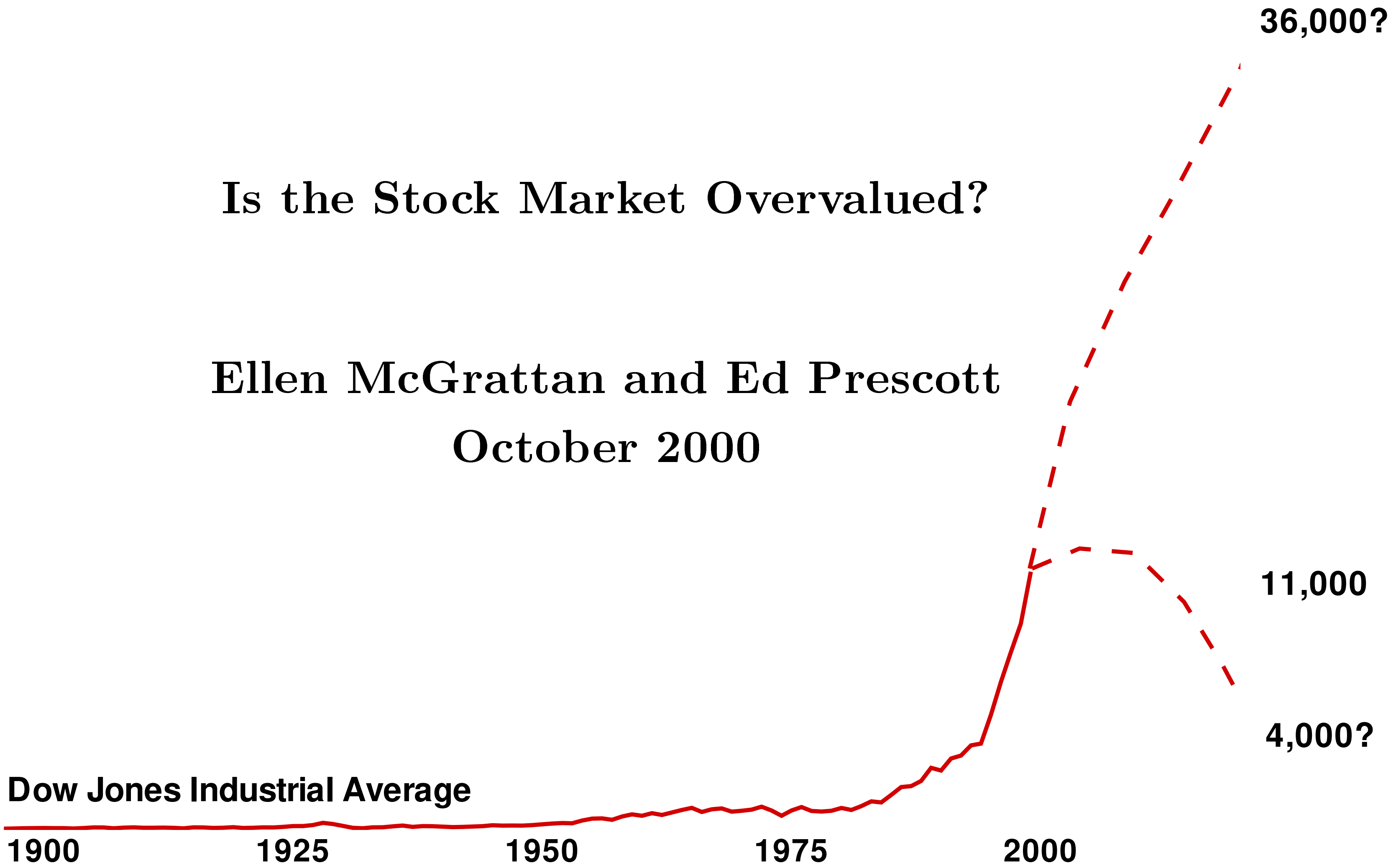
Is the Stock Market Overvalued?

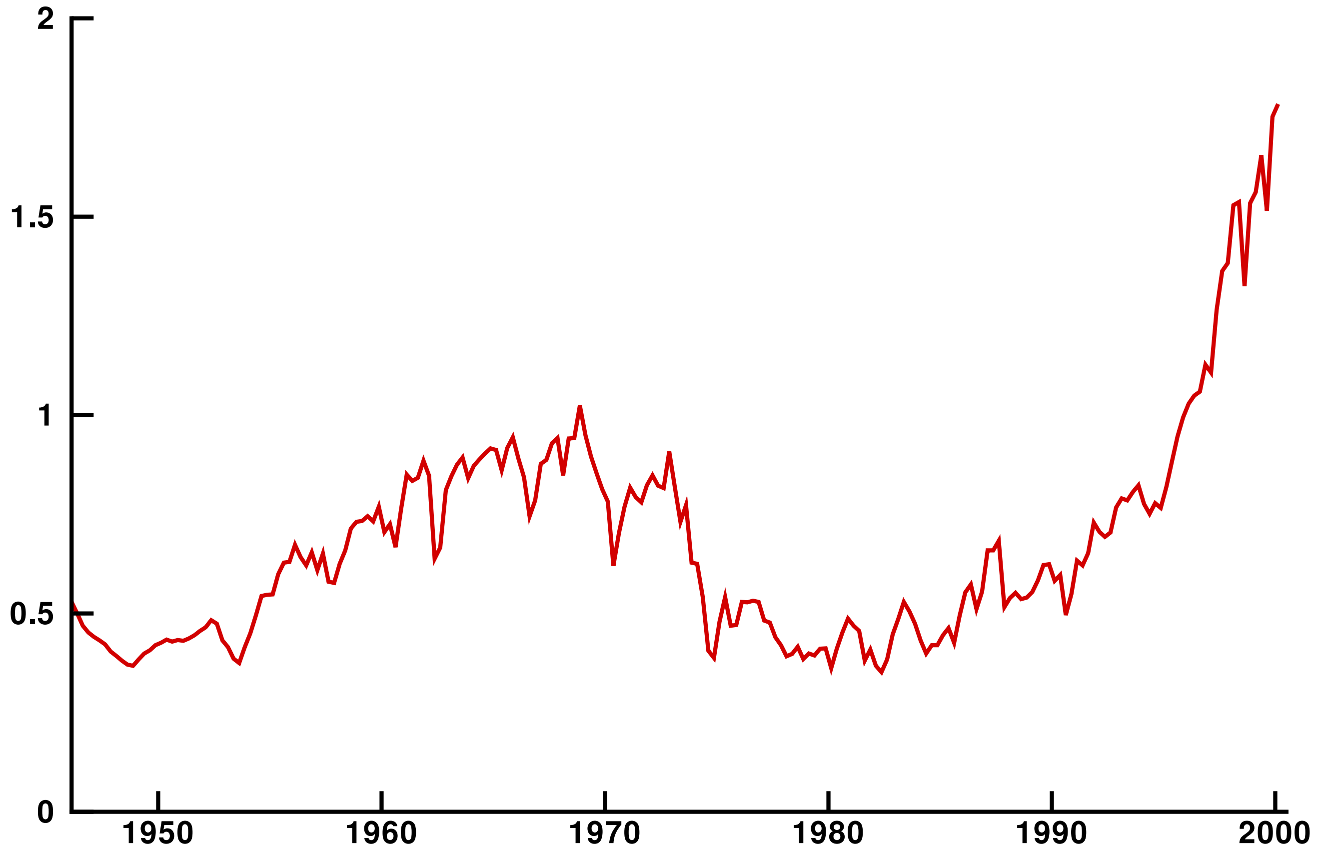
Ellen McGrattan and Ed Prescott

October 2000



Stock Market Value to GNP

- Doubled since 1994
- Previous peak in 1968

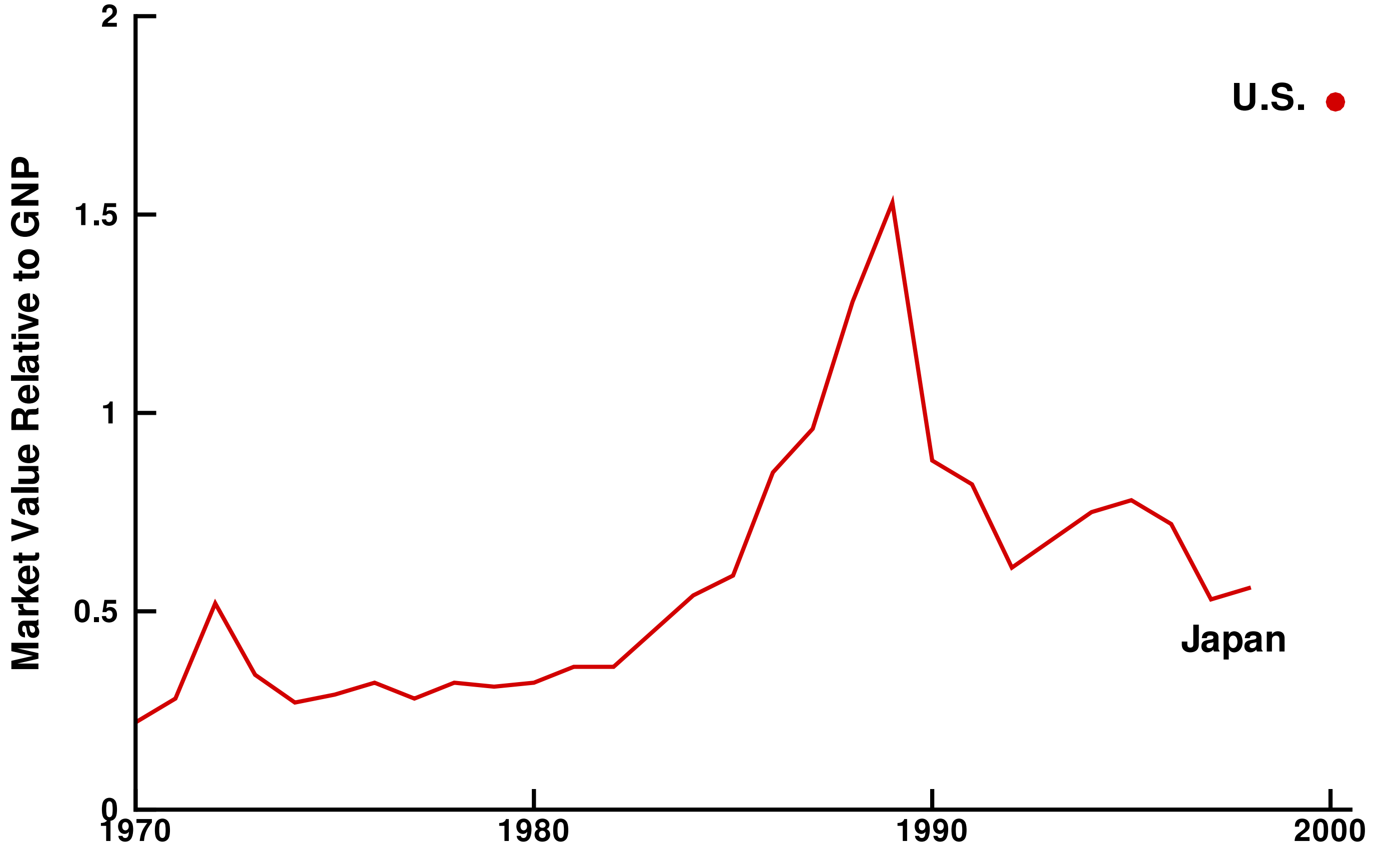


Stock Market Value

- Is 1.8 GNPs too high?
- Will there be a crash
  - with big capital losses?
  - with bad macro consequences?

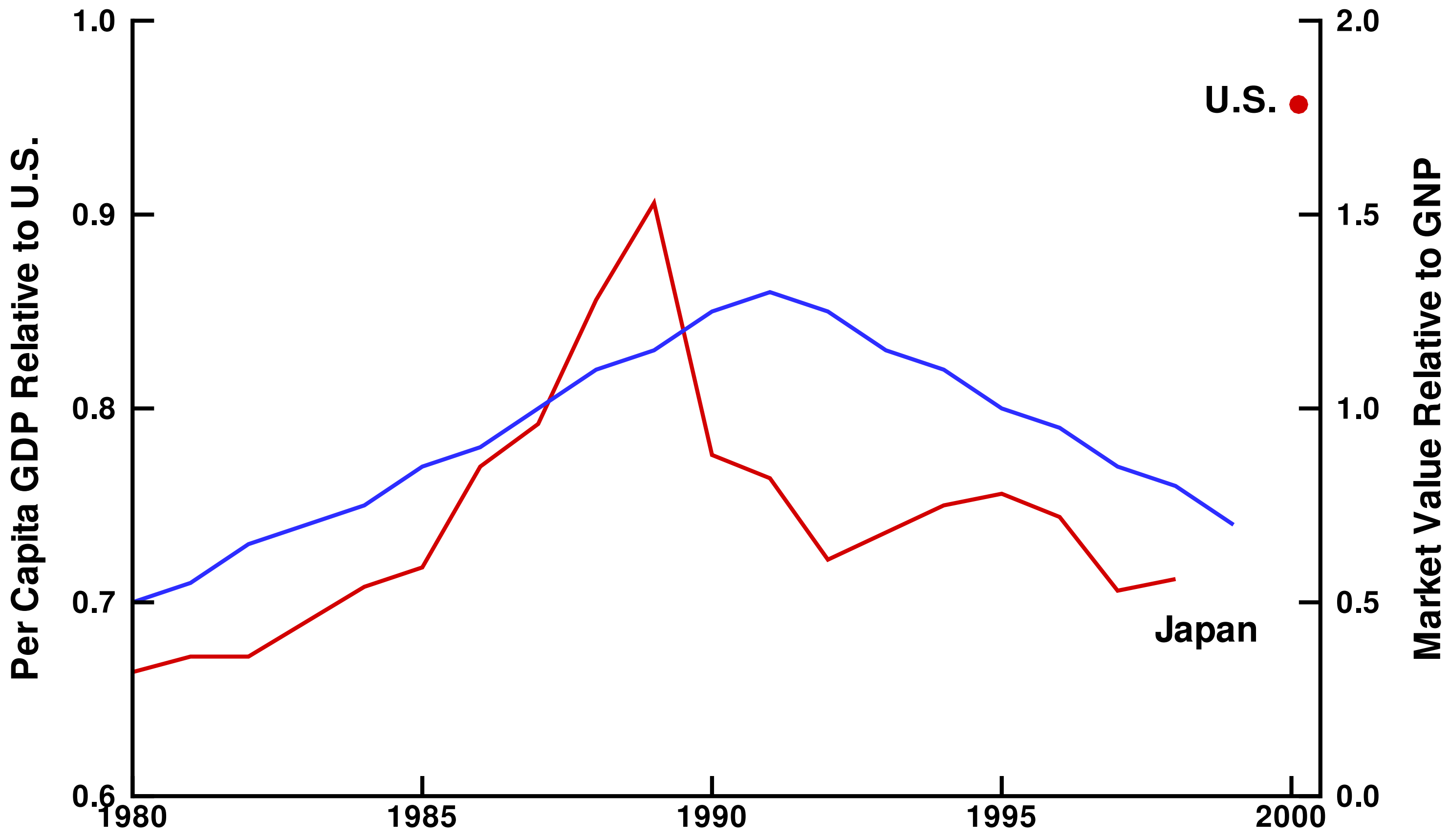
It happened in Japan

... there were big capital losses



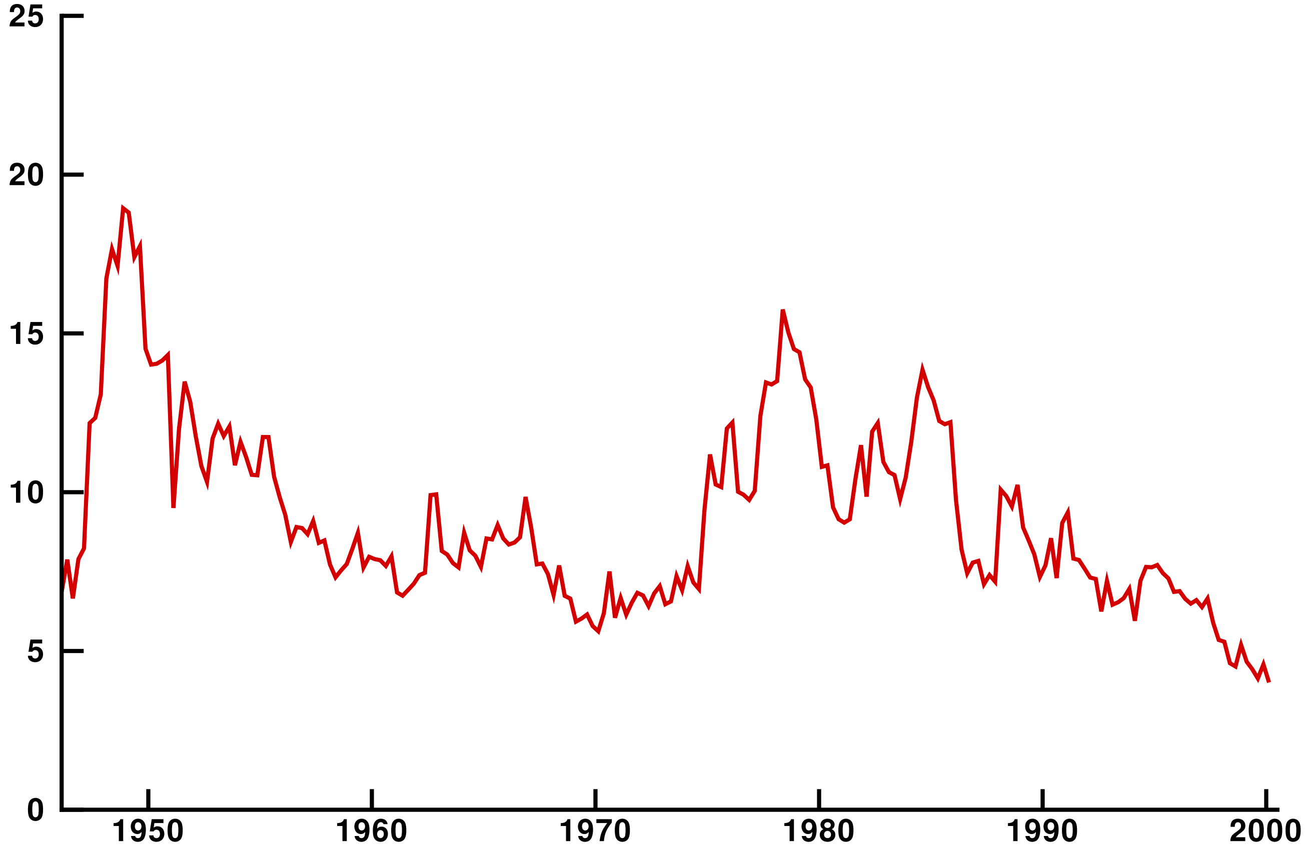
It happened in Japan

... and there were bad macro consequences



Earnings-Price Ratio

- **E/P like return**
- **At historical low at 4% $\approx$ TIPS rate**
- **Is it too low?**



Our Findings

- Is 1.8 GNPs too high? No.
- Do we expect a market crash? If above 1.8 GNPs.
- Is earnings-price ratio of 4% too low? No.
- Should investors switch from stocks to bonds? Possibly.

Two Approaches

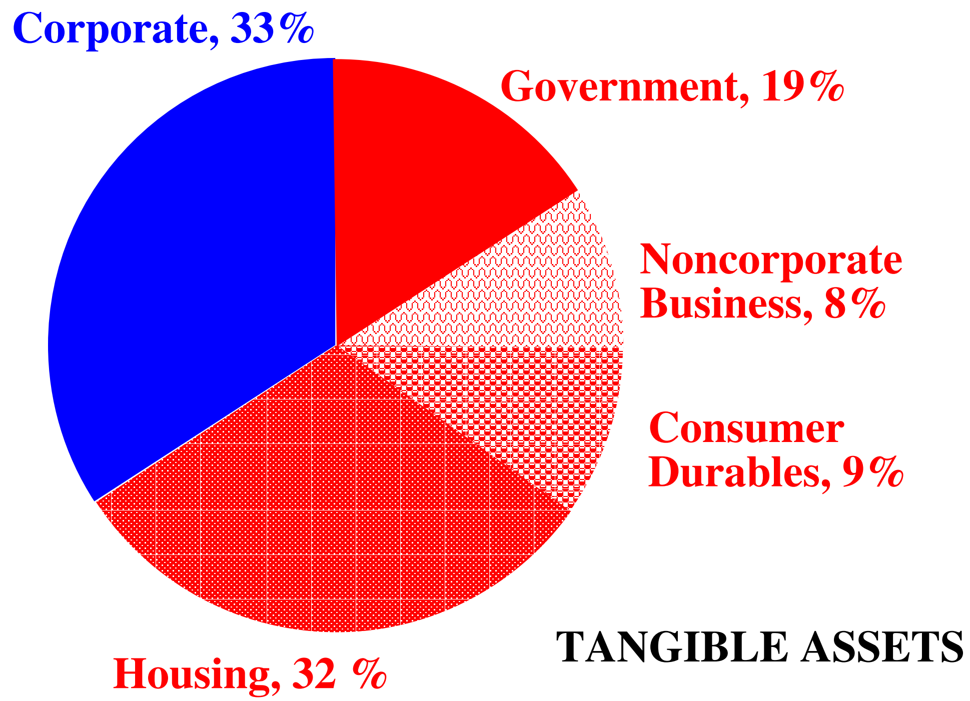
- **Finance:**
  - **Data: CRSP**
  - **Theory:** $V_0 = E\left[\frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \ldots\right]$

- **Macro:**
  - **Data: NIPA and *Flow of Funds***
  - **Theory: growth theory with** $V = K$

Key Facts Motivating Theory We Use

- Corporate sector only half of U.S. value added

- Corporate sector has 1/3 of tangible assets



Key Facts Motivating Theory We Use

- **Capital abroad is large**
  - **Net foreign subsidiary profits 1.6% GNP**

- **Intangible capital is large**
  - **Examples:**

    R&D investment ($\approx$ 3% GNP)

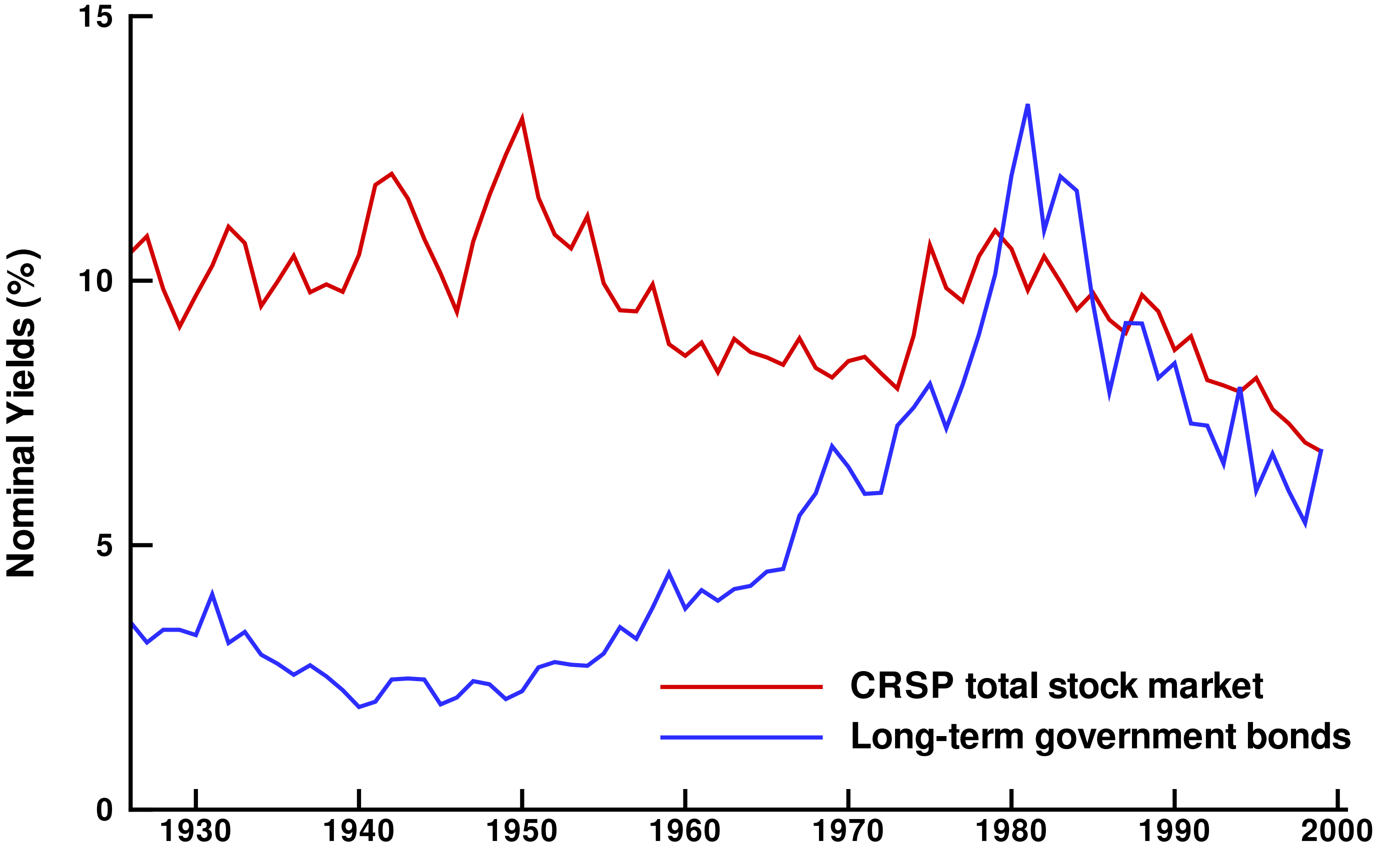
    On-the-job training

Key Facts Motivating Theory We Use

- **Frictions are *now* small**
  - **Lower costs of diversification (e.g., mutual funds)**
  - **Lower broker fees and transaction costs (e.g., Vanguard)**
  - **Fewer restrictions on pensions (e.g., TIAA, CA)**
  - **Better access to information (e.g., internet)**

Key Facts Motivating Theory We Use

… and equity premia are coming down



Key Facts Motivating Theory We Use

- **Corporate sector is close to 100% equity financed**

These facts $\Rightarrow$ model with:

- **2 sectors**
- **foreign and intangible capital**
- **no transaction or informational frictions**
- **no corporate debt**

Theory

- **Now that frictions are small ...**
  - **Value of stocks = Value of corporate capital stock**
  - **Return on stocks $\approx$ Return on capital stock**
  - **Equity premium is small**
  - **Earnings-price ratio $\approx$ Return on stocks**

Two-Sector Growth Model

- **Willingness to substitute:**

$$\sum_{t=0}^{\infty} \beta^t \left[\tfrac{1}{1-\sigma} (c_t \, \ell_t^{\psi})^{1-\sigma} \right] N_t$$

- **Ability to transform:**

$$y_1 = (k_{1m})^{\phi_m} (k_{1u})^{\phi_u} (z \, n_1)^{1-\phi_m-\phi_u} \qquad \textbf{1=corporate}$$

$$y_2 = (k_2)^{\theta} (z \, n_2)^{1-\theta} \qquad \textbf{2=noncorporate}$$

$$y = A \left(\mu \, y_1^{\rho} + (1-\mu) \, y_2^{\rho} \right)^{1/\rho}$$

Variables:

c = **consumption**, ℓ = **leisure**, N = **household size**

y = **output**, k = **capital**, n = **labor**, z = **technology**

Household Budget Constraint

$$\underbrace{(1+\tau_c)c}_{\text{consumption}} + \underbrace{x_{1m} + x_{1u} + x_2}_{\text{investments}}$$

$$= \underbrace{r_{1m}k_{1m} + r_{1u}k_{1u} + r_2 k_2}_{\text{rental income}} + \underbrace{wn}_{\text{wages}} - \underbrace{\tau_{1k}k_{1m} - \tau_{2k}k_2}_{\text{property taxes}} - \underbrace{\tau_n wn}_{\text{labor taxes}}$$

$$- \underbrace{\tau_1\left[(r_{1m} - \delta_{1m} - \tau_{1k})k_{1m} + r_{1u}k_{1u} - x_{1u}\right]}_{\text{corporate taxes}}$$

$$- \underbrace{\tau_2\left[(r_2 - \delta_2 - \tau_{2k})k_2\right]}_{\text{noncorporate taxes}} + \underbrace{\pi}_{\text{transfers}}$$

1 = corporate

2 = noncorporate

Stock Value and Asset Returns

- **Value at date t**

$$V_t = \underbrace{k_{1m,t+1}}_{\text{value of tangible capital}} + \underbrace{(1-\tau_{1,t})k_{1u,t+1}}_{\text{value of intangible capital}}$$

- **Asset returns, t to $t+1$:**

$$r^e_{t,t+1} = \frac{V_{t+1} + D_{t+1}}{V_t} - 1$$

$$r^f_t = [\beta E_t\{U_c(c_{t+1}, \ell_{t+1})/U_c(c_t, \ell_t)\}]^{-1} - 1$$

Note: 1 = corporate

τ_1 **is the corporate tax rate**

D **is total corporate distributions**

Value of Corporate Capital, 1990-1999

Structures	**0.47 GNPs**
Equipment	**0.36**
Inventories	**0.16**
Land	**0.06**
U.S. capital abroad	**0.38**
Unmeasured intangible capital	**0.41**
Total	**1.84 GNPs**
Current Value of Stocks	**1.80 GNPs**

$\Rightarrow$ 1.8 GNPs is not too high.

Estimates of Capital, 1990-1999

- **U.S. Capital Abroad**
  - **Profits of foreign subsidiaries = .0156 GNPs**
  - **Return on their capital ≈ 4.1 %**

  $\Rightarrow$ **Value of foreign capital ≈ .0156/.041 = .38 GNPs**

- **Intangible Capital**
  - **Assume part of profits from intangible capital**
  - **Assume returns to capital in all sectors equal**

  $\Rightarrow$ **Value of intangible capital = .41 GNPs**

Estimate of Intangible Capital

- **Interest rate from *noncorporate* sector:**

$$i = \frac{\text{noncorporate profits}}{\text{noncorporate capital stock}}$$

$$\Rightarrow \; i = \mathbf{4.1}\%$$

- **Equate interest rates in two sectors:**

$$i\, k_{1m}/(1-\tau_1) = \text{NIPA profits} + x_{1u} - i\, k_{1u}$$

3% growth $\Rightarrow \; x_{1u} = .03\, k_{1u} \Rightarrow \; k_{1u} = \mathbf{.64}$

Some Algebra

- **NIPA before-tax profits =** $.073$

- **Economic profits =** $.073 + x_{1u}$

- **Economic profits =** $(r_{1m} - \delta_1 - \tau_{1k})k_{1m} + r_{1u}k_{1u}$

  $\Rightarrow \;(r_{1m} - \delta_1 - \tau_{1k}) = (.073 + x_{1u} - r_{1u}k_{1u})/k_{1m}$

- **In equilibrium, returns are equated:**

  $\Rightarrow \; i = (1 - \tau_1)(r_{1m} - \delta_1 - \tau_{1k}) = (1 - \tau_2)(r_2 - \delta_2 - \tau_{2k}) = r_{1u}$

- **Combining these gives us the result:**

  $\Rightarrow \; i = (1 - \tau_1)(.073 + x_{1u} - ik_{1u})/k_{1m}$

  or $.0408 = (1 - .36)(.073 + .03k_{1u} - .0408k_{1u})/1.043$

An Accounting Issue

- Imputed net interest paid by banks is big, 5.7% GNP
- U.S. system imputes this interest to lender
- U.N. system imputes this interest to borrower
- Our system:
  - All pay or receive market interest rate
  - Difference is purchase of financial services

Asset Returns: Prediction of Theory

- **Steps taken:**
  - **Calibrate model to U.S. 1990-1999**
  - **Allow uncertainty in**

    technology

    tax rates

    corporate capital shares
  - **Simulate model – compute average returns**

Asset Returns: Prediction of Theory

- **Findings:**
  - **Average returns on equity (r^e) and debt (r^f) $\approx$ 4.1%**
  - **Equity premium $<$ 0.1%**

$\Rightarrow$ **earnings-price ratio of 4% not too low**

Our Findings

- Is 1.8 GNPs too high? **No.**
- Do we expect a market crash? **If above 1.8 GNPs.**
- Is earnings-price ratio of 4% too low? **No.**
- Should investors switch from stocks to bonds? **Possibly.**

Our Investment Strategy

- **Diversify**
- **Consider holding some inflation-protected bonds**
- **Sell if market value gets much above 1.8 GNPs**
- **Buy if market crashes**