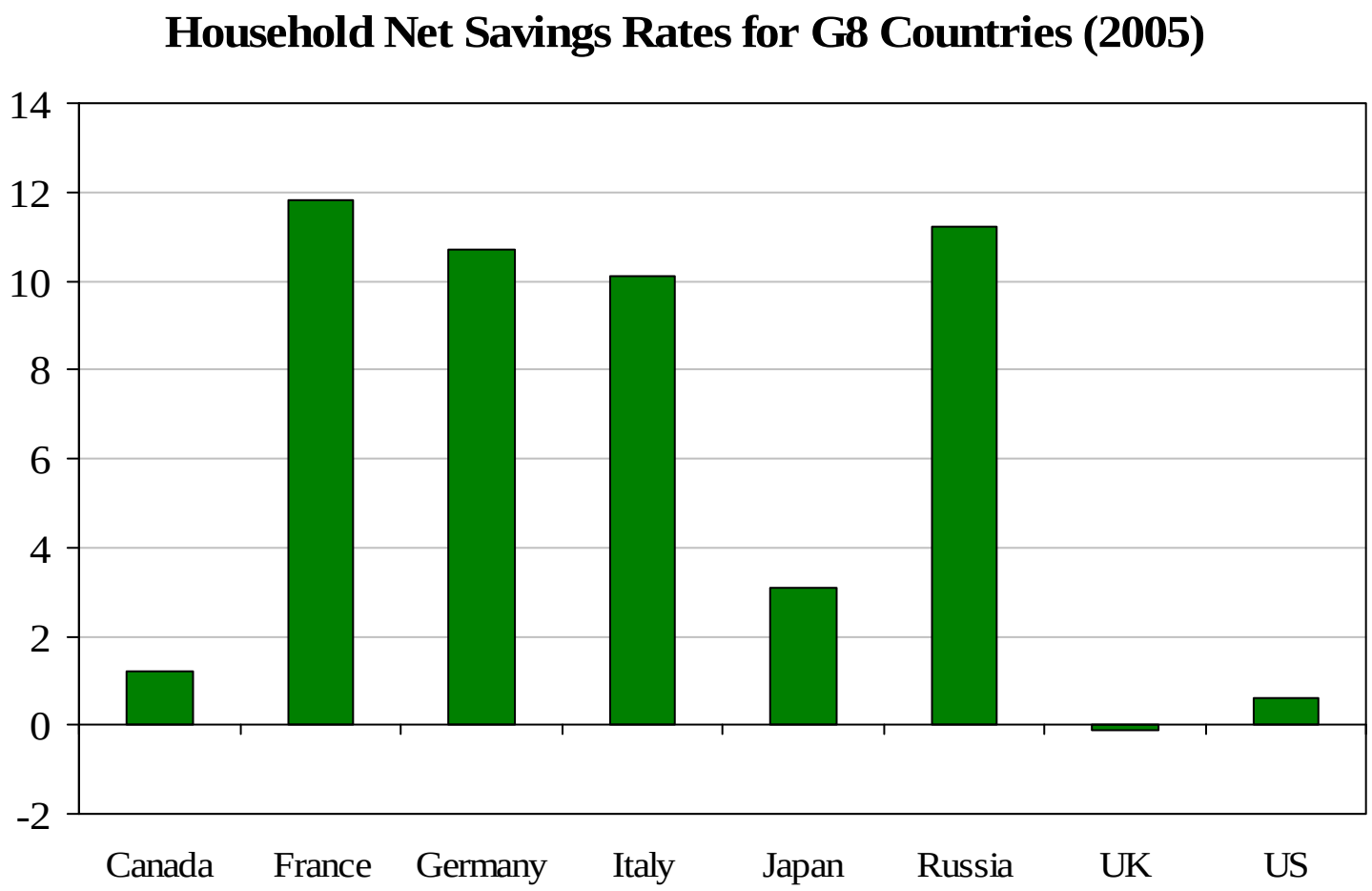
Disclaimer

The views expressed here do not reflect official positions of the Federal Reserve Bank of St. Louis or the Federal Reserve System.

Motivation

- Why do we care about personal finance?
- Why should we teach students about personal finance?
  - Savings

Personal Savings Rate by Country

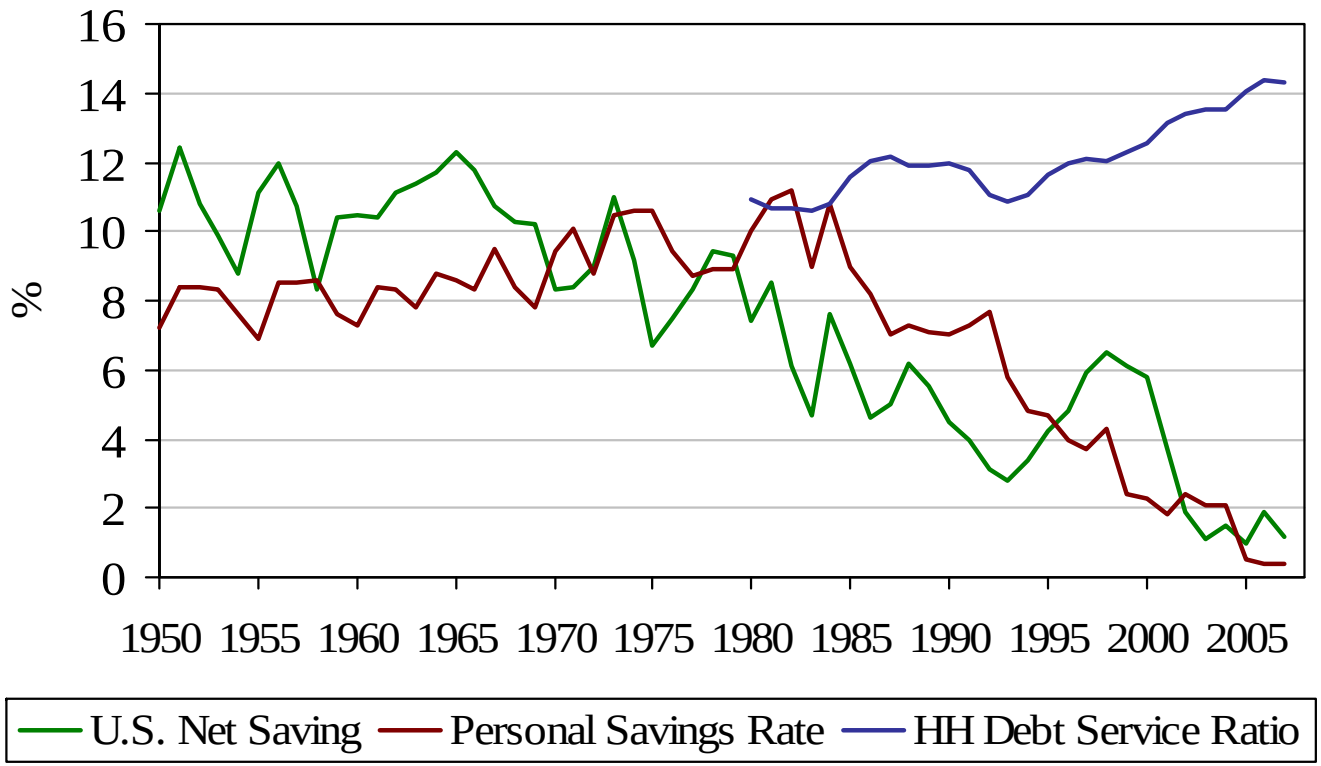


NOTE: Saving as % of HH disposable income; SOURCE: OECD Factbook 2008: Economic, Environmental, and Social Statistics

Motivation

- Why do we care about personal finance?
- Why should we teach students about personal finance?
  - Savings
  - Debt

U.S. Savings & Debt

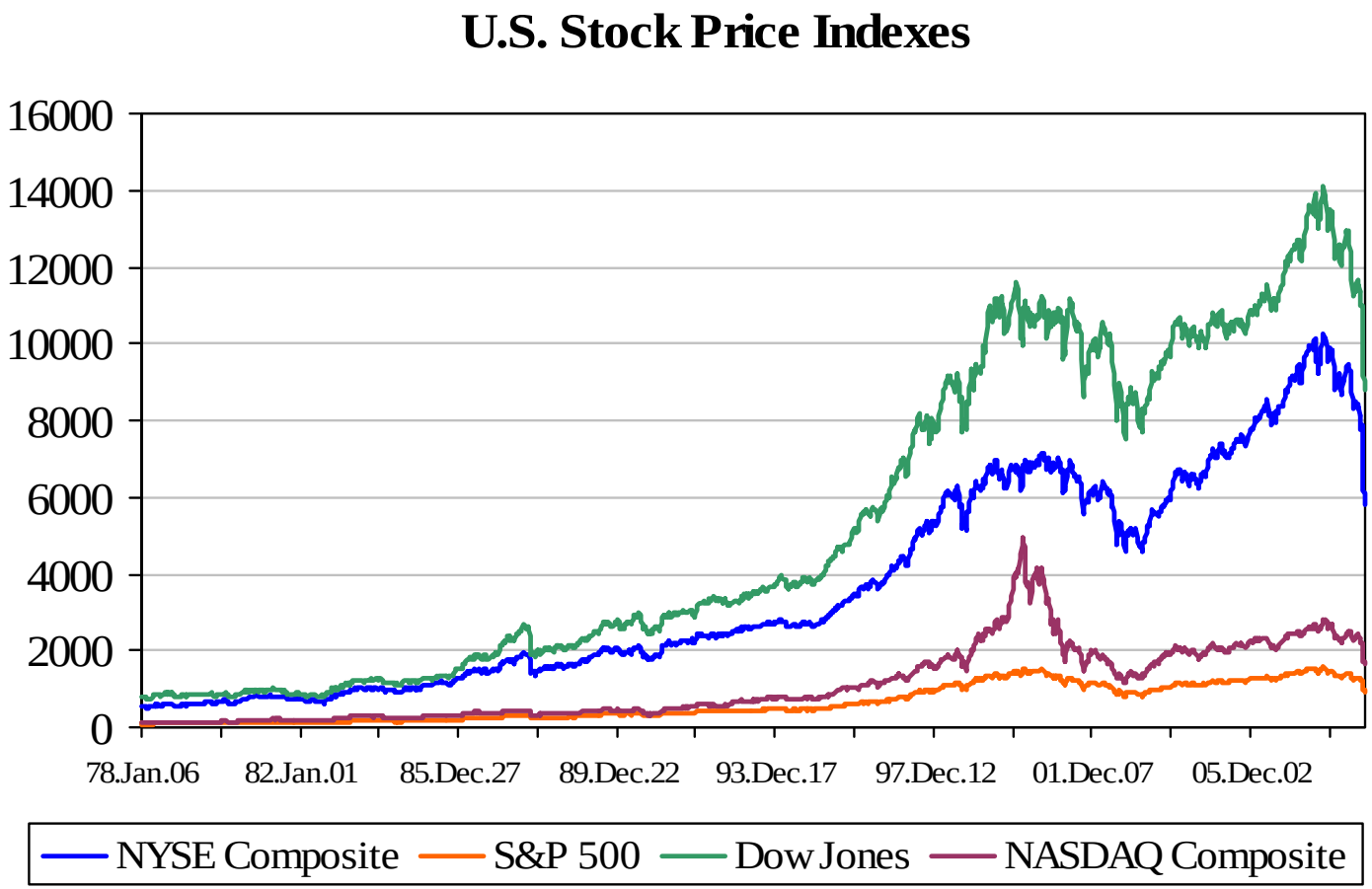


NOTE: U.S. Net Saving as % of Gross National Income; Personal Saving and HH Debt as % of HH disposable income;
SOURCE: Bureau of Economic Analysis, Federal Reserve Board

Motivation

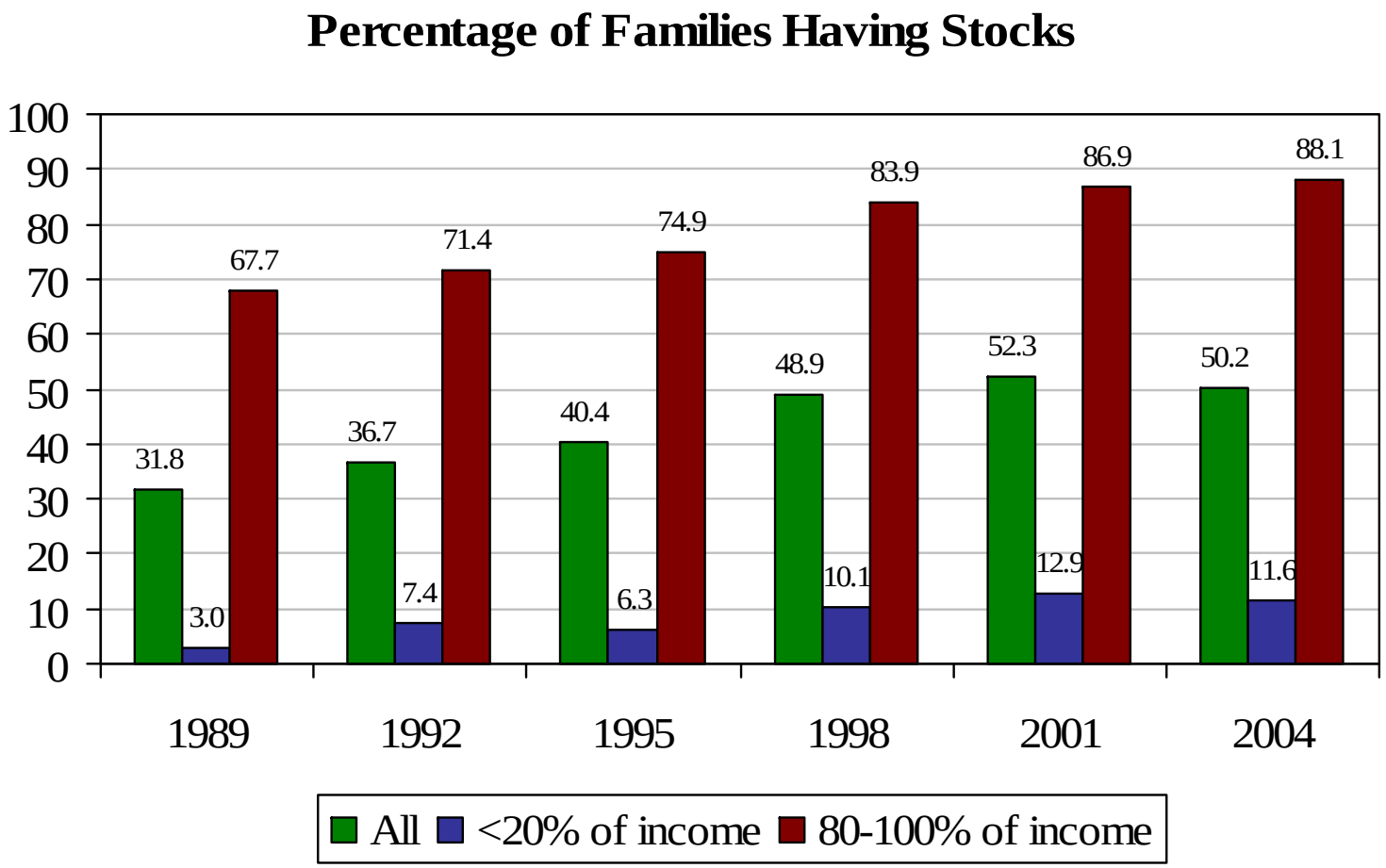
- Why do we care about personal finance?
- Why should we teach students about personal finance?
  - Savings
  - Debt
  - Investments

Stock Prices



NOTE: Data are averages for week ending Friday; for NYSE Composite, Dec.31, 2002=5000; for S&P 500, 1941-43=100; for Down Jones 30 Industrial Stocks, average price close; for NASDAQ Composite, Feb.5, 1971=100. The last week on the chart is the week ending October 24, 2008. Historical prices can be found at http://finance.yahoo.com/.

Stock Ownership



NOTE: Table includes direct and indirect stock holdings; from 2004 Survey of Consumer Finances.

Overview

An Overview of the Sessions

Session A: An introduction to finance

- The time value of money
  - Future Value
  - Present Value
- Risk, Return, and Diversification
  - What is risk and why don’t we like it?
  - How can we mitigate it?
  - How are we rewarded for taking it?

An Overview of the Sessions

Session B: Assets

- Bonds
  - Types of bonds
  - Yields
  - Returns
  - Pricing
- Stocks
  - Dividends
  - Portfolios and risk
  - Pricing stocks

An Overview of the Sessions

Session C: Liabilities

- Mortgages
  - Types of mortgages (Fixed Rates, ARMs)
  - Amortization and mortgage finance
- Payday Loans
  - Who gets payday loans?
  - Are they associated with bankruptcy?
- Credit Cards
  - The Credit-Debt Puzzle

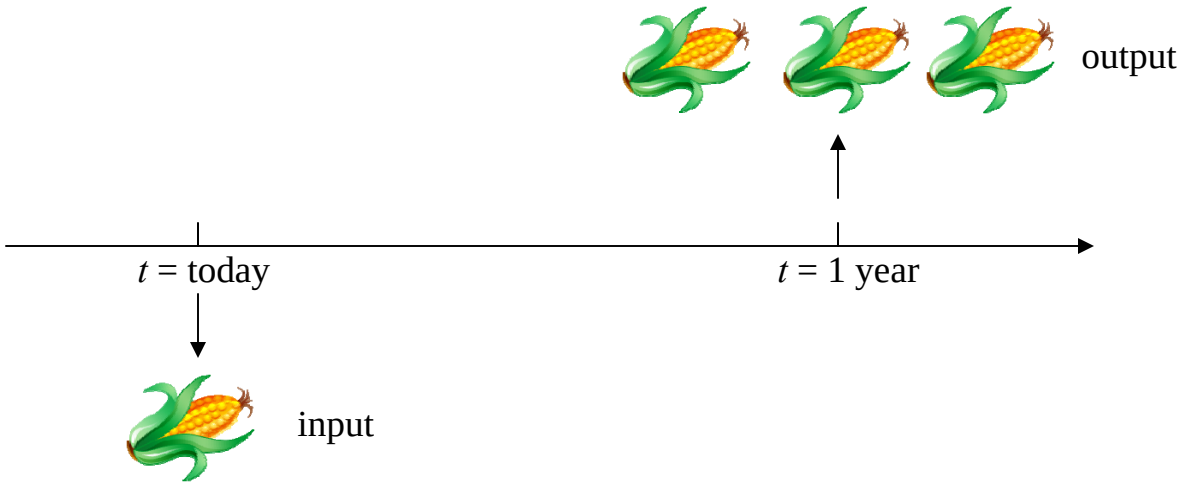
The Value of Money

The Value of Money

- What is an interest rate?
- Why do banks pay interest rates?
  - Banks pay to obtain funds to loan at a higher interest rate
- What does this mean for us?
  - Money now is more valuable than money in the future

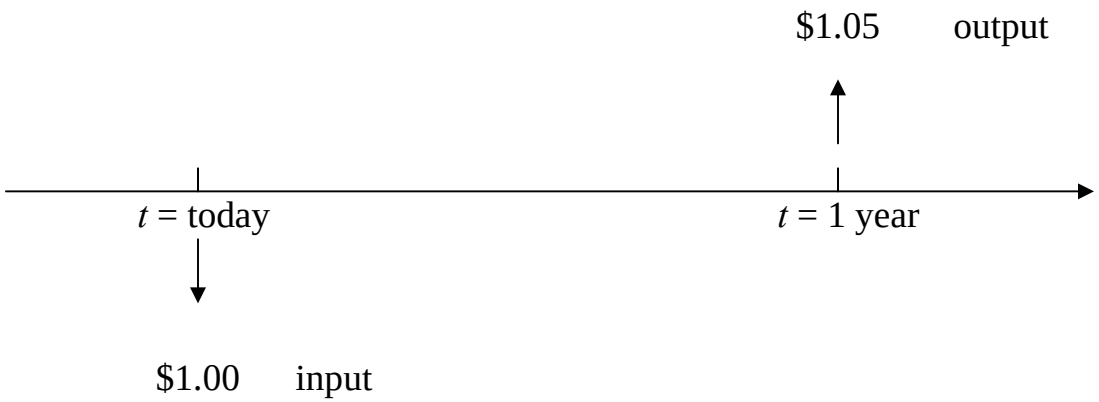
The Future Value of Assets 1

- Real Example: Suppose I give you an ear of corn now. You could eat it or you could plant it and get 3 ears of corn 1 year from now. The future value of that corn is 3 ears.



The Future Value of Assets 2

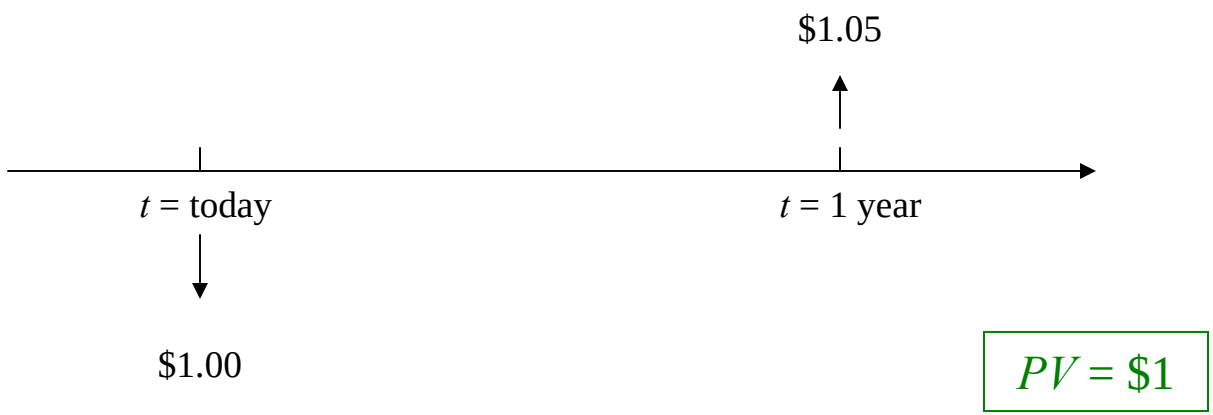
- Now suppose I give you $1 and tell you the interest rate is 5%. You can spend $1 now or you can save it at 5% and in 1 year you'd have $1.05. The future value of $1, in this case, is $1.05.



- Formula: $$FV = (1+r)^t$$

The Present Value of Future Assets 1

- Suppose the interest rate is still 5% and I promise to give you $1.05 next year. What's the present value of that $1.05?



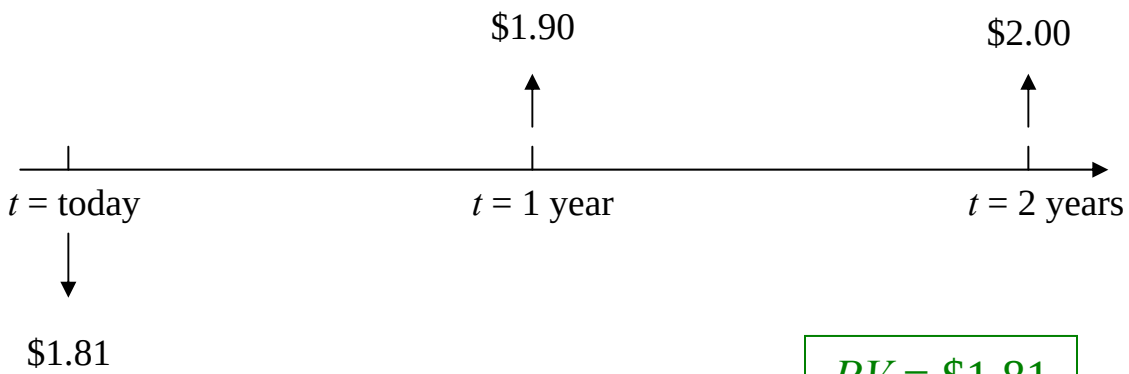
The Present Value of Future Assets 2

- Suppose now that I promise to give you $2.00 next year. What's the present value of that $2.00 one year from now?

$PV = \$1.90$

The Present Value of Future Assets 3

- Suppose now that I promise to give you $2.00 two years from now (and the interest rate remains unchanged). What's the present value of $2.00 two years from now?



$PV = \$1.81$

- Formula for Present Value: $$PV = \frac{FV}{(1+r)^t}$$

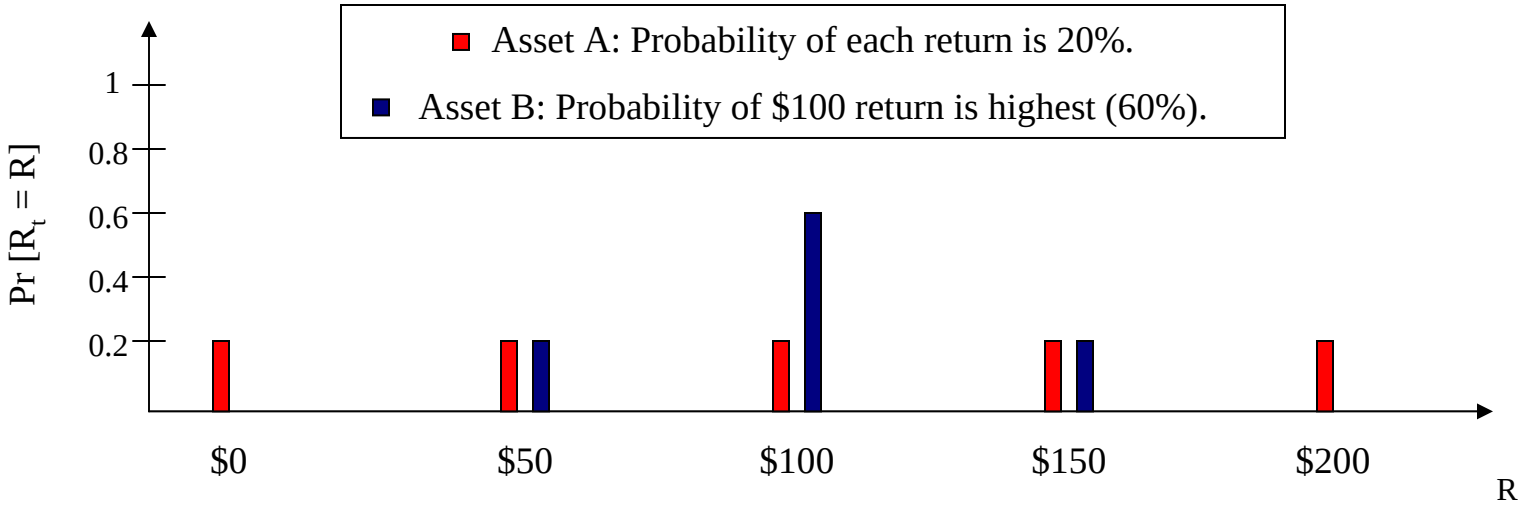
Summary

- Money now is better than the same money later
- Higher interest rates make:
  - Money now more valuable because….
    - …its future value of that money now rises
  - Money later less valuable because…
    - …the present value of that money later falls

Risk and Return

Risk and Return 1

- Asset returns are often uncertain (risky)



- Both have expected return of $100, but Asset A is riskier

Risk and Return 2

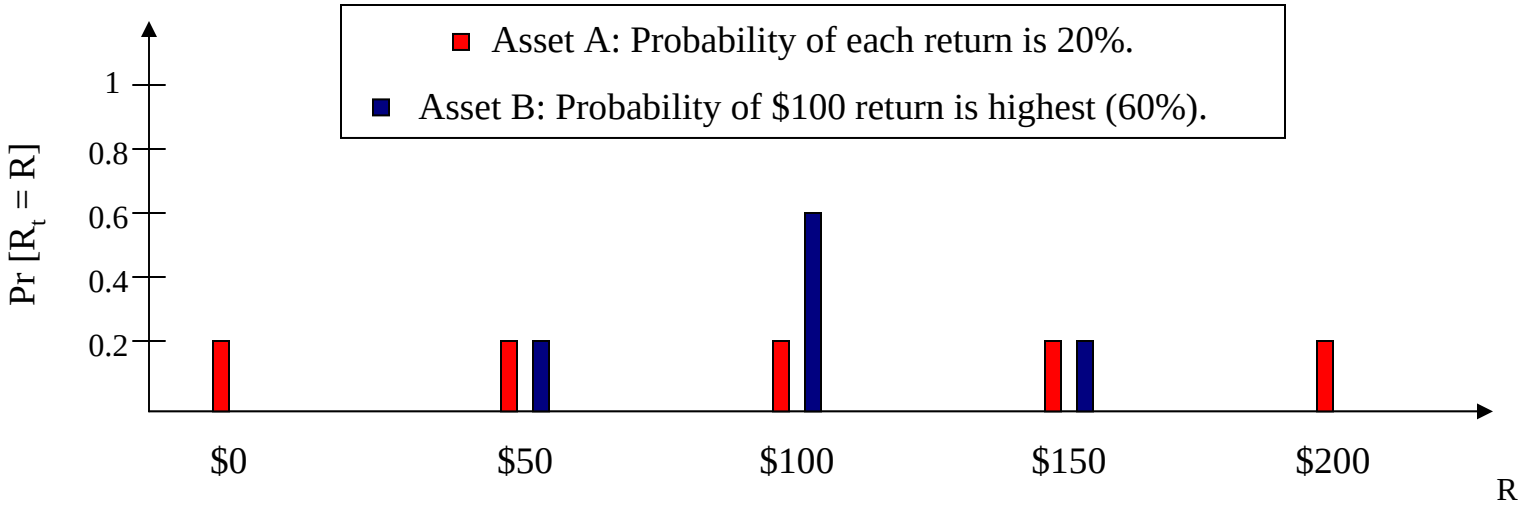
- People tend not to like risk => must pay people to take risk
- So…if r is the expected return on an asset,

$$r = r_f + \pi$$

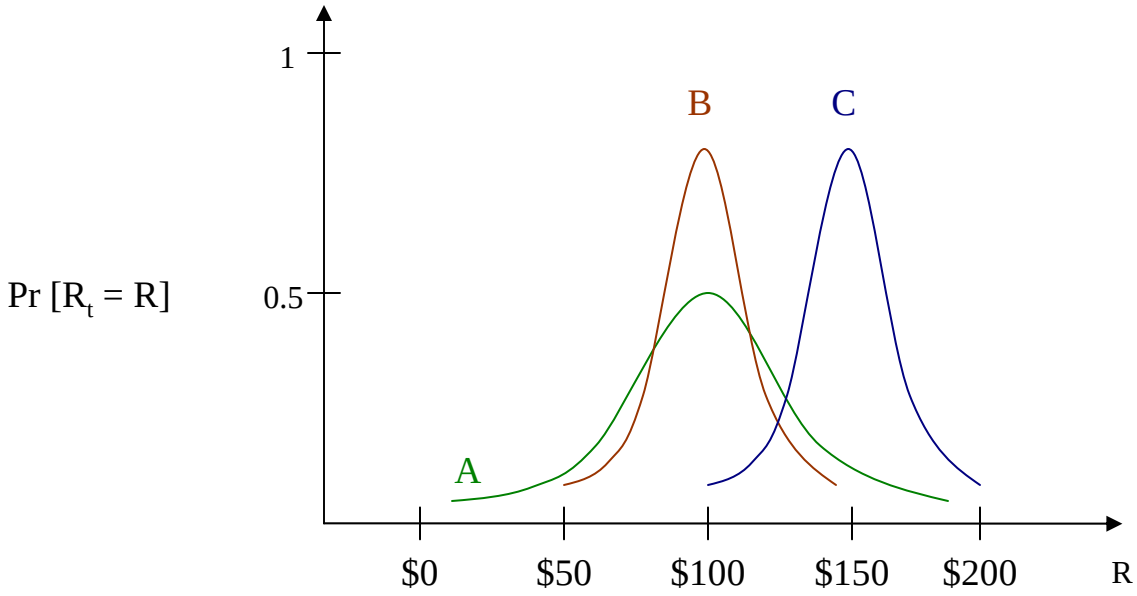
- r_f is the risk-free rate (maybe a savings rate)
- π is the risk premium

How Do We Measure Risk?

- A convenient measure of risk is the standard deviation (spread) of returns



How Do We Measure Risk?



- Asset A has the same expected return as Asset B but is riskier
- Asset C has the same risk as Asset B but has a higher expected return

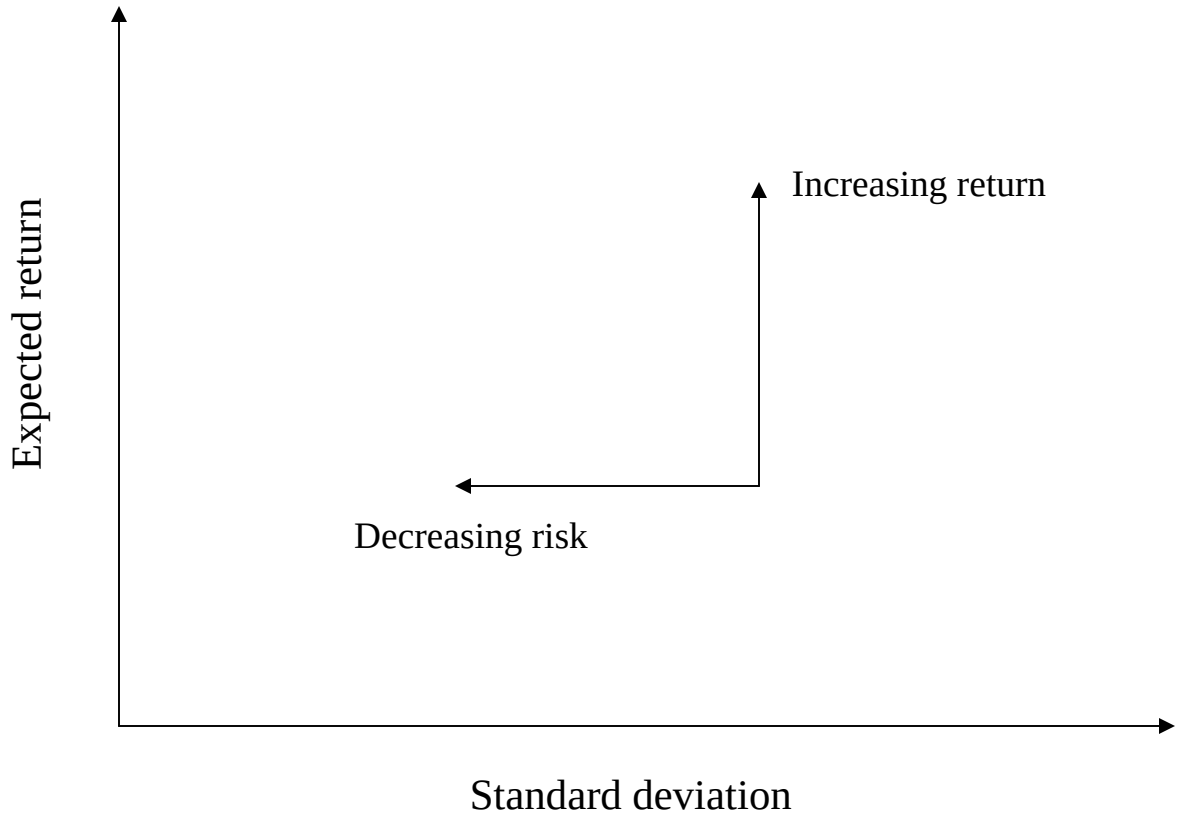
Managing Risk

- Broadly, two kinds of risk: Systematic risk and idiosyncratic risk (other kinds of risk can usually fit into these two categories)
- Systematic risk is common to many assets and is non-diversifiable
- Idiosyncratic risk is particular to one asset and is diversifiable
- Diversification can eliminate some risks
- We diversify by buying a portfolio of assets

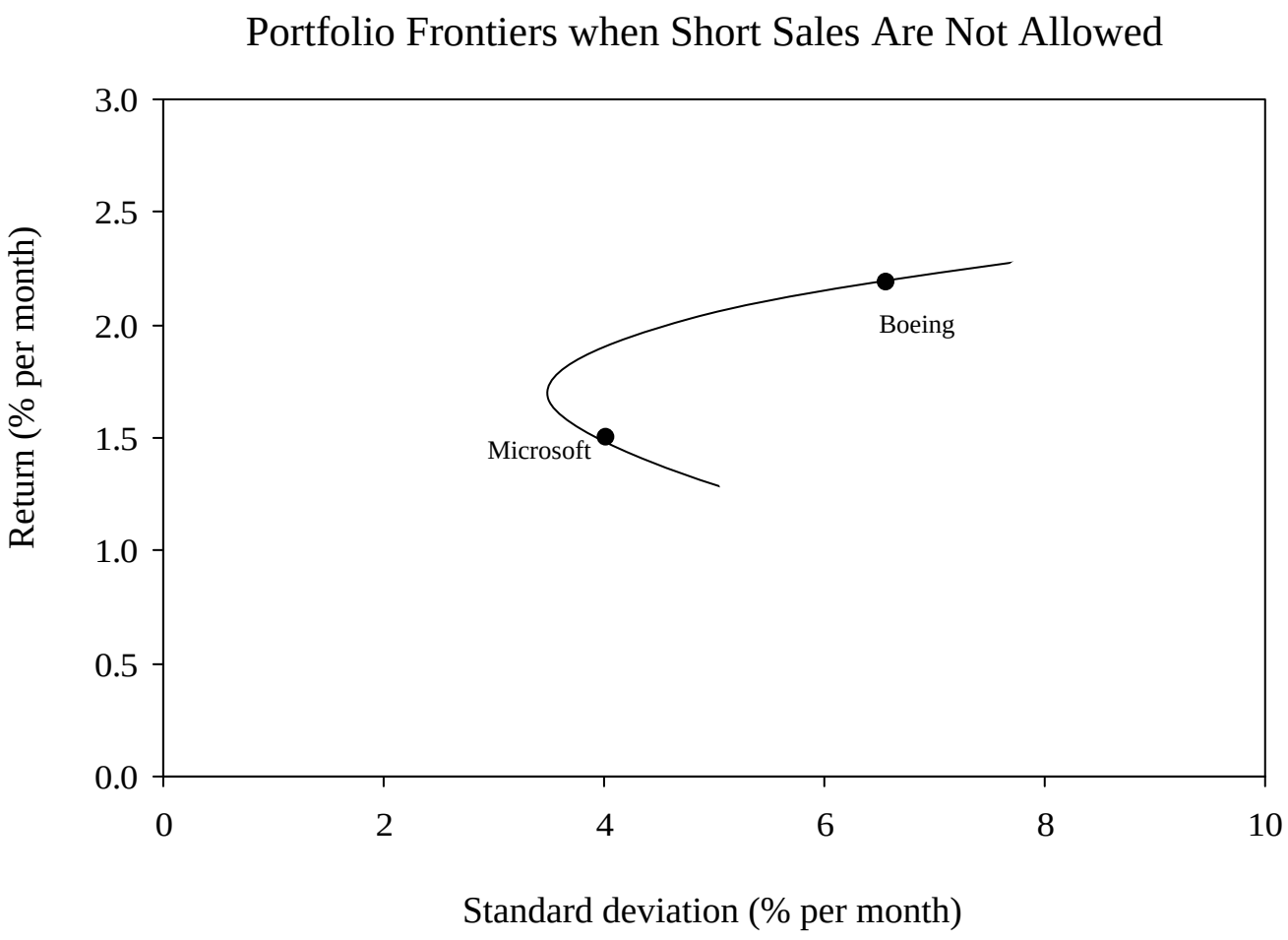
What Is a Portfolio?

- A portfolio is a collection of assets whose return is a weighted average of the individual asset returns
- Why construct a portfolio? Asset returns may be correlated
  - For example: American Airlines and Delta vs. American Airlines and Exxon
    - Might expect that AA and Delta move together (positively correlated)
    - Might expect AA and Exxon to move in opposite directions (negatively correlated)

Trading Off Risk and Return

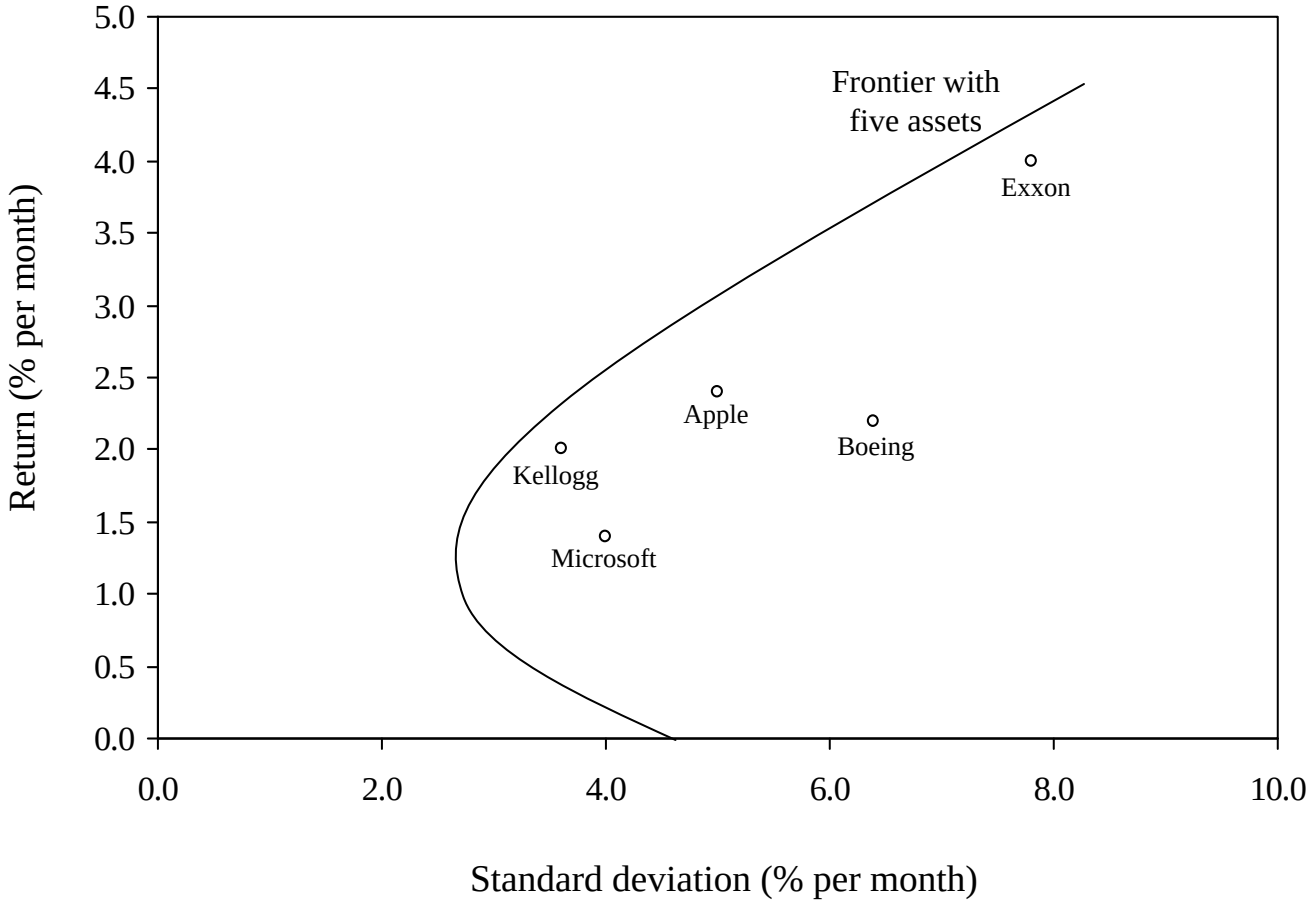


A Graph of a Portfolio



NOTE: Values were arbitrarily assigned; for demonstration purposes only.

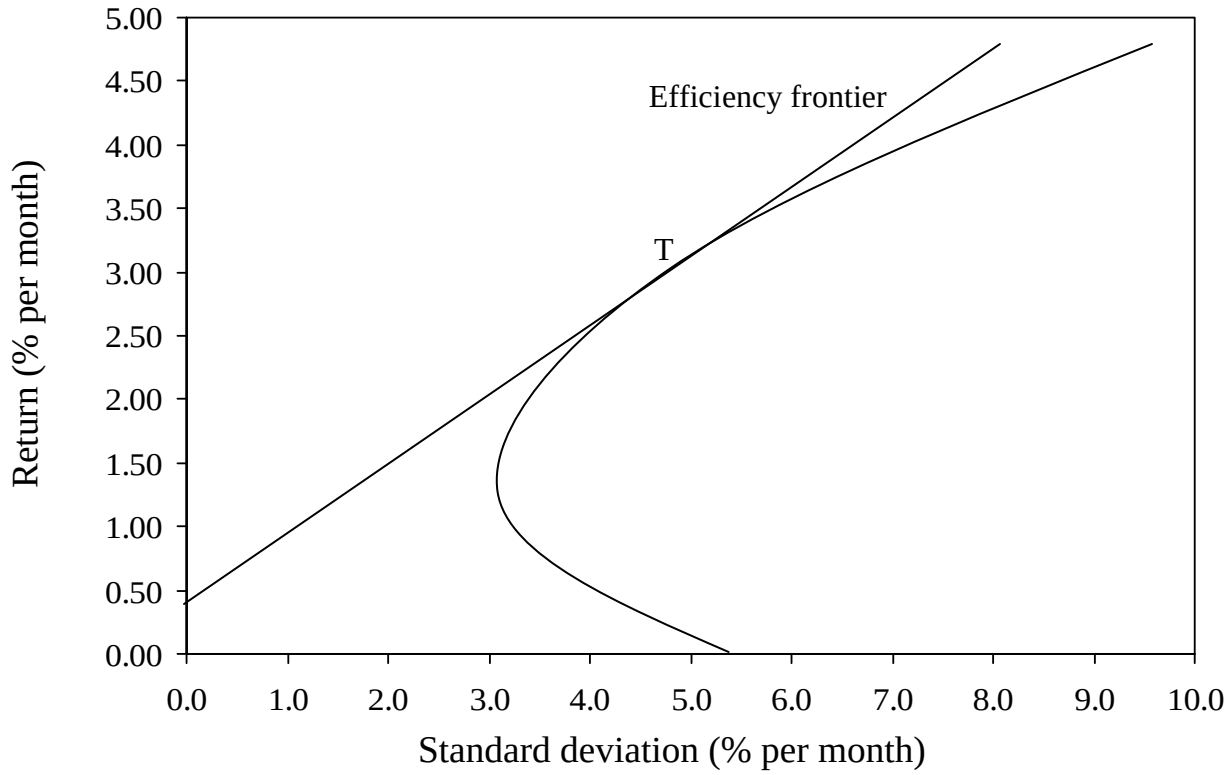
Multiple Assets



NOTE: Values were arbitrarily assigned; for demonstration purposes only.

The Efficient Frontier

- The EF provides asset combinations with the lowest risk for any expected return



Summary

- Cash now is more valuable than cash later
- Certain cash is preferred over uncertain (risky) cash
- Risk is bad but
- Can eliminate some (idiosyncratic) risk by diversifying (creating a portfolio of assets)
- Not all risk can be eliminated

Session B:
Assets

Types of Assets

- Bonds
- Stocks
- Commodities
- Futures
- Options
- Housing and Land
- More…

Bonds

Bonds

What are bonds?

- Agreement to borrow certain amount of money (principal) at a particular interest rate (coupon rate)
- Price/value of the bond depends on the interest rate
- Can be secured (backed by real assets) or unsecured
- Fixed maturity with no ownership but senior asset claims

Risk/Return on Bonds

Return

- Interest
- Capital Gains

Risk

- Interest Rate Risk
- Inflation
- Default
- Others…(call risk, liquidity)

Returns on a Bond

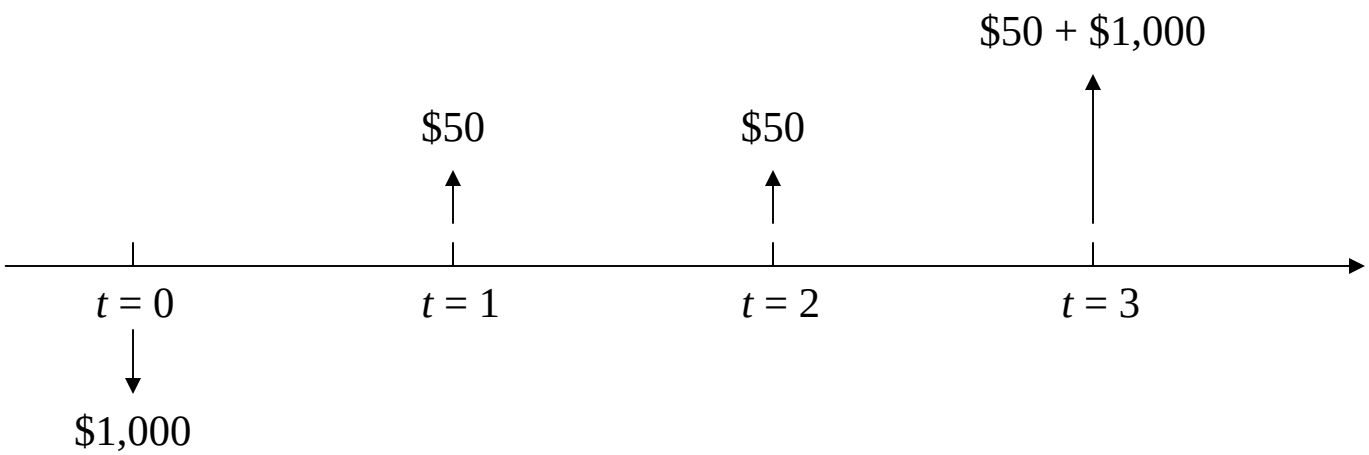
$$R_t = \frac{P_{t+1} - P_t}{P_t} - \frac{I_t}{P_t}$$

Capital gains Interest

- Things that affect return on a bond:
  - Maturity
  - Size
  - Risk
  - Market rates

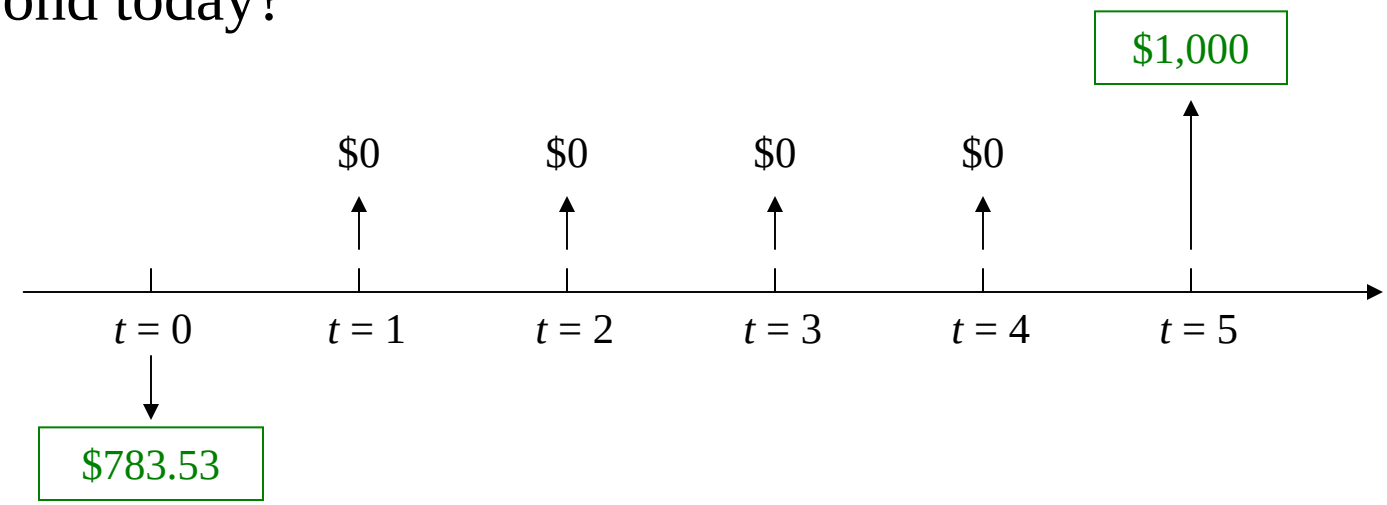
Cash Flow for Bonds 1

- <u>Coupon Bond</u>: say you have a 3-year bond with principal of $1,000 and annual coupon payment of 5%



Cash Flow for Bonds 2

- Zero-Coupon (Discount) Bond: e.g., U.S. Treasury bills, U.S. savings bonds
- Say you have a bond (5% interest rate) that matures in 5 years and will pay $1,000. How much will you pay for the bond today?



- Formula: $P_t = \$1{,}000 * \frac{1}{(1+r_t)^t} = \$1{,}000 * \frac{1}{(1+0.05)^5} = \$783.53$

Pricing a Bond

- Bond price depends on interest rate
- Higher interest rates => lower bond prices
- Why?
  - Higher interest rates devalue future coupon payments
- Means bonds have some “interest rate risk”
- Bonds are typically quoted in “yield to maturity”
  - This is (constant) interest rate that gives back the price of the bond

Stocks

Stocks

- How are stocks different from bonds?
  - Stocks imply ownership (voting)
  - Dividends vs. Coupon payments
- Unlike fixed-income securities, stocks have variable cash flows
- Thus, pricing a stock involves forecasting cash flows AND market rates plus other stuff….

Pricing Stocks

- There are a number of ways to estimate the price of a stock
- Price of the stock might be a function of the present value of expected future stream of dividends
- Dividend discount model (DDM)

DDM Valuation over a Fixed Investment Horizon

- Suppose I think I'm going to sell the stock next year

$$P_0 = \frac{E[D_1]}{(1+r_1)} + \frac{P_1}{(1+r_1)}$$

- Suppose I think I'm going to sell the stock two years from now

$$P_0 = \frac{E[D_1]}{(1+r_1)} + \frac{E[D_2]}{(1+r_1)(1+r_2)} + \frac{P_2}{(1+r_1)(1+r_2)}$$

Implications of DDM

- To know stock prices, we need to know future streams of dividends and future rates
- What helps us forecast dividends?
  - Earnings
  - Payout ratio
  - Book value
  - Return on book value

Is It Really that Simple?

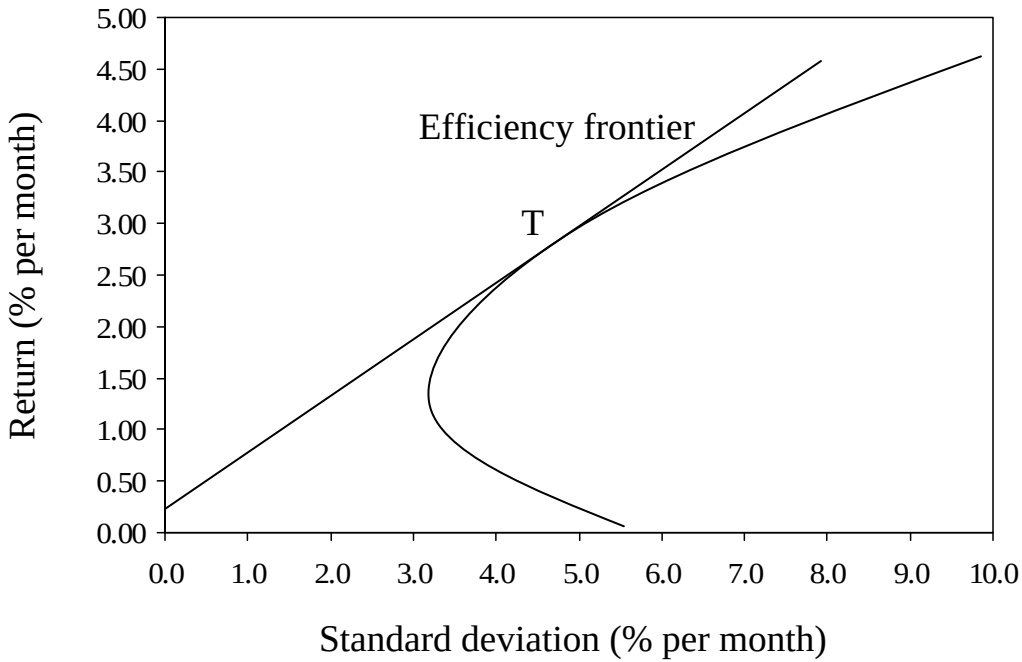
- No!
- DDM tells us the stream of dividends (and things that affect them) may be important
- But what else?
  - Risk!

CAPM

CAPM 1 – Pricing Risky Assets

- In session A, we learned diversification can eliminate some risk
- There is a portfolio that minimizes the risk for any level of (expected) return
- But that portfolio still has some systematic risk (let's call this beta)
- Then, under certain assumptions about investor behavior, CAPM says:
  - Everyone holds risky assets in the same proportion (the tangent portfolio)
  - Everyone holds a combination of the risky portfolio and the risk-free asset
  - The tangent portfolio is the Market Portfolio

CAPM 2 – The Market Portfolio



- If everyone is holding the same (risky) portfolio:
  - The ratio of each risky asset held is the share of its value in the market
  - This value is called "Capitalization"

Capitalization

- Market Capitalization is equal to price per share x # of shares outstanding
- EXAMPLE: Microsoft

$$\text{MCAP}_{MSFT} = \$28.30/\text{share} \ \text{ x } \ 9{,}313{,}292{,}833 \text{ shares}$$
$$= \$263.57 \text{ billion}$$

NOTE: Microsoft's stock price, COB 6/5/08; # of shares of common stock outstanding as of 4/21/08.

CAPM, Capitalization, and the Market Portfolio

- Suppose there are only two assets in the market: Microsoft stock and Boeing stock, with market caps $263.57 billion and $58.09 billion, respectively
- The following gives the weights in the market portfolio

Company	Microsoft	Boeing
Stock Price	$28.30	$77.31
# of Shares	9,313,292,833	751,453,000
Market Cap	$263.57B	$58.09B
Weight	82%	18%

NOTE: Boeing's stock price & # of shares of common stock outstanding as of COB 6/5/08.

How CAPM Determines Price

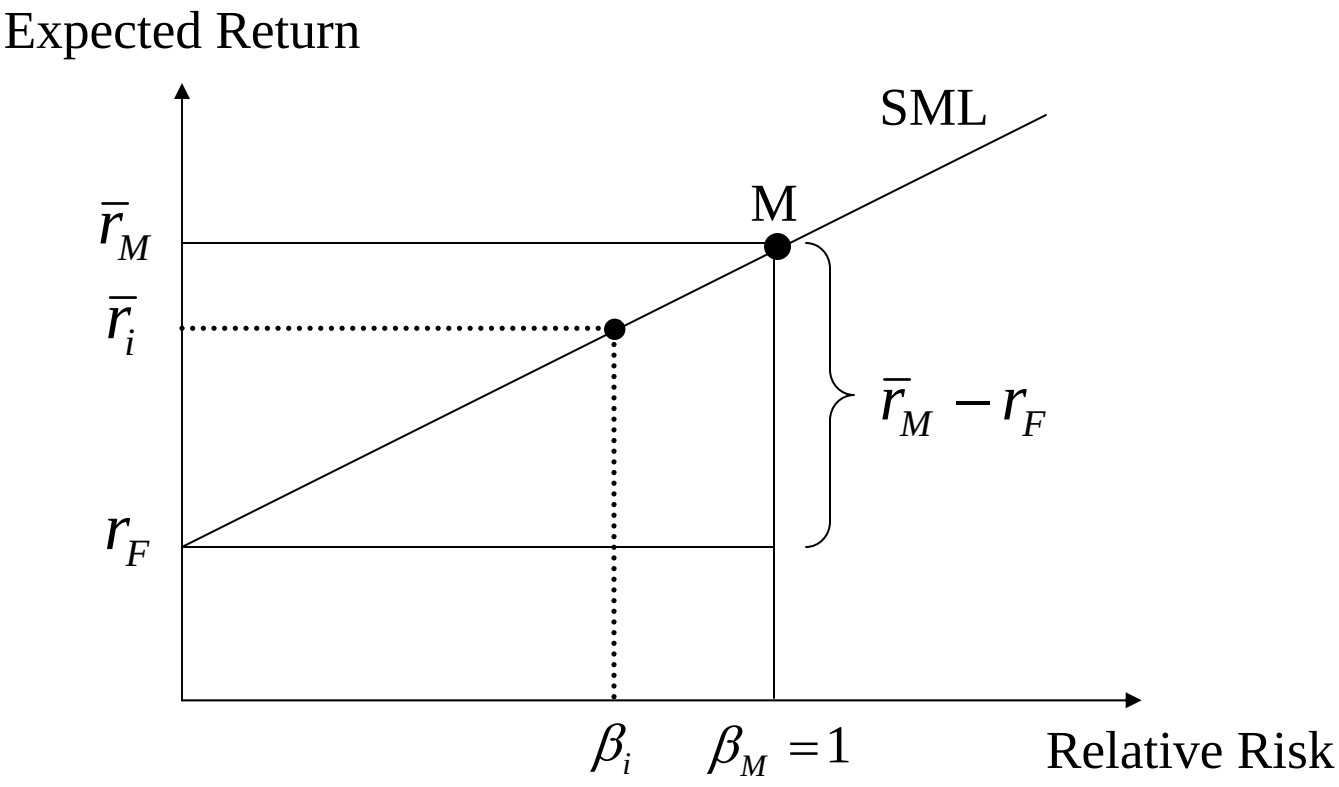
- The weights in the previous slide are determined by each stock's capitalization (equivalently # shares and price)
- Recall that weights in the tangent portfolio are determined by risk, expected return
- This means the asset's price is a function of risk, return, and # of shares

Implications of CAPM

- The return on an asset (relative to the market) can be measured as a function of its relative risk (we call this beta)
- Risk is measured by the asset's correlation to the market portfolio
- The higher the (un-diversifiable) risk of the asset, the higher its expected return
- Thus bearing systematic risk is rewarded
- Bearing idiosyncratic risk is not rewarded

Security Market Line

This relation is expressed in the SML:



Limitations of CAPM

- The model is predicated on a number of assumptions
  - Investors have the same information and beliefs
  - Each investor's expectation of all returns is the same
  - Investors make decisions solely on risk/return
- This implies everyone owns the same portfolio
- These assumptions are probably unrealistic
- CAPM still provides logic for risk premia

Summary of Stock Pricing

- No perfect model of stock prices
- Stock prices can be a function of many things
  - Expected dividends
  - Earnings
  - Book value
  - Risk
- Un-diversifiable risk is rewarded

Session C:
Liabilities

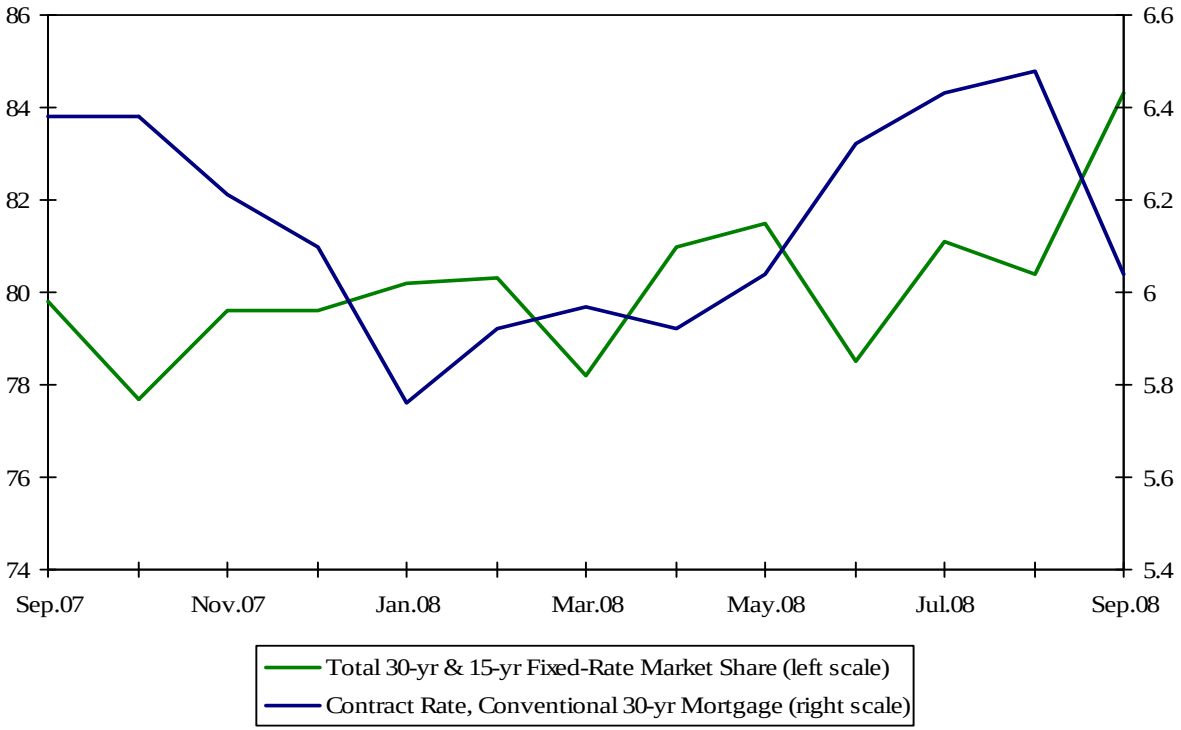
Mortgages

Mortgages

- Mortgages are loans similar to bonds
- Typically, the borrower makes an interest payment plus some principal
- The maturity of the loan determines the amount of principal paid
- Interest rates can be fixed or variable
- Loans can be amortized over periods of up to 30 years or more

Fixed vs. Adjustable-rate Mortgages 1

- In the U.S., most mortgages are fixed-rate mortgages



SOURCE: Federal Housing Finance Board; Board of Governors of the Federal Reserve System.

Fixed vs. Adjustable-rate Mortgages 2

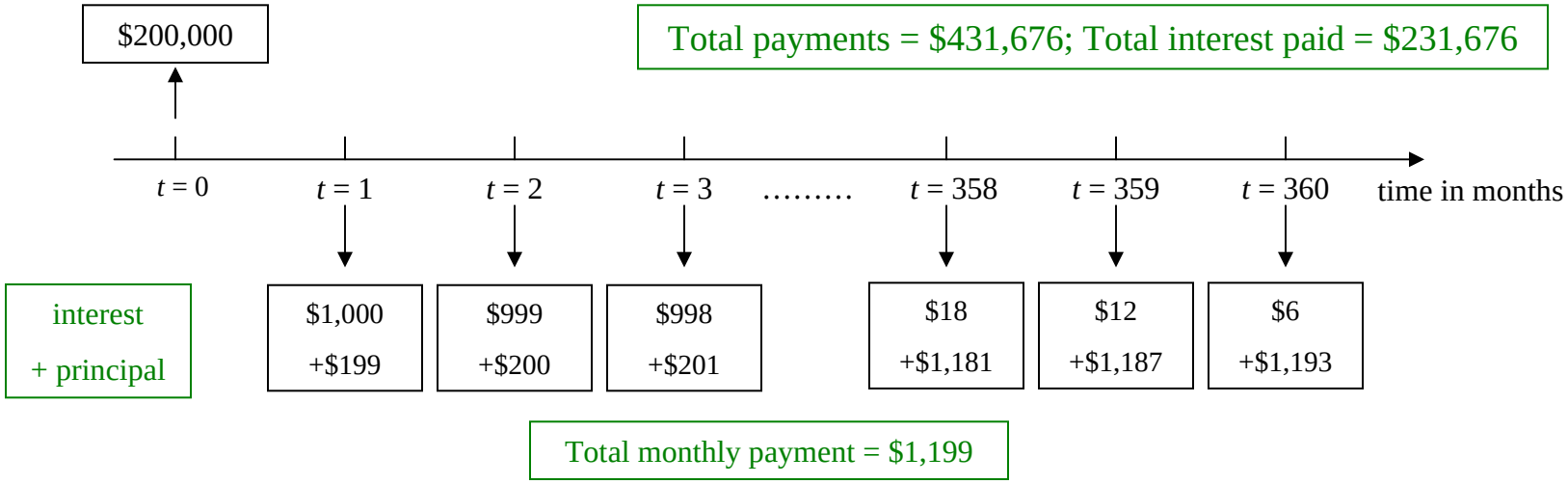
- Why would a borrower want an ARM?
- Since the borrower assumes some risk, the (starting) interest rate on the ARM is usually lower

Comparing Effective Interest Rates on Fixed- and Adjustable-Rate Mortgages			
	Fixed-Rate	ARM	Difference
1997	7.91	6.95	0.96
1998	7.21	6.69	0.52
1999	7.47	6.93	0.54
2000	8.30	7.50	0.80
2001	7.19	6.72	0.47
2002	6.84	6.13	0.71
2003	6.05	5.20	0.85
2004	6.17	5.53	0.64

SOURCE: Federal Housing Finance Board; historical summary tables, by loan to price ratio. Numbers are based on an LTP ratio of 0.8 to 0.9.

How to calculate payments

- Example: 30-year, 6% fixed-rate mortgage, $200,000



- We must pay the loan off over its maturity
- The loan principal is amortized over the maturity of the loan, meaning:
  - The amount of interest decreases
  - The amount of principal paid increases each month

SOURCE: Data from "A Primer on the Mortgage Market and Mortgage Finance" by Daniel J. McDonald and Daniel L. Thorton, Federal Reserve Bank of St. Louis *Review*, Jan./Feb. 2008, Vol. 90, pp. 31-45.

Mortgage Finance 1

Partial Amortization Table for a 6 Percent Fixed-Rate Mortgage

Month	Rate (%)	Monthly payment	Interest paid	Principal paid
1	6.00	$1,199.10	$1,000.00	$199.10
13	6.00	$1,199.10	$987.72	$211.38
25	6.00	$1,199.10	$974.68	$224.42
37	6.00	$1,199.10	$960.84	$238.26
73	6.00	$1,199.10	$913.98	$285.12
109	6.00	$1,199.10	$857.90	$341.20
145	6.00	$1,199.10	$790.79	$408.31
181	6.00	$1,199.10	$710.49	$488.61
217	6.00	$1,199.10	$614.39	$584.71
253	6.00	$1,199.10	$499.39	$699.71
289	6.00	$1,199.10	$361.77	$837.34
325	6.00	$1,199.10	$197.08	$1,002.02
360	6.00	$1,199.10	$5.97	$1,193.14

Total interest paid: $231,676.38

SOURCE: McDonald and Thorton (2008).

Mortgage Finance 2

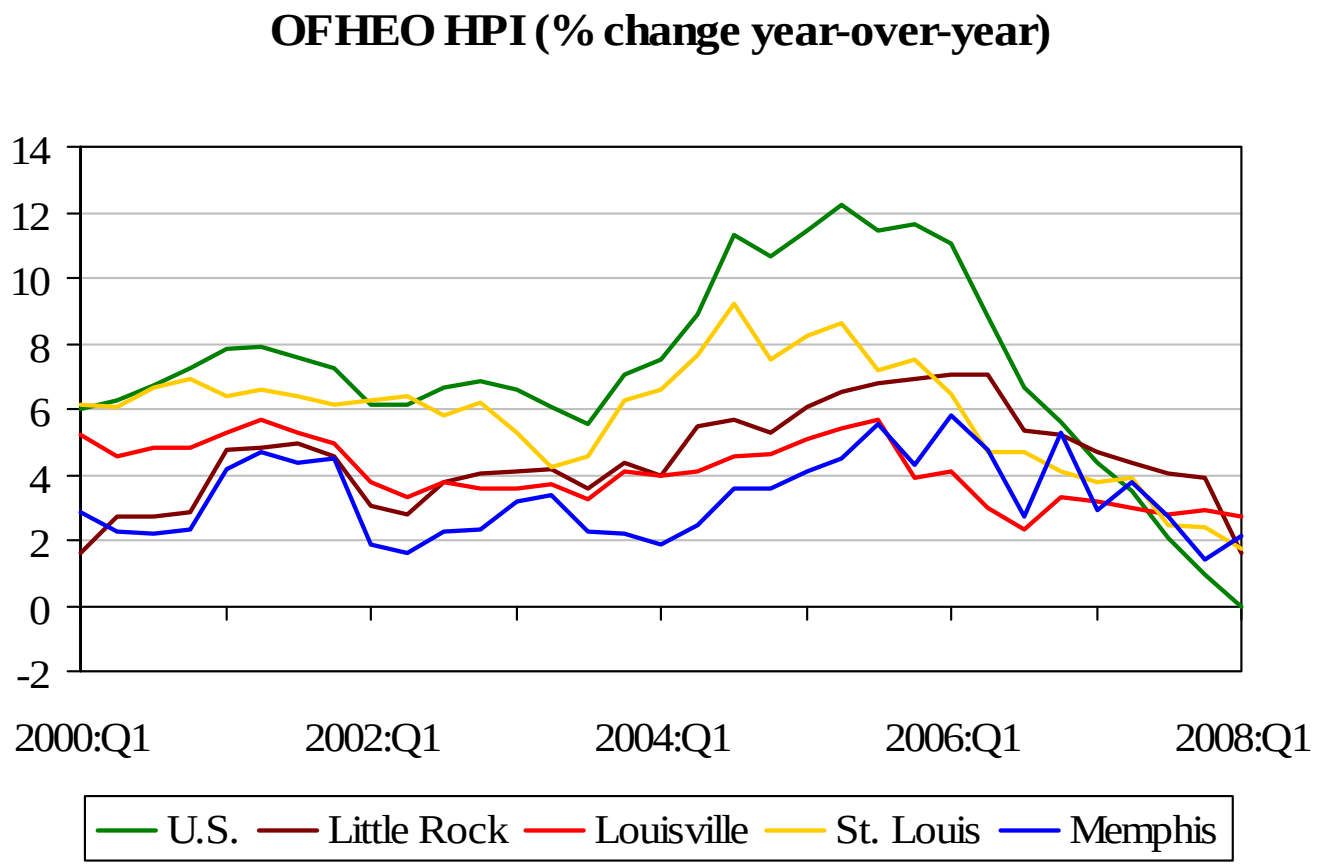
Partial Amortization Comparison of Fixed-Rate vs. ARM

	Fixed-Rate Mortgage				Adjustable-Rate Mortgage			
Month	Rate (%)	Monthly payment	Interest paid	Principal paid	Rate (%)	Monthly payment	Interest paid	Principal paid
1	6.00	$1,199.10	$1,000.00	$199.10	5.50	$1,135.58	$916.67	$218.91
13	6.00	$1,199.10	$987.72	$211.38	5.50	$1,135.58	$904.32	$231.26
25	6.00	$1,199.10	$974.68	$224.42	5.50	$1,135.58	$891.27	$244.31
37	6.00	$1,199.10	$960.84	$238.26	5.50	$1,135.58	$877.49	$258.09
73	6.00	$1,199.10	$913.98	$285.12	6.00	$1,190.63	$907.52	$283.11
109	6.00	$1,199.10	$857.90	$341.20	6.75	$1,269.14	$960.38	$308.76
145	6.00	$1,199.10	$790.79	$408.31	7.50	$1,341.81	$992.50	$349.31
181	6.00	$1,199.10	$710.49	$488.61	8.25	$1,407.45	$997.41	$410.04
217	6.00	$1,199.10	$614.39	$584.71	9.00	$1,464.71	$965.29	$499.42
253	6.00	$1,199.10	$499.39	$699.71	9.00	$1,464.71	$811.15	$653.56
289	6.00	$1,199.10	$361.77	$837.34	9.00	$1,464.71	$609.43	$855.28
325	6.00	$1,199.10	$197.08	$1,002.02	9.00	$1,464.71	$345.46	$1,119.25
360	6.00	$1,199.10	$5.97	$1,193.14	9.00	$1,465.22	$10.91	$1,454.31

Total interest paid: Fixed-Rate = $231,676.38; ARM = $283,903.99; DIFFERENCE = $52,227.61

SOURCE: McDonald and Thorton (2008) for FRM; online financial calculator from KJE Computer Solutions for ARM.

Recent Decline in House Prices 1



SOURCE: OFHEO, http://www.ofheo.gov/hpi_city.aspx

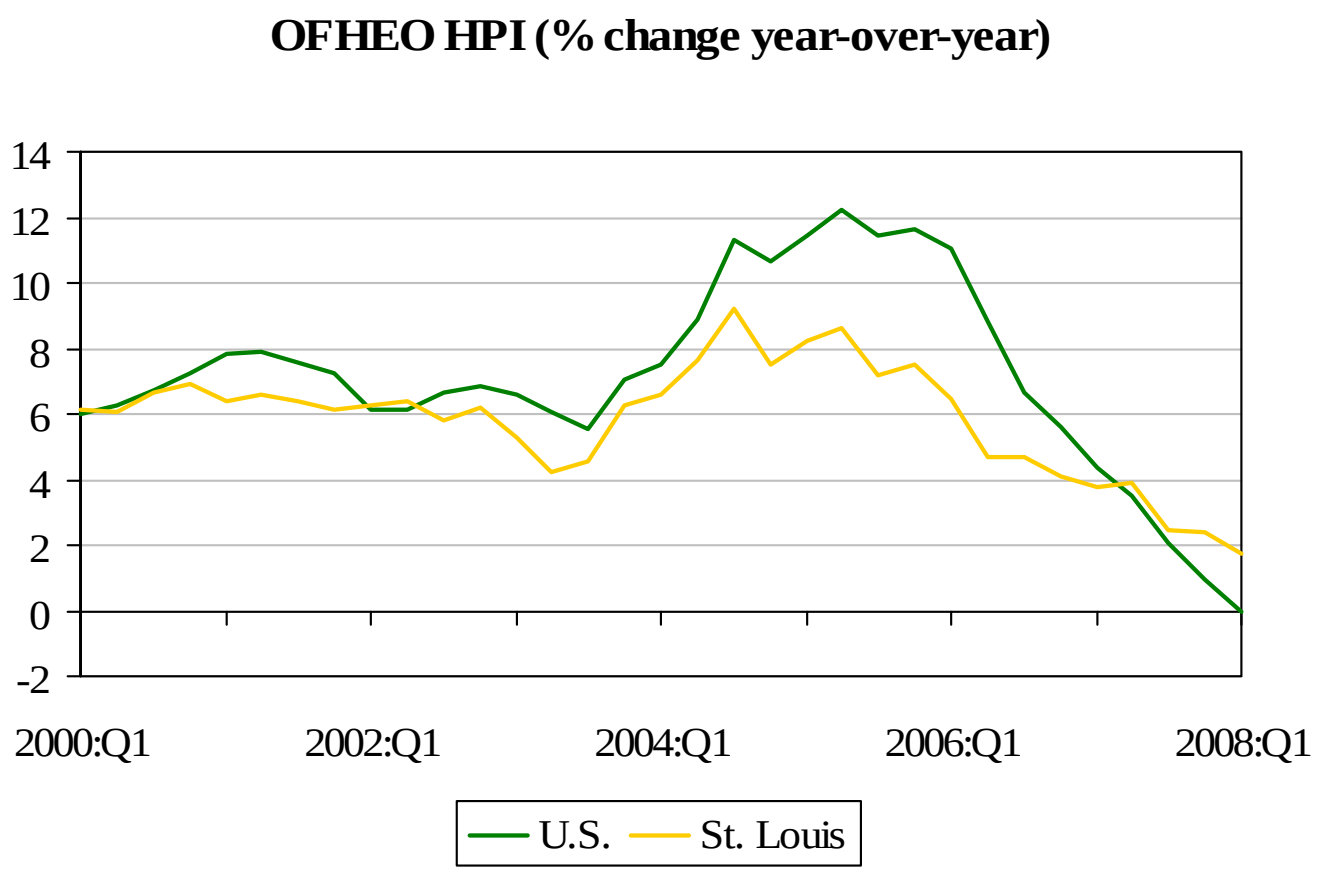
Recent Decline in House Prices 2

- When house prices fall, what happens to mortgages?
  - Selling a house at a lower price is a capital loss
  - Mortgages are collateralized loans
  - If house prices fall enough, owners with little equity who have to move can walk away

Recent Decline in House Prices 3

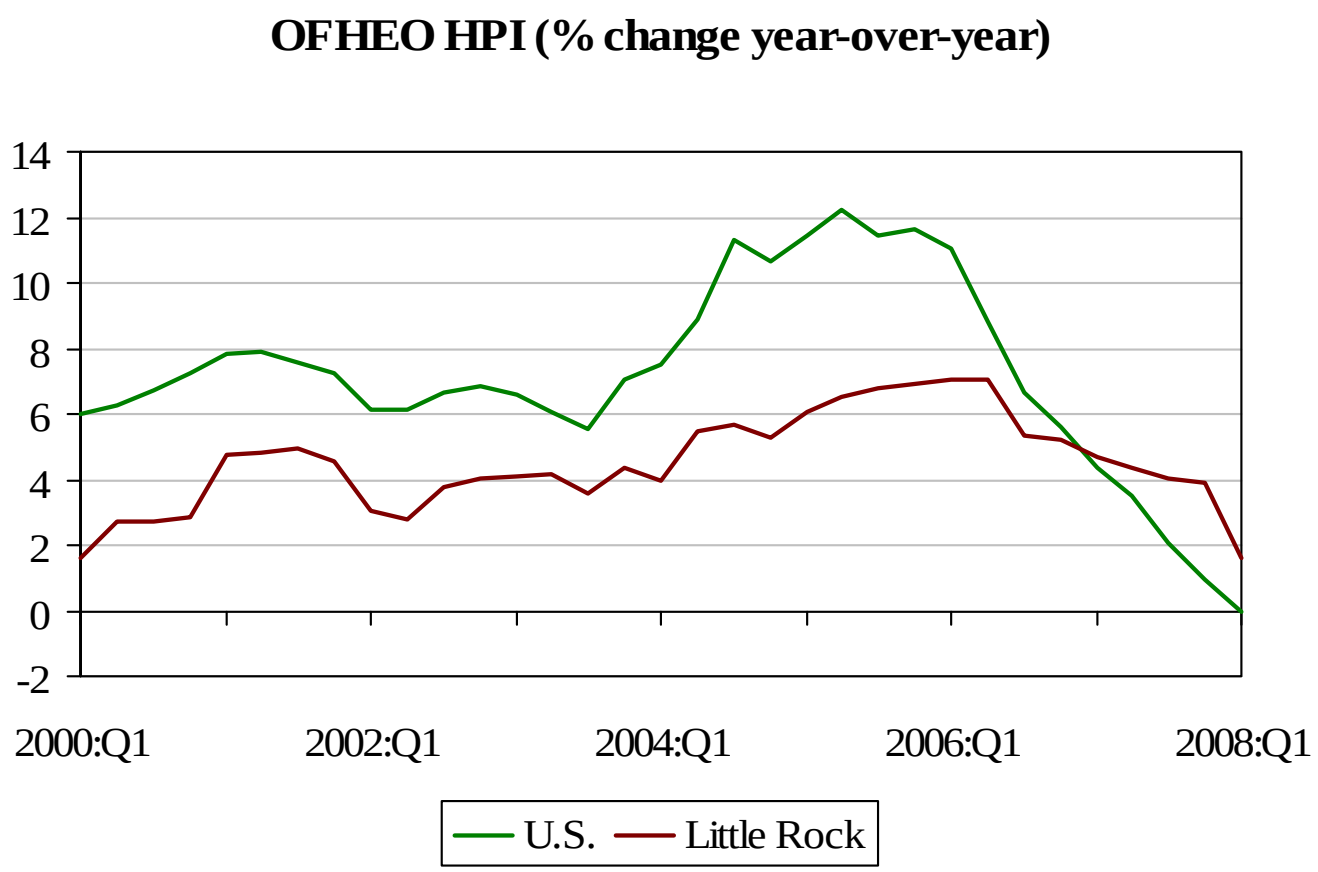
- What happens when interest rates also rise?
  - Fixed rate mortgages => no change
  - ARMs => payments increase
    - Again, owners with little equity can default
  - Homeowners typically want to refinance
  - Falling prices increase risk to lenders and makes refinancing harder

Recent Decline in House Prices 4



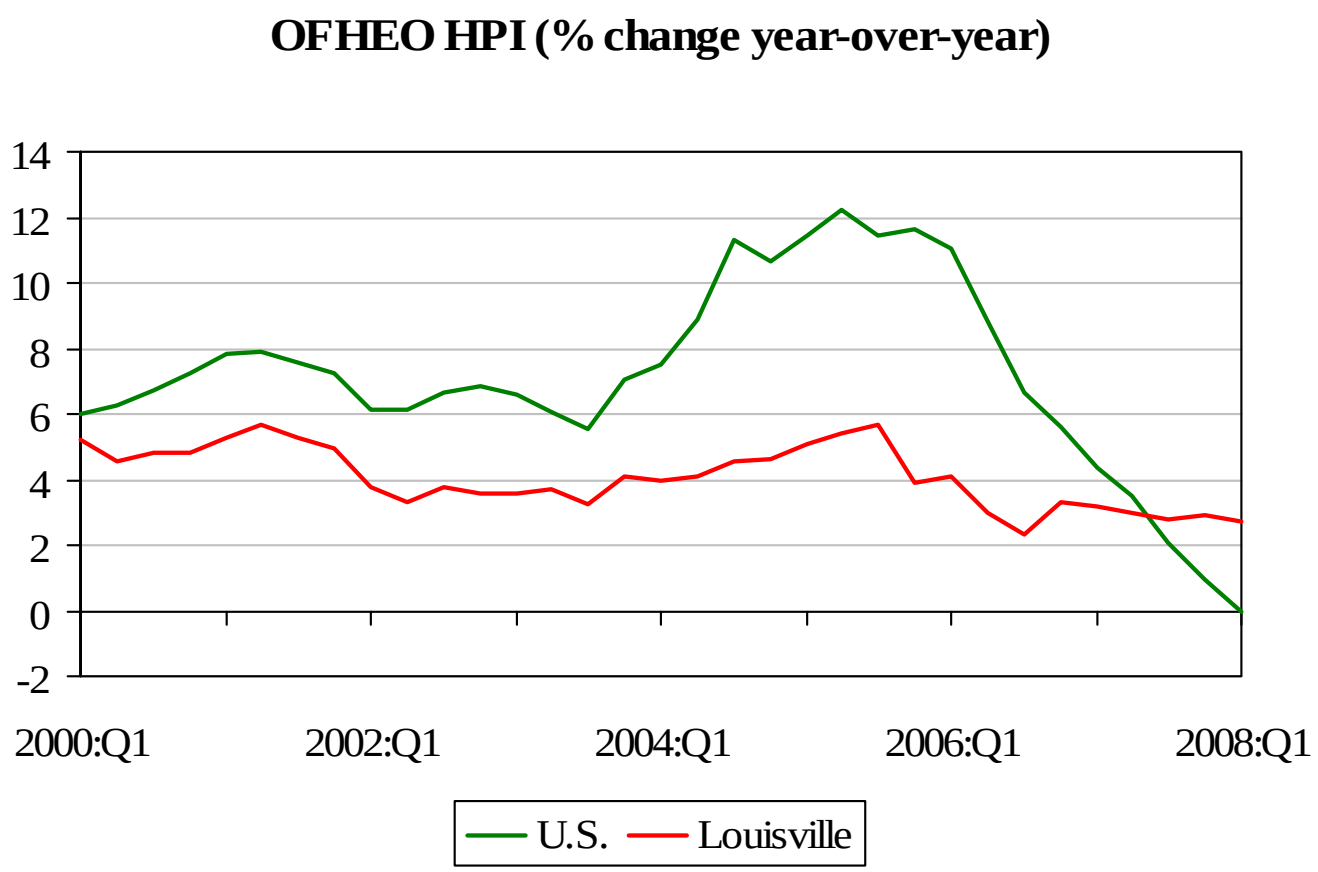
SOURCE: OFHEO, http://www.ofheo.gov/hpi_city.aspx

Recent Decline in House Prices 5



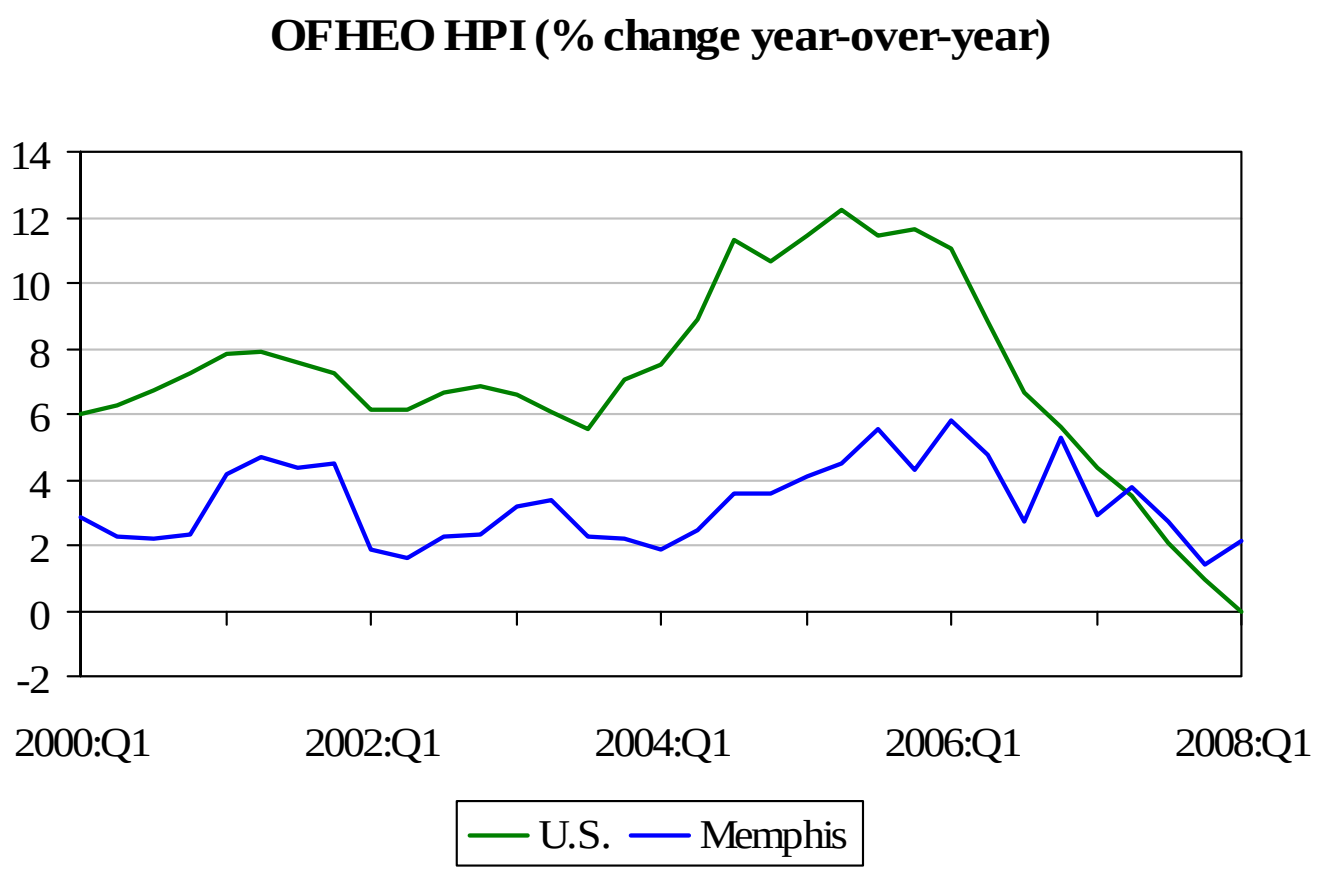
SOURCE: OFHEO, http://www.ofheo.gov/hpi_city.aspx

Recent Decline in House Prices 6



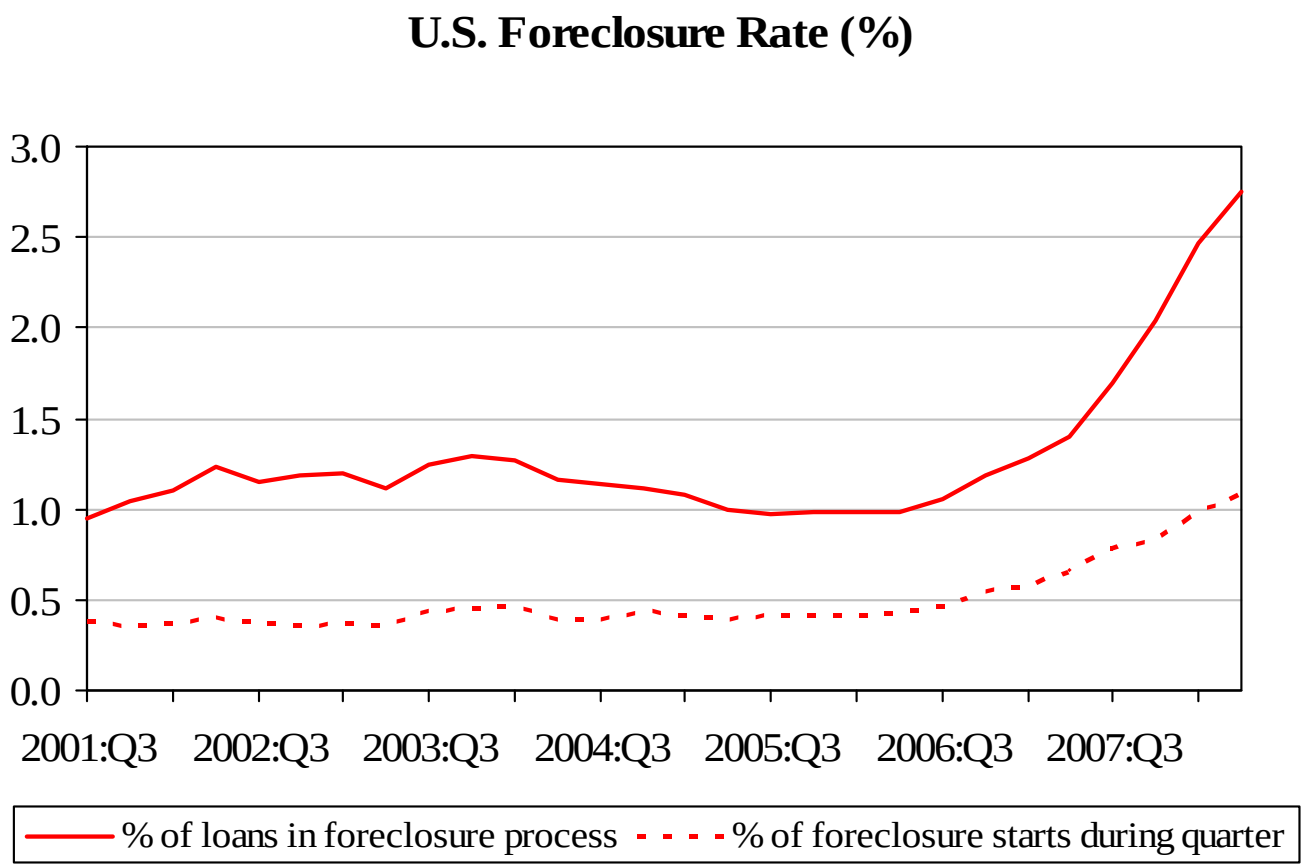
SOURCE: OFHEO, http://www.ofheo.gov/hpi_city.aspx

Recent Decline in House Prices 7



SOURCE: OFHEO, http://www.ofheo.gov/hpi_city.aspx

Foreclosures



SOURCE: Mortgage Bankers Association, quarterly press releases.

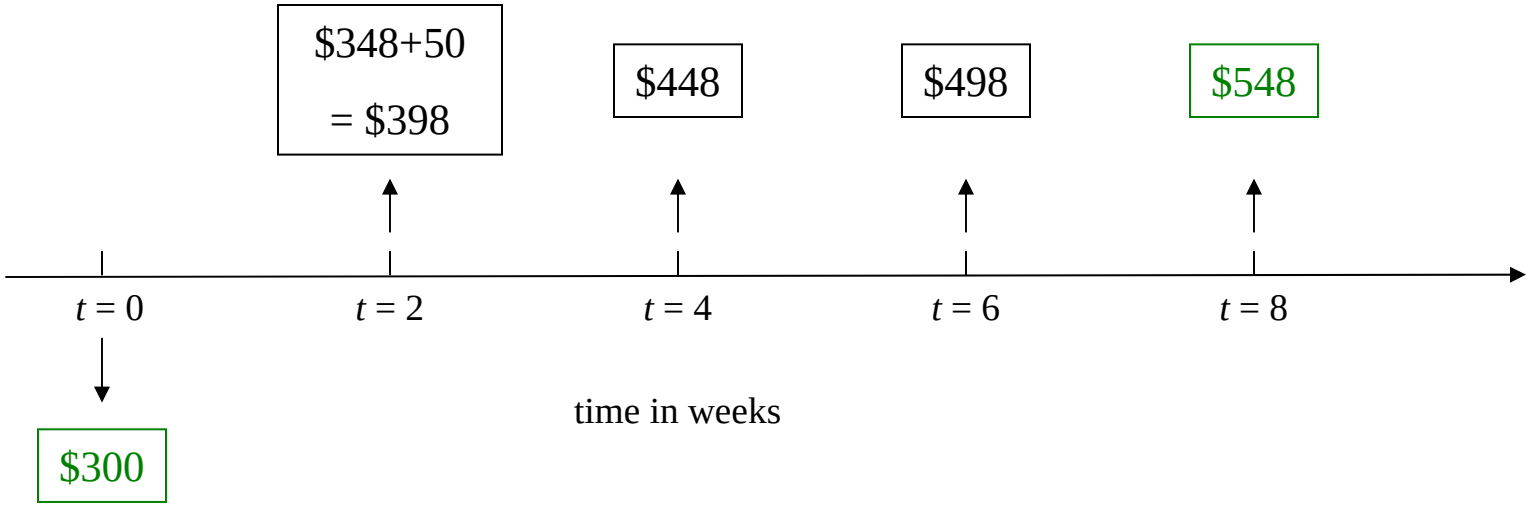
Payday Loans

Payday Loans 1

- Small loan, usually for two weeks, due on payday
- Typical interest rate of 15-18% for that time; translates into 15*26=390% APR to 18*26=468% APR
- Can renew loans if unable to pay on payday, usually for a fee (rollover); typical borrower renews a loan 8 times

Payday Loans 2

- Example: say you borrow $300, with 16% interest and renew 4 times with a fee



- You would end up paying back $548 for your initial $300 loan ($248 in interest/fees)
- If you renew the average of 8 times, you would end up paying back $748 for your initial $300 loan ($448 in interest/fees)

Payday Loans and Liquidity

- A disproportionate number of payday loan shops are located near military bases and in African-American neighborhoods (source: Center for Responsible Lending fact sheet)
- Characteristics of payday loan applicants (from a Skiba/Tobacman study discussed in a later slide):
  - Average monthly income of $1,699 and $235 in checking account
  - 77% black or Hispanic
  - 62% women

Payday Loans and Bankruptcy 1

- Data from American Bankruptcy Institute show that for every 1 million adults in the U.S., about 1,800 filed for bankruptcy in 1980…but 7,300 in 2004
- These numbers coincide with increased personal debt (e.g., payday loans, credit cards)
- Does access to payday loans increase the likelihood of bankruptcy?
- A study by Paige Skiba and Jeremy Tobacman says YES!
- BUT a study by Donald Morgan and Michael Strain says yes and NO!

Payday Loans and Bankruptcy 2

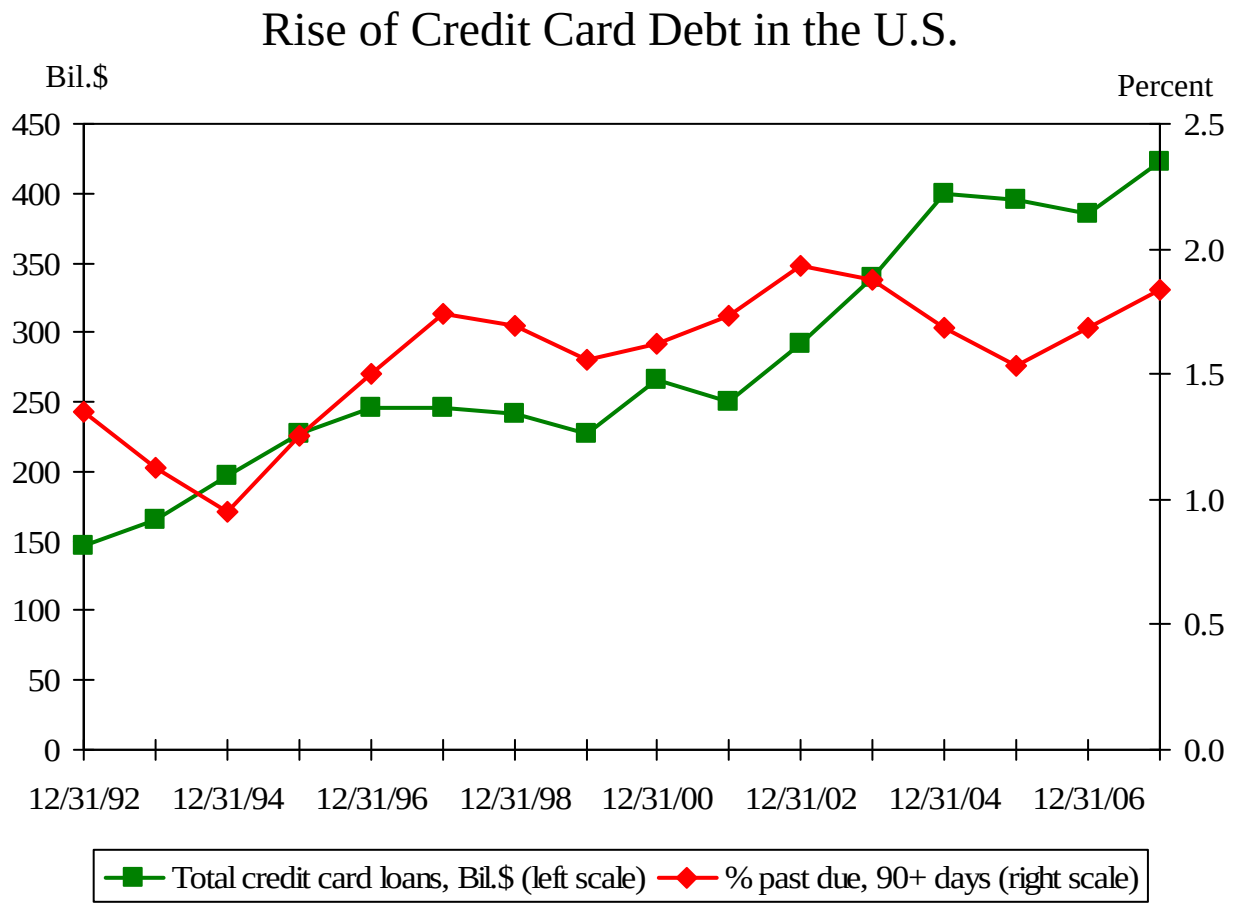
- According to the Skiba/Tobacman study: payday loan applicants were 6 times more likely (2.3% vs. 0.38%) to file for bankruptcy than the general population in Texas (took place there from Jan.01 to Jun.05)
- Within a year of first payday loan, probability of filing for Chapter 13 bankruptcy (which creates a long-term repayment plan) increased by 1.9 percentage points; and within 2 years, by 2.5 percentage points

Payday Loans and Bankruptcy 3

- In the Morgan/Strain study, they found a decrease in Chapter 13 bankruptcy filings in Georgia and North Carolina after those states banned payday loans
- BUT they found HIGHER filings for Chapter 7 bankruptcy and informal bankruptcies (defaulting on debt without officially filing for bankruptcy)
- The authors conclude that borrowers are not better off without access to payday loans; payday loans are a better alternative than bouncing checks

Credit Cards

Credit Cards



SOURCE: FDIC – Statistics on Depository Institutions Report

Median credit card debt (in 2004$) for all families increased from $1,300 in 1989 to $2,200 in 2004 (SOURCE: 2004 SCF).

Who Uses Credit Cards

- Credit card usage has increased over time[1]
  - In 1989, 55.8% of American families owned at least one c.c., which increased to 74.9% in 2004
  - C.C. holders have changed to include people who are riskier for lenders (e.g., higher percentages of single people , renters, workers with less job seniority, lower incomes, and unskilled jobs)
- In 1989, 39.7% of families held c.c. debt; in 2004, 46.2% did[2]
- Largest increase in c.c. debt among lower-income families[2]
  - Lowest 20% of income distribution, fraction with c.c. debt increased by 14.1 percentage points
  - Second lowest 20% of income distribution, fraction increased by 14.3 percentage points
  - Fraction for the highest 20% and the second highest 20% decreased slightly between 1989 and 2004

[1] Sources: Black and Morgan (1999) and Bucks, Kennickell, and Moore (2006). [2] Source: 2004 Survey of Consumer Finances. See "Extra Credit: The Rise of Short-term Liabilities" by Engemann and Owyang in *The Regional Economist*, April 2008, pp. 12-13.

The Usual Story about Paying the Minimum Balance

- Say you have a c.c. balance of $5,000, 14% APR, and you only pay the minimum each month (the max of 5% of total & $10)
- Your (partial) payment schedule would be the following:[1]

Month	Min. Payment	Interest Paid	Principal Paid	Remaining Bal.
				$5,000.00
1	$250.00	$58.34	$191.67	$4,808.34
12	$162.63	$37.95	$124.69	$3,128.00
24	$101.74	$23.74	$78.00	$1,956.88
36	$63.65	$14.85	$48.80	$1,224.22
48	$39.82	$9.29	$30.53	$765.87
60	$24.91	$5.81	$19.10	$479.13
72	$15.58	$3.64	$11.95	$299.74
84	$10.00	$2.27	$7.73	$187.27
96	$10.00	$1.12	$8.88	$87.23
106	$2.54	$0.03	$2.51	$0.00

- It would take you nearly 9 years to pay off the credit card, and you'd pay a total of $1,490 in interest

[1] For example, see http://aol1.bankrate.com/aol/calc/MinPayment.asp?nav=cc&page=calc_home to calculate payments.

The Credit Card Debt Puzzle

- Some consumers carry c.c. balances but also have sufficient funds in the bank to pay off high-interest debt—"The Credit Card Debt Puzzle"
- Study by economist Irina Telyukova showed:
  - 28% of people had at least $500 both in c.c. debt and liquid assets—called "borrowers-and-savers"
  - This group had average c.c. debt of $5,766 and average of $7,237 in liquid assets
  - Average interest rate was 13.7% on c.c. but 1% on liquid assets
- PUZZLE: why not pay off credit cards?
- Hypothesis: people want to keep "cash" for emergencies

The CCD – A Numerical Example

- Consider the c.c. example from before: $5,000 balance, 14% APR, and you only pay the minimum each month
- Now say you have $5,000 in a bank account that is earning 1% APR, paid annually

	Credit Card				Bank Account	
Month	Min. Payment	Interest Paid	Principal Paid	Remaining Bal.	Int. Earned	Total Bal.
				$5,000.00		$5,000.00
1	$250.00	$58.34	$191.67	$4,808.34		
12	$162.63	$37.95	$124.69	$3,128.00	$50.00	$5,050.00
24	$101.74	$23.74	$78.00	$1,956.88	$50.50	$5,100.50
36	$63.65	$14.85	$48.80	$1,224.22	$51.01	$5,151.51
48	$39.82	$9.29	$30.53	$765.87	$51.52	$5,203.02
60	$24.91	$5.81	$19.10	$479.13	$52.03	$5,255.05
72	$15.58	$3.64	$11.95	$299.74	$52.55	$5,307.60
84	$10.00	$2.27	$7.73	$187.27	$53.08	$5,360.68
96	$10.00	$1.12	$8.88	$87.23	$53.61	$5,414.28
106	$2.54	$0.03	$2.51	$0.00		
107						
108					$54.14	$5,468.43
Total interest		**$1,489.99**			**$468.43**	

- By keeping the money in the bank and only paying the minimum balance each month, you'd pay $1,021.56 more in interest than you earn