Is the Stock Market Overvalued?

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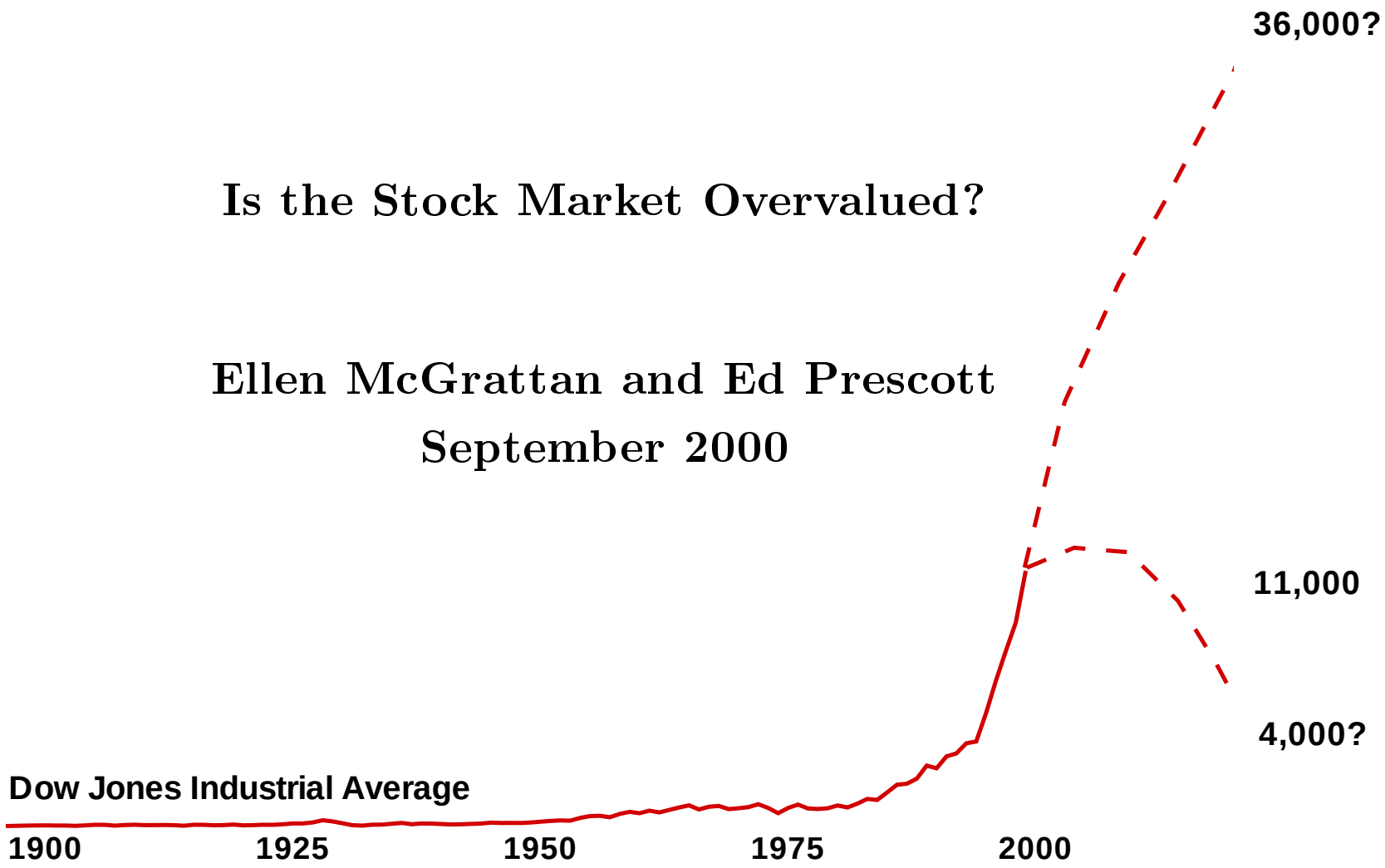
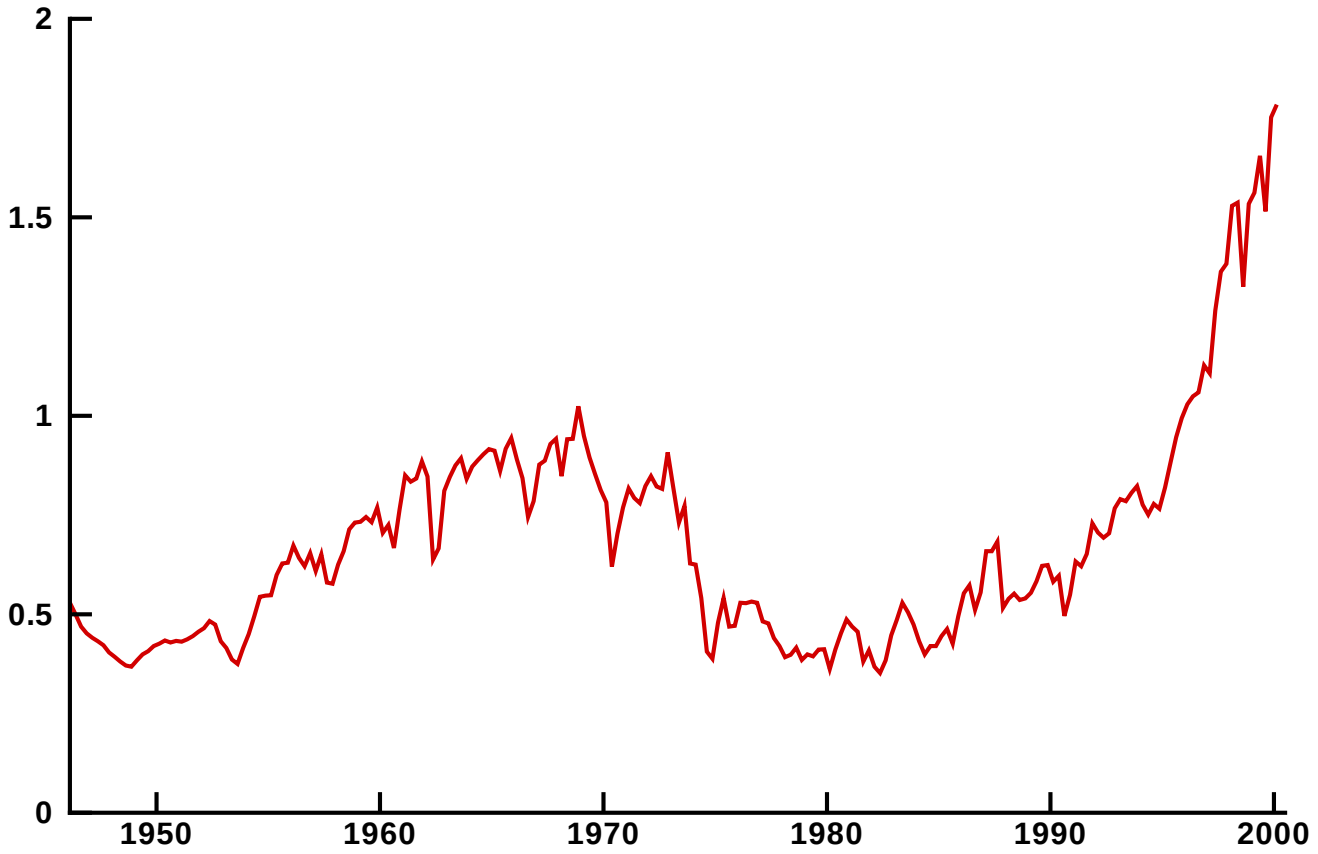
September 2000



Stock Market Value to GNP

- Doubled since 1994
- Previous peak in 1968

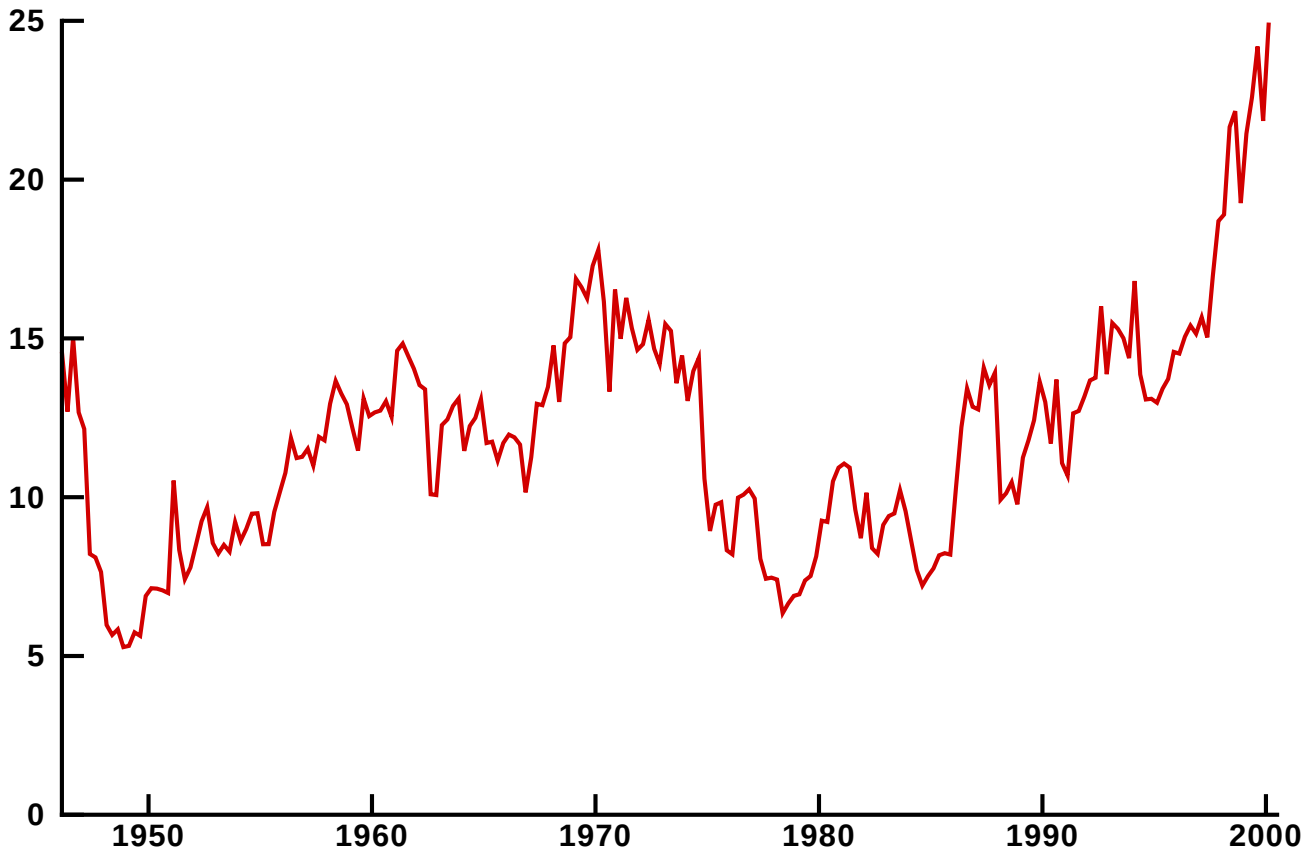


Stock Market Value

- **Is 1.8 GNPs too high?**
- **Should Greenspan be concerned?**
- **Should investors switch from stocks to bonds?**

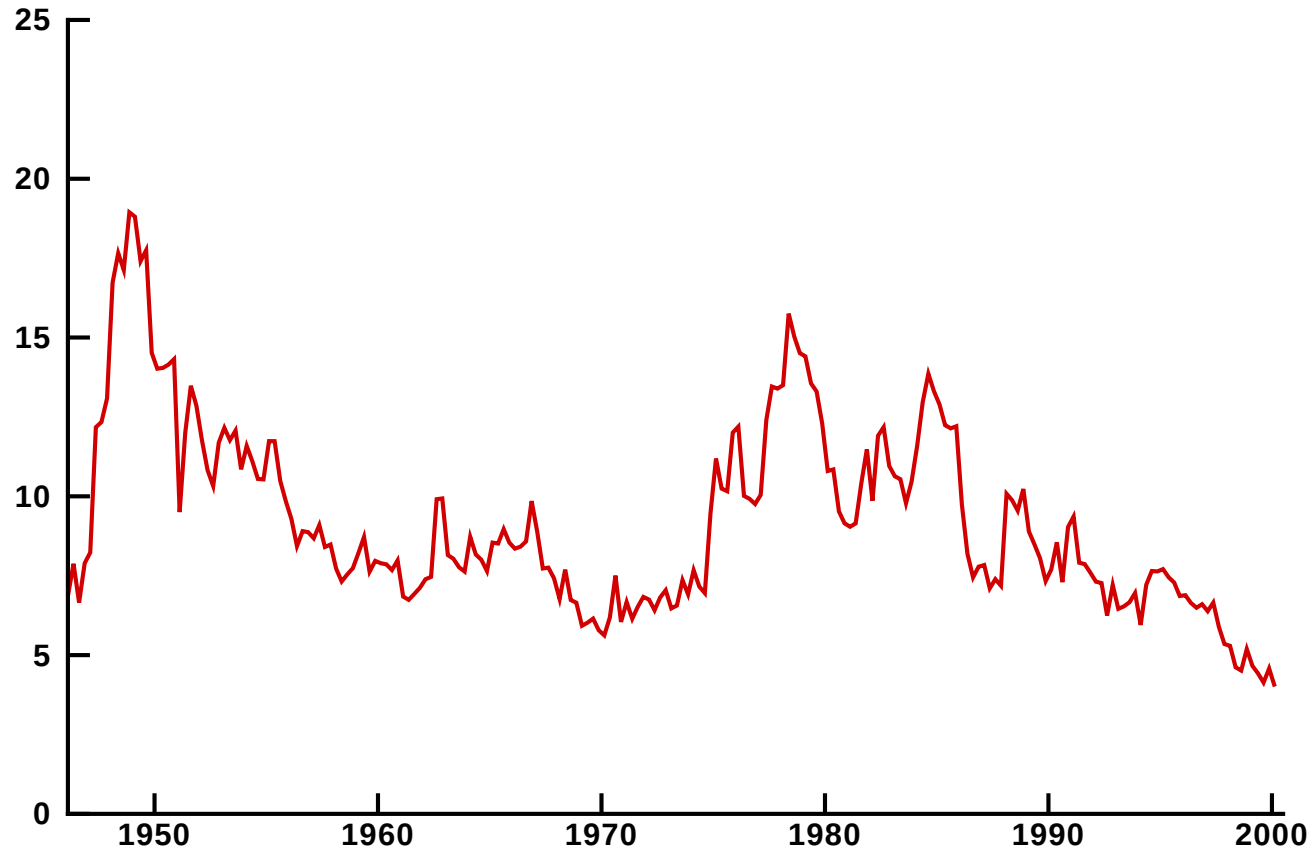
Price-Earnings Ratio

- At historical high
- Earnings not rising with price



Another look: Earnings-Price Ratio

- E/P like return
- At historical low



Earnings-Price Ratio

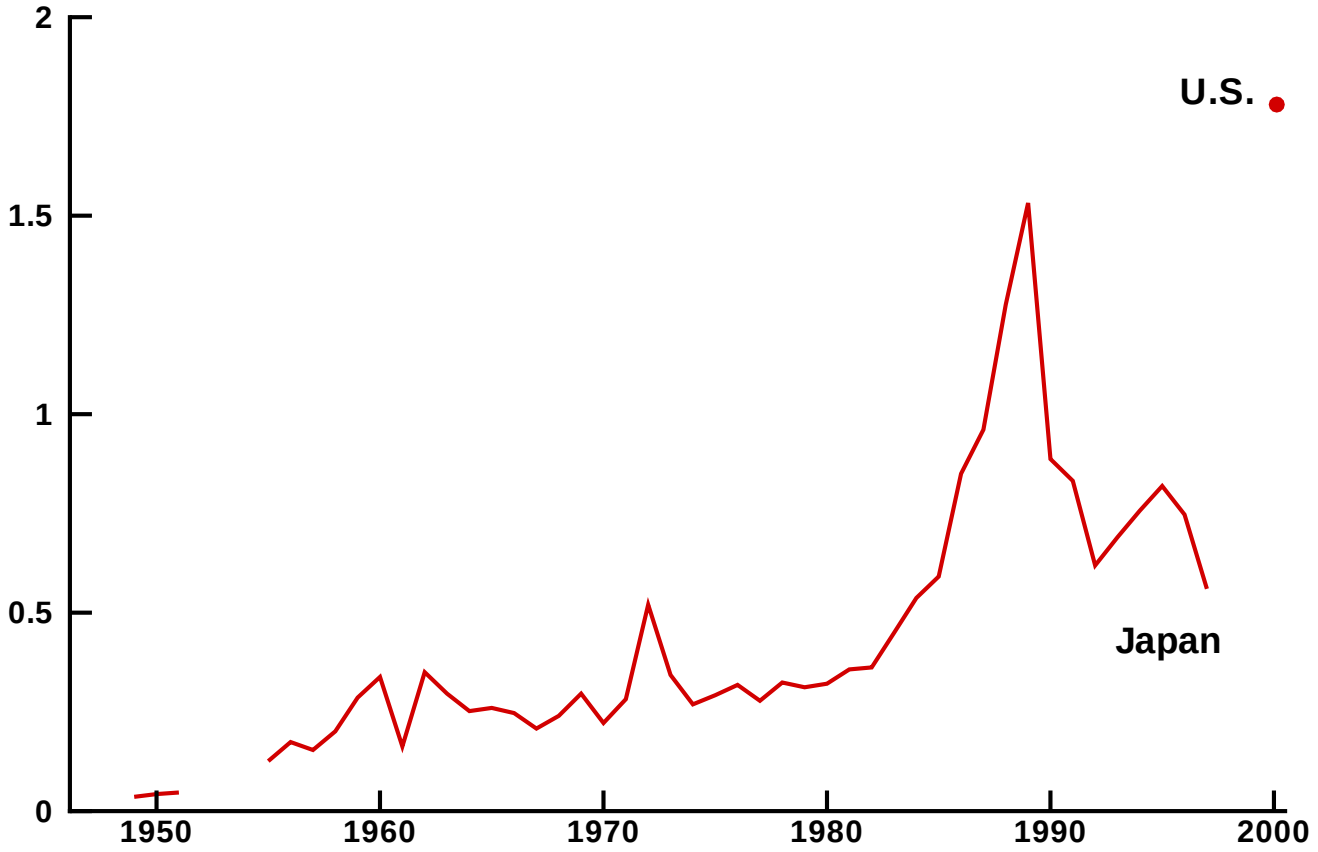
- **Is earnings-price ratio of 4% too low?**
- **Should we expect 7% *real* stock returns of the past?**

\$1 in 1802 in stocks $\Rightarrow$ \$658,000 in 2000

in long-term bonds $\Rightarrow$ \$900

Bubble?

- **Or should we expect a crash like in Japan?**



Our Reading of the Data

- **Is 1.8 GNPs too high?** No.
- **Should Greenspan be concerned?** No.
- **Should investors switch from stocks to bonds?** Possibly.
- **Is earnings-price ratio of 4% too low?** No.
- **Should we expect 7% real returns of the past?** No.
- **Should we expect a market crash?** If it goes higher.

Two Approaches

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

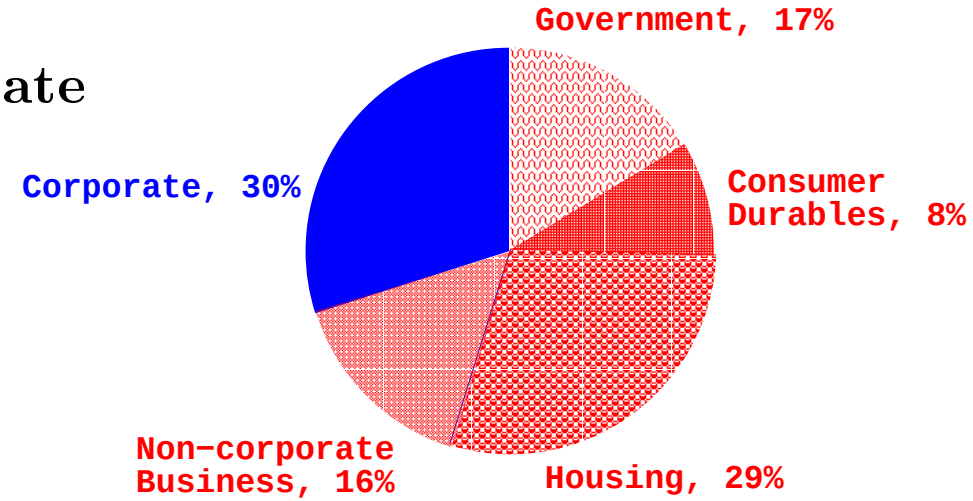
- **Macro:**
  - **Data: NIPA**
  - **Theory: growth theory with** $V = K$

Theory

- **Main results:**
  - **Value of stocks = Value of corporate capital stock**
  - **Return on stocks $\approx$ Return on capital stock**
  - **Earnings-price ratio $\approx$ Return on stocks**
  - **Equity premium is small**

Key Facts Motivating Model We Use

- Corporate and non-corporate sectors large
  ⇒ need 2 sectors



- Corporate sector nearly 100% equity financed
  ⇒ don't worry about corporate debt

- Household debt/equity holding is 1.9/1.4 GNPs
  ⇒ households not on corners

- Household pension debt/equity is .57/.63 GNPs
  ⇒ can avoid transaction costs of switching

2-Sector Growth Model

- **Willingness to substitute:**

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

- **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,** $\ell =$ **leisure,** $N =$ **household size**

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

2 Decentralizations

1. **Firms make dynamic decisions & households get profits**
2. **Households make dynamic decisions**

$$\underbrace{(1+\tau_{c,t})c_t}_{\text{consumption}} + \underbrace{x_{1m,t}+x_{1u,t}+x_{2,t}}_{\text{investments}} \qquad \text{(period } t \text{ budget)}$$

$$= \underbrace{r_{1m,t}k_{1m,t}+r_{1u,t}k_{1u,t}+r_{2,t}k_{2,t}}_{\text{rental income}} + \underbrace{w_t n_t}_{\text{wages}}$$

$$- \underbrace{\tau_{1k,t}k_{1m,t}-\tau_{2k,t}k_{2,t}}_{\text{property taxes}} - \underbrace{\tau_{n,t}w_t n_t}_{\text{labor taxes}}$$

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

$$- \underbrace{\tau_{2,t}\left[(r_{2,t}-\delta_2-\tau_{2k,t})k_{2,t}\right]}_{\text{noncorporate taxes}} + \underbrace{\pi_t}_{\text{transfers}}$$

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 $t+1$:**

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

$$r^f_t = \left[\beta E_t \frac{(c_{t+1})^{-\sigma}(\ell_{t+1})^{\psi(1-\sigma)}}{(c_t)^{-\sigma}(\ell_t)^{\psi(1-\sigma)}}\right]^{-1} - 1$$

Note: τ_1 is the corporate tax rate

d is 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	**0.29**
Unmeasured intangible capital	**0.41**
Total	**1.75 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 = .012 GNPs**
  - **Return on their capital ≈ 4.1 %**

  ⇒ Value of stock ≈ .012/.041 = .29 GNPs

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

  ⇒ formula for value of intangible capital = .41 GNPs

Estimate of Intangible Capital

- **Determine interest rate from noncorporate sector:**

$$i = \frac{\text{accounting} + \text{imputed profits}}{\text{noncorporate} + \text{foreign subsidiary capital}}$$

$$= \frac{.064 + .89i}{2.16 + .012/i} \qquad \Rightarrow \; i = \mathbf{4.1\%}$$

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

$$i = \frac{\text{after}-\text{tax profits from measured capital}}{\text{measured capital}}$$

$$= (1 - .36)\frac{.073 + .03k_{1u} - .0408k_{1u}}{1.043} \qquad \Rightarrow \; k_{1u} = \mathbf{.64}$$

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 less than .1%**

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

$\Rightarrow$ **we should not expect 7% real returns of the past**

Equity Premium Puzzle

- **Mehra and Prescott (1985):**
  - **showed large historical premium inconsistent with standard theory**
  - **this lead to many theories of large premium**
- **Current data show a vanishing premium**

What Should Investors Do?

- **Diversify**
- **Consider inflation-protected bonds**
- **Sell if market value continues to rise**
- **Buy if it crashes**

What Should Theorists Do?

- **Address:**
  - **What accounts for low historical stock values?**
  - **What accounts for large swings in stock values?**
  - **What accounts for business cycles and asset returns?**