Equity Premium in a World Without Uncertainty

Edward C. Prescott

Conference on Economic Dynamics
Tokyo University November 2-3, 2006

Overview

- For any lender a borrower there must be
- See large amount of borrowing and lending between old people (people over 50)
- Lots of intermediated borrowing and lending is within the old generation
- What is going on?

Overview

- Lenders are the annuity holders
- Borrowers own partially debt financed real estate
  - rental properties (direct, limited partnerships, and REITS)
  - owner occupied housing (with mortgages)
  - small businesses
- Borrowers also hold corporate equity

Features of Model Economy

- No aggregate uncertainty
- Only uncertainty is idiosyncratic
- This uncertainty is length of lifetime
- In equilibrium some lend (have a annuity) and hold no equity
- Some borrow, hold equity
- Bequest motive varies over people

- In equilibrium the holders of equity are those with a bequest motive of sufficient strength
- H.H. borrowing rate and the return on equity r_e equal
- H.H. lending rate is lower by the amount of intermediation costs (match with NIPA)
- People on corners is key

The Model Economy

- Steady state analysis
- People have a working period
- Retirement life is exponential with death rate δ
- Density 1.0 born every instance

Preferences

- If retire at t = 0, preferences ordered by

$$\sum_{t=0}^{\infty} \beta^t (1-\delta)^t \log c_t + \sum_{t=1}^{\infty} \beta^t (1-\delta)^{t-1} \delta \alpha \log b_t$$

- b is the bequest, which is given at time of death
- People differ in strength of bequest motive α

Best No Annuity Strategy

- For some $\overline{c}$
- Consumption: $c_t = \overline{c}\, w_t$
- Bequest if die at t: $b_t = w_t$
- Wealth law of motion: $w_{t+1} = (1 + r_e)(w_t - \overline{c}\, w_t)$

Use Recursive Methods to Find $\overline{c}$

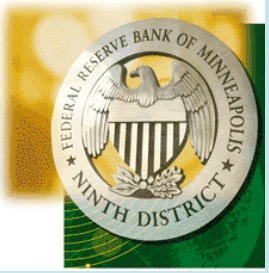
The functional equation is

$$v(w) = \max\{\log c + \delta\,\alpha\,\beta \log b + (1-\delta)\,\beta\, v(w')\}$$

$$\text{s.t.} \quad c + \frac{w'}{1+r_e} \leq w$$

Here r_e is the return on equity, which equals the household borrowing rate

- Straightforward to show …



- The form of the solution to optimality equation is

$$v(w) = a + \theta \log w$$

- *where*

$$\theta = \frac{1 + \alpha\,\beta\,\delta}{1 - (1 - \delta)\beta}$$

- *Therefore*

$$\overline{c} = \frac{1}{1 + \alpha\,\beta\,\delta + (1 - \delta)\beta\,\theta}$$

Best Annuity Strategy

- Use non recursive methods
- For some (b,c) best strategy has form

$$b_t = b[\beta(1+r)]^t$$

$$c_t = c[\beta(1+r)]^t$$

The Problem is Maximize

$$\sum_{t=0}^{\infty} \beta^t (1-\delta)^t \log c_t + \sum_{t=1}^{\infty} \beta^t (1-\delta)^{t-1} \delta \alpha \log b_t$$

subject to

$$c \sum_{t=0}^{\infty} \frac{(1-\delta)^t [\beta(1+r)]^t}{(1+r)^t} +$$

$$b \sum_{t=1}^{\infty} \frac{(1-\delta)^{t-1} \delta [\beta(1+r)]^t}{(1+r)^t} = w_0$$

- Problem structure:

$$\max\{\sigma_c \log(c) + \sigma_b \log(b)\}$$

s.t. $$p_c c + p_b b = w_0$$

- This is a standard problem with solution

$$p_c c = \frac{\sigma_c}{\sigma_c + \sigma_b} w_0 \qquad p_b b = \frac{\sigma_b}{\sigma_c + \sigma_b} w_0$$

Intermediation

- The intermediation technology is constant returns to scale with intermediation costs ϕ per unit of value intermediated

- Thus

$$r_e = r + \phi$$

Working Age People

- All that matters is the wealth these individuals have when they retire
- Some receive bequests, some don't
- Wealths of those retiring differ for other reasons
  - endowed stock of human capital
  - occupational choice (Rios-Rull)

Balance Sheets

- Most of debt assets are pensions, but also include M2 and government debt
- These numbers selected to be consistent with Flow-of-Funds statistics
- Ignored rest of world, but did match to U.S. household net worth

Pre-Retiree's Balance Sheet

Assets		Liabilities	
Equity	0.5	Debt Liabilities	0.5
Debt	0.8	Net Worth	0.8

Retiree's Balance Sheet who Annuitize

Assets		Liabilities	
Equity (houses)	0.3	Debt Liabilities	0.2
Debt assets	1.0	Net Worth	1.1

Retiree's Balance Sheet Who Don't Annuitize

Assets		Liabilities	
Equity	2.0	Debt Liabilities	1.0
Debt Assets	0.2	Net Worth	1.2

Government

Assets		Liabilities	
Equity	0.3	Debt Liabilities	0.3
Debt Assets	0	Net Worth	0

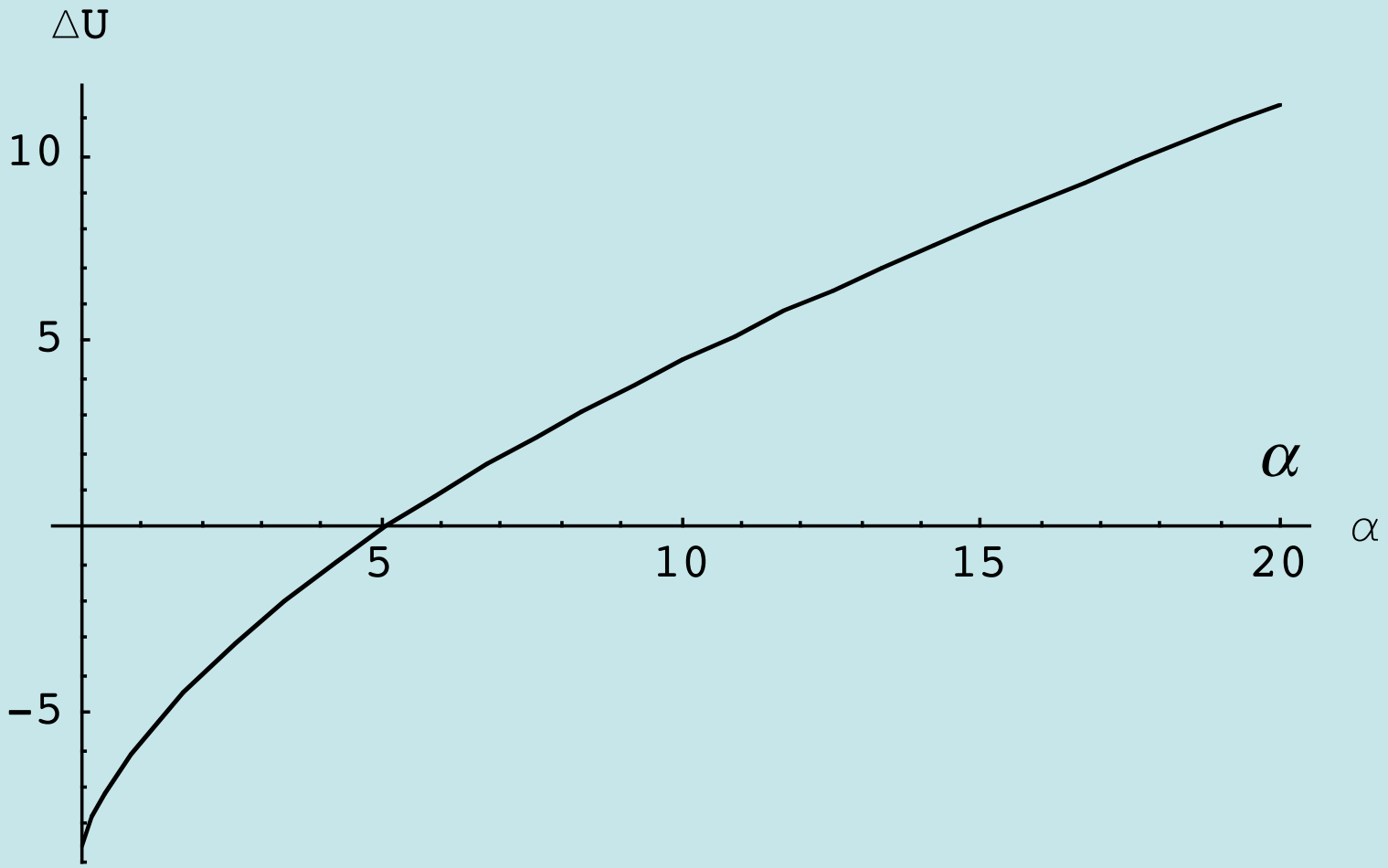
Some Results

- People with a low α use annuities.
- Those with a high α hold equity and debt.
- For the parameters

$$\beta = 0.99, \delta = 0.05, r = 0.04 \text{ and } r_e = 0.06$$

- People with $0 \leq \alpha \leq 5$ buy annuities.
- Those with a higher α buy equities.

Utility Difference for Maximal No Annuity and Maximal Annuity Strategies as function of α



Making General Equilibrium

- Have the government debt that results in r = 0.04
- This results in a capital annual-output ratio of about 3.5, which matches with observation
- See Birkeland and Prescott (2006), “How Much Government Debt Should There Be”.

Concluding Comments

- This is just a first baby step in what I conjecture will a big and fruitful research program
- Build in survival rates is one thing
- Build in adverse selection on annuities is another
- Build in moral hazard of annuity holders living too healthy a life style

- Need better statistics on individual asset holdings – not so easy to get
- Theory should match stocks of assets held
- Theory should match intermediation spreads, which are big
- U.S. NIPA shift from lenders buying the imputed intermediation services to lenders buying these services reduced GDI by nearly 5 percent