Reconciling conflicting evidence on the elasticity of intertemporal substitution

A macroeconomic perspective

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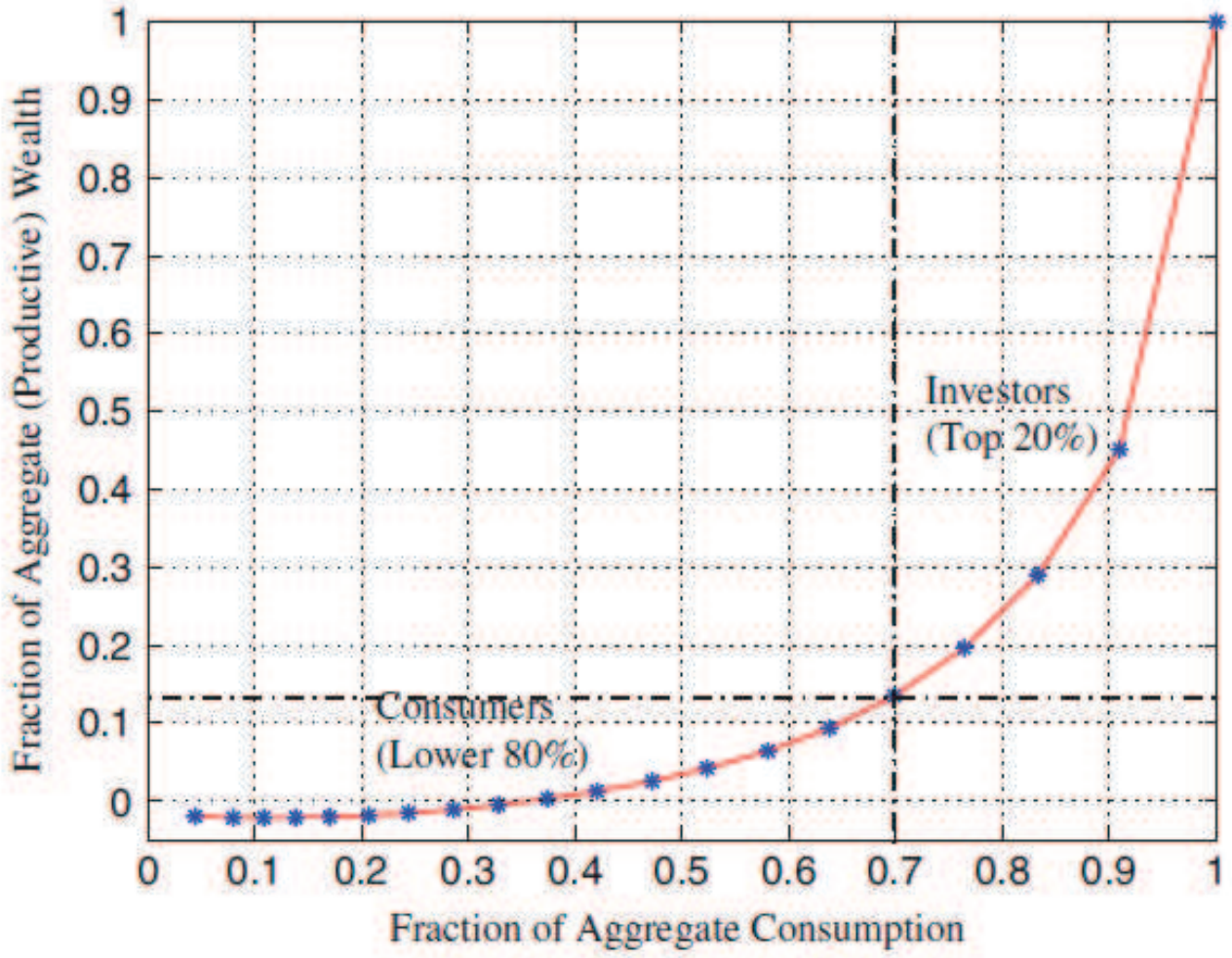
Motivation: Conflicting Evidence on EIS

$$R_t^f = \eta + \frac{1}{EIS} log(\frac{C_{t+1}}{C_t})$$

- Macroeconomists
  - High EIS: around 1
  - RBC models: Jones et al. (2000)
- Empirical studies
  - Low EIS: around 0.1
  - Conditional euler equation estimation: Hall(1988)

Motivation: Wealth and Consumption Inequality



▸ Model Results

Guvenen (2006)

- A model to 'reconcile' conflicting evidence:
  1. Limited participation
  2. Heterogeneous EIS
- Introduce these features in standard RBC
- Main results:
  1. Substantial wealth inequality
  2. Investment and output determined by wealthy (high EIS) stockholders
  3. Consumption reflects low EIS of the majority (poor)

The Model: Basic Setup

- 2 types of agents: stockholders (high EIS) and non-stockholders (low EIS)
- Both have access to bond (in zero net supply), only stockholders can buy firm shares (capital)
- Epstein-Zin Preferences
- CRS production by representative firm
- Only aggregate uncertainty

The Model: Firm's Problem

- The firm solves sequence of static problems

$$\underset{K_t, L_t}{Max}\, Z_t K_t^{\theta} L_t^{1-\theta} - (R_t^s + \delta) K_t - W_t L_t$$

- FOCs

$$R_t^s = \theta Z_t (K_t / L_t)^{\theta - 1} - \delta$$
$$W_t = (1 - \theta) Z_t (K_t / L_t)^{\theta}$$

- Z_t follows a first-order Markov process

The Model: Households' Dynamic Problem

- Households type i $\in \{n, h\}$ solve

$$V(\omega; \mathbf{Y}) = \underset{C,b',s'}{Max} \left((1-\beta)C^{\phi} + \beta \left(E[V(\omega'; \mathbf{Y}')^{1-\alpha} | Z] \right)^{\frac{\phi}{1-\alpha}} \right)^{\frac{1}{\phi}}$$

$$s.t.$$

$$\begin{aligned} C + q(\mathbf{Y})b' + s' &\leq \omega + W(K, Z) \\ \omega' &= b' + s'(1 + R^s(K', Z')) \\ K' &= \Gamma_K(\mathbf{Y}) \\ B' &= \Gamma_B(\mathbf{Y}) \\ b' &\geq \underline{B} \end{aligned}$$

where the aggregate state is

$$\mathbf{Y} \equiv (K, B, Z)$$

The Model: RCE

A recursive competitive equilibrium for this economy is given by $V^i(\omega^i; \mathbf{Y})$, $C^i(\omega^i; \mathbf{Y})$, $b^i(\omega^i; \mathbf{Y})$ for i $\in \{h, n\}$, $s(\omega^h; \mathbf{Y})$, price functions $q(\mathbf{Y})$, $R^s(K, Z)$, $W(K, Z)$, and laws of motion $\Gamma_K(\mathbf{Y})$, $\Gamma_B(\mathbf{Y})$, such that:

1. Given q, R^s, W, Γ_K and Γ_B, V^i, C^i, b^i and s solve each agent's problem.
2. Factors are paid their marginal product.
3. Bond Market clears (and L=1),

$$\lambda b^h(\overline{\omega}^n; \mathbf{Y}) + (1 - \lambda) b^n(\overline{\omega}^n; \mathbf{Y}) = 0$$

4. Aggregates are consistent with individual behavior,

$$K' = \lambda s(\overline{\omega}^h; \mathbf{Y})$$
$$B' = (1 - \lambda) b^n(\overline{\omega}^n; \mathbf{Y})$$

Baseline Calibration (annual)

Parameter	Value
β	0.96
α^h, α^n	3
ρ^h	**1**
ρ^n	**0.1**
λ	**0.3**
π_{11}, π_{22}	2/3
σ_Z	0.031
θ	0.4
δ	0.08
$\underline{B}^h$	$4\overline{W}$
$\underline{B}^n$	$0.3\overline{W}$

Results from Baseline Economy (1)

Table: Business Cycle Statistics

	S. Dev. (%)			Autocorrelation		
	Y	I	C	Y	I	C
U.S. data	2.2	8.5	1.5	0.52	0.36	0.57
Models						
RA (EIS=0.1)	3.6	10.8	1.5	0.65	0.49	0.98
RA (EIS=1.0)	3.0	8.7	1.7	0.52	0.33	0.94
Limited Participation	3.0	8.8	1.5	0.53	0.36	0.96

Results from Baseline Economy (2)

Table: Concentration of Wealth and Consumption

	U.S. data		Model	
Wealth Percentile	1-30	31-100	1-30	31-100
Variable				
Net Worth	0.88	0.12	0.89	0.11
Productive Wealth	0.94	0.06	0.89	0.11
Financial assets	1.04	-0.04	**0.89**	**0.11**
Consumption	0.43	0.57	**0.37**	**0.63**

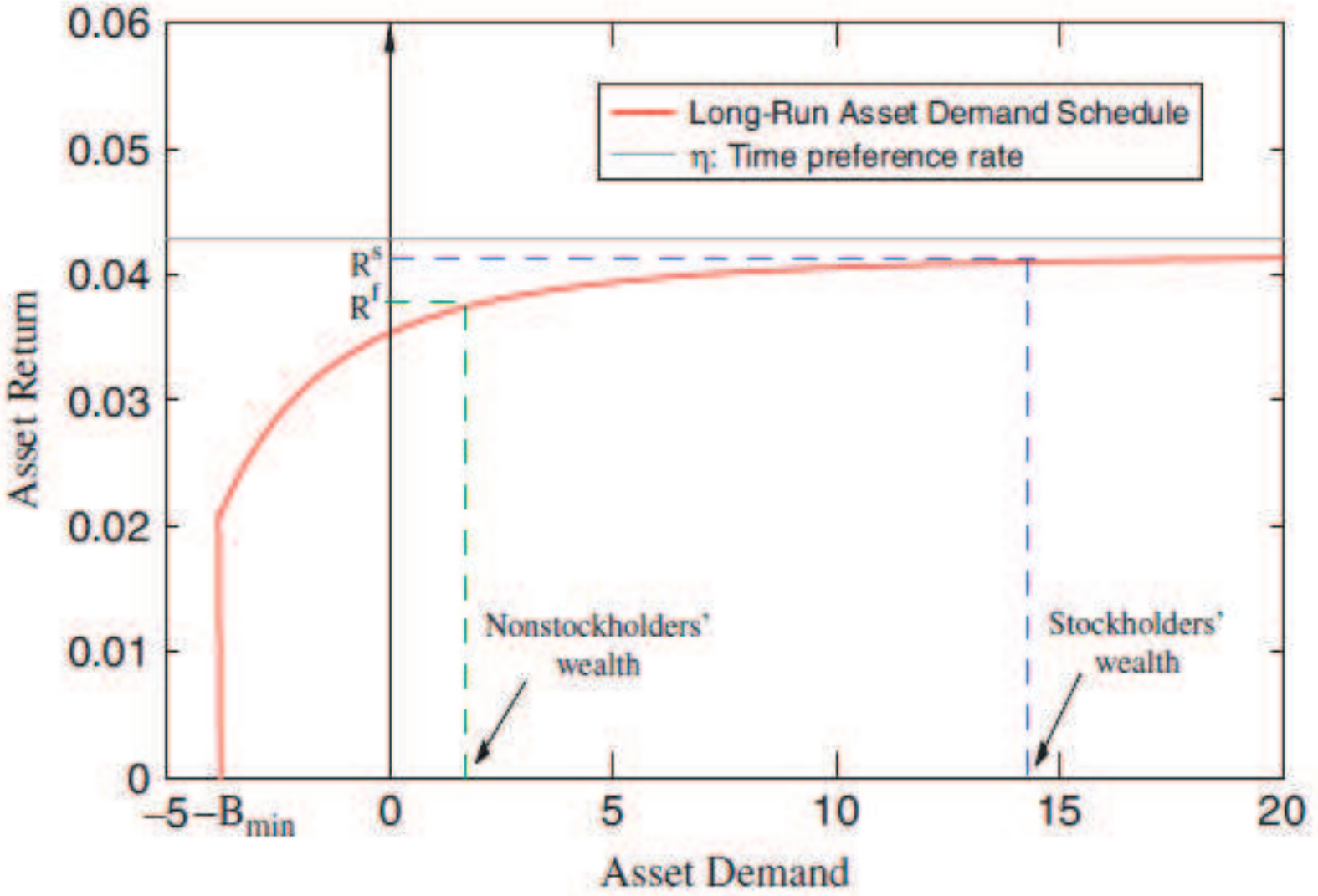
▸ Empirical Distribution

Limited Participation & cross-sectional heterogeneity

Table: Limited participation model with identical agents

	Stockholders	Non-stock.
Share of $\overline{\omega}$	0.78	0.22
Per-capita ω	8.27	1.00
Per-capita C	1.48	1.00
Sdev (log C)	0.018	0.019
Corr. (C,Y)	0.44	0.77

Effect of Limited Participation



Empirical Estimates of the EIS

$$\Delta c_{t+1} = k + \rho r^{f}_{t+1} + \epsilon_{t+1}$$

Table: Log-linearized Euler equation with risk-free return

	Non-stock.	Stockholders	Agg.
True EIS	0.10	1.00	0.47
		k=constant	
EIS	0.11	0.54	0.25
(t-stats)	(22.15)	(51.1)	(36.82)
		k=constant+$(1/2\rho)var_t(\Delta c_{t+1})$	
EIS	0.101	1.07	0.48
(t-stats)	(17.02)	(27.96)	(21.84)

Appendix (1): Policy Implications

- Welfare gain of simple tax reform
  - $t^k = 36\%$, unexpectedly eliminated
- Representative agent economy
  - $\rho = 1.0 \rightarrow 0.93\%$ of C per period (incl. transition)
  - $\rho = 0.1 \rightarrow 0.4\%$ of C per period (incl. transition)
- Limited participation economy
  - 0.82% of total C per period (incl. transition)
  - $+5.4\%$ Stockholders, -2.1% Non-stockholders