Lecture 2: Preferences

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Individual Preferences

Why Should We Care about Different Preferences?

- Many key ideas we learn in economics are discussed in the context of (i) expected utility preferences, (ii) defined over consumption, (iii) that are time separable.

- Relaxing any one of these assumptions can substantially alter key conclusions (we thought were very general).

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- Relaxing any one of these assumptions can substantially alter key conclusions (we thought were very general).
- Three examples:
  - Tests of complete markets/perfect "consumption" insurance
  - Is the "Permanent Income Hypothesis" same as "consumption smoothing"?
  - Is precautionary savings driven by risk aversion?

Example 1: Tests of Perfect Insurance, Test 1

- Complete markets $\rightarrow$ Marginal utility growth is equated across individuals (X: leisure, demographics, etc):

$$\beta^i \frac{U_c^i(C_{t+1}^i, X_{t+1}^i)}{U_c^i(C_t^i, X_t^i)} = \beta^j \frac{U_c^j(C_{t+1}^j, X_{t+1}^j)}{U_c^j(C_t^j, X_t^j)} = \lambda_{t+1}.$$

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- Utility is unobserved, so we have to add assumptions (i) $U^i = U^j$ for all i, j; (ii) U separable in C & X, and (iii) U is CRRA $\rightarrow$ consumption growth is equated across individuals:

$$\left(\frac{C_{t+1}^i}{C_t^i}\right)^{-\alpha} = \left(\frac{C_{t+1}^j}{C_t^j}\right)^{-\alpha} \rightarrow \Delta log(C_{t+1}^i) = \Delta log(C_{t+1}^j) = -\Delta log(\lambda_{t+1})/\alpha \tag{1}$$

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- Test 1: Regressing individual consumption growth using panel data on time effect (aggregate shock) & any idiosyncratic variable (wage growth, health shocks, etc, etc.) should yield a zero coefficient on the latter.
  - E.g., Cochrane (1991): rejects full insurance.

Example 1: Tests of Perfect Insurance, Test 2

- Test 2: Plot consumption growth of group g (e.g., college grads) vs their wage growth: $log(\overline{C}^g_{t+k}) - log(\overline{C}^g_t)$ vs $log(\overline{W}^g_{t+k}) - log(\overline{W}^g_t)$ for any $k > 0$. Should be flat if markets are complete

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Figure 1: Attanasio and Davis (1996)

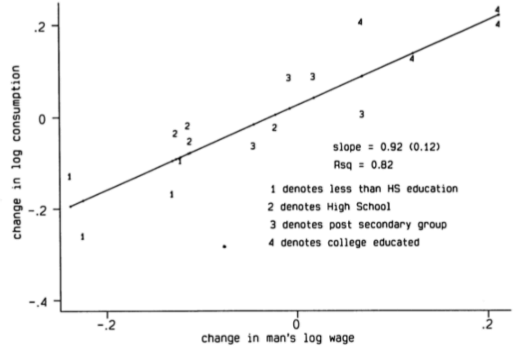

FIG. 2.—Household consumption vs. man's wage, 1980–90 log change residuals. Groups are defined by four-way education crossed with 5-year birth cohorts. Plotted values are residuals from regressions on a cubic in age.

Example 1: Tests of Perfect Insurance, Test 3

- Test 3: Within-Cohort consumption inequality should not rise with age even if income inequality rises (Deaton and Paxson (1994)).

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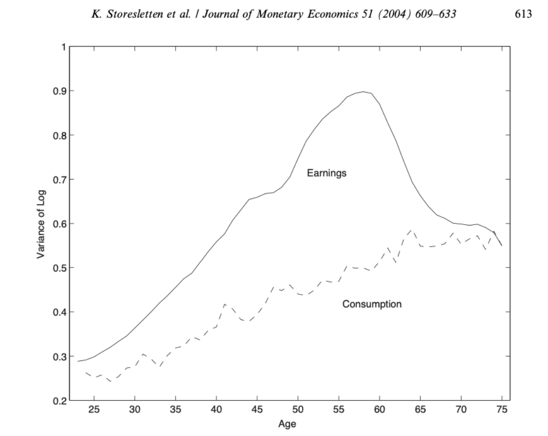

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- Altug and Miller (1990) & Hayashi et al. (1996): Model nonseparabilities through Beckerian household utility function—non-separable in spouses' leisure time, # of children, home production, etc.
  - (Hayashi et al. (1996) still rejects full insurance so evidence against it is very strong.)

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- Similarly, if utility is non-homothetic, eq (1) won't hold under perfect insurance. Ogaki and Zhang (ECMA 2001) cannot reject risk sharing in India and Pakistan under this assumption.

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1. In some specifications below, such as habit formation, PIH will imply smoothing not the level but the growth rate of consumption.

2. When consumption and leisure are non-separable:
   - Consumption may grow over the life cycle even without any borrowing constraints or incomplete markets.
   - Consumption *expenditures* may fall at retirement fully rationally (recall Aguiar and Hurst (JPE 2005) paper "Consumption vs Expenditures" discussed in Lecture 1).

Taking Stock

- Trade-off between the number or stringency of assumptions we impose and the sharpness of predictions we get.
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- Anytime you see an empirical "fact," you should ask what assumptions were made to obtain it.
- Subtle implicit assumptions often outnumber explicit ones.
- Choice of preferences is a key assumption, which is the topic for today.

Preference Specifications

Homothetic Preferences

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2. For any $\theta > 0$ we can write a utility function as:

$$u = F(v(x_1, x_2)) \quad \text{and } v(\theta x_1, \theta x_2) = \theta v(x_1, x_2),$$

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3. they can be represented with a utility function homog. of deg. 1 (i.e., choice theory analog of CRS in production theory.)
4. Engel curves are linear and go through the origin, so that when a consumer's income doubles, her consumption of all goods doubles.

Individual Preferences over (c,ℓ): Basics

1. Separable power utility (POW):

$$U(c,\ell) = \frac{c^{1-\sigma}}{1-\sigma} + \psi \times \frac{\ell^{1-\gamma}}{1-\gamma} \quad \text{or} \quad U = \frac{c^{1-\sigma}}{1-\sigma} - \phi \times \frac{(1-\ell)^{1+\eta}}{1+\eta} \qquad (2)$$

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3. Greenwood-Hercowitz-Huffman (GHH) preferences:

$$U(c,\ell) = \left(\frac{c - \psi(1-\ell)^{1+\gamma}}{1+\gamma}\right)^{1-\sigma}. \tag{4}$$

No wealth/income effect: labor supply depends on wages only, which makes it tractable and convenient in certain applications (e.g., aggregation).

Reference- or Benchmark-Dependent Preferences

I. Simplest Form: Stone-Geary Utility

- Stone-Geary utility captures the idea of "subsistence-level" consumption, $\underline{c}$, below which an individual cannot survive.
- A common specification would be a simple modification to CRRA utility:

$$\mathcal{U} = \frac{(c_t - \underline{c})^{1-\gamma}}{1-\gamma} \qquad \text{for } c_t > \underline{c}.$$

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- In development econ., $\underline{c}$ is thought of as the minimum calorie intake for someone to survive.
- It is natural to view $\underline{c}$ to be a constant level. Therefore, in a growing economy, as the level of c_t rises, $\underline{c}$ becomes negligible, and preferences approximate CRRA.
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  - So you can create preference heterogeneity with income level differences alone.
- Note that Stone-Geary utility is not homothetic.

II. Habit Formation (aka Endogenous Habit)

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- A more general specification:

$$\mathcal{U} = \frac{(c_t - \theta x_{t-1})^{1-\gamma}}{1-\gamma}, \quad \text{where } x_t = \phi x_{t-1} + (1-\phi) c_t. \tag{6}$$

- When $\phi = 0$, (6) reduces to (5). When $\phi > 0$, habit stock is geometrically discounted average of past consumption:

$$x_t = (1-\phi) \sum_{s=0}^{\infty} \phi^s c_{t-s}.$$

III. "Catching-up/Keeping-up with Joneses" (External Habit)

- Another plausible idea: Utility from consumption depends on consumption of peer group. Very old idea in economics (Veblen 1899, Duesenberry 1949).
- A simple but common specification ($\theta \in (0,1)$) :

$$\text{Catching up: } \mathcal{U}^i = \frac{(c_t^i - \theta \overline{C}_{t-1})^{1-\gamma}}{1-\gamma}, \text{ or Keeping up: } \mathcal{U}^i = \frac{(c_t^i - \theta \overline{C}_t)^{1-\gamma}}{1-\gamma} \tag{7}$$

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  1. Simplifies dynamic problem: utility is time-separable & today's choices don't affect future utility (as individual perceives it).
  2. Benchmarking creates an externality effect $\rightarrow$ individual consumption choice is typically not socially optimal
     - Ljungqvist & Uhlig (AER, 2000): Income tax socially desirable & can recover Pareto optimality! Everyone better off when everyone works/consumes less!

A More General "External" Habit Specification

- Campbell and Cochrane (JPE, 1999): Almost 6000 google cites.
- Surplus consumption ratio: $S_t^a \equiv (C_t^a - X_t)/C_t^a$. Small letters logs:

$$s_{t+1}^a = (1-\phi)s + \phi s_t^a + \lambda(s_t^a)(c_{t+1}^a - c_t^a - g),$$

$$\lambda(s^a) = \begin{cases} (1/\overline{S})\sqrt{1-2(s^a-\overline{s})} - 1 & \text{if } s^a \leq s_{max} \\ 0 & \text{if } s^a \geq s_{max} \end{cases}$$

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- They reverse engineer $\lambda(s^a)$ function & can match equity premium & solve other asset pricing puzzles.
- However, it also leads to some strange behavior:
  - C-C: C & X move in same direction. More cons. always social. desirable.
  - Ljungqvist & Uhlig (2015, JPE): Not robust to discrete deviations → Occasionally destroying part of endowment can lead to large welfare improvements.
  - Also, RRA in C-C is 80 on average & as high as 300 in recessions.

Combining External and Endogenous Habit

- Abel (1990):

$$x_t \equiv \left[c_{t-1}^{D} \overline{C}_{t-1}^{(1-D)} \right]^{\alpha}$$

where $\alpha \geq 0$ and $D \geq 0$, and

$$\mathcal{U} = \frac{(c_t / x_t)^{1-\gamma}}{1-\gamma}.$$

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When $D = 0$, this specification reduces to a pure external habit formulation, whereas $D = 1$ is the pure endogenous habit formulation.

- Unlike "difference" formulations, this one preserves homotheticity. Not as popular as formulations above.
- Also used in Chan and Kogan (2002) with $D = 0$.

Habit in Heterogeneous-Agent Models

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- This can also happen in rep. agent models but is much more severe in heterog. agent for two reasons. Individual consumption is much more
  - volatile than aggregate so $c_t < \theta c_{t-1}$ is much more likely.
  - dispersed cross-sectionally, so $c_t < \theta \bar{C}_t$ is much more likely.
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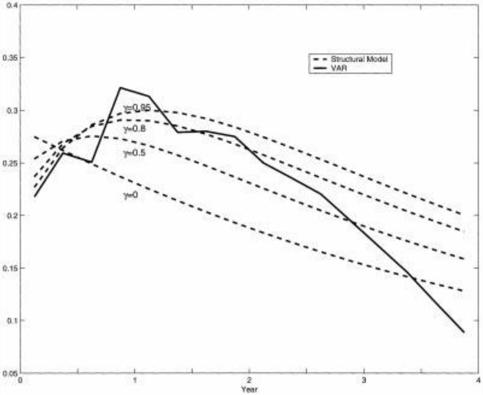
- To avoid this, $\theta \ll 1$, which then weakens the effect of habit.
- This does not happen with Abel's formulation because utility is well defined even when $c_t < x_t$, which is why it's more commonly used in het. agent models.
- e.g., Chan and Kogan (2002) & Pijoan-Mas, Diaz, Rios-Rull (2001), etc.

Applications of Habit Preferences: In Macro

- Key fact about business cycles: real GDP, consumption, and many othe real variables respond to "shocks" with a delay.
- In other words, their impulse responses (to inflation, monetary, etc. shocks) are "hump-shaped".
  - Delay is not small: Peak of hump happens between 12 to 18 months.
- RBC models fail to match this pattern: responses to most shocks are almost instantaneous.
- Enter habit formation: raising consumption suddenly, raises habit stock too much and lowers future utility. So consumption rises slowly instead. Generates the hump-shaped response.

Fuhrer (AER, 2000)

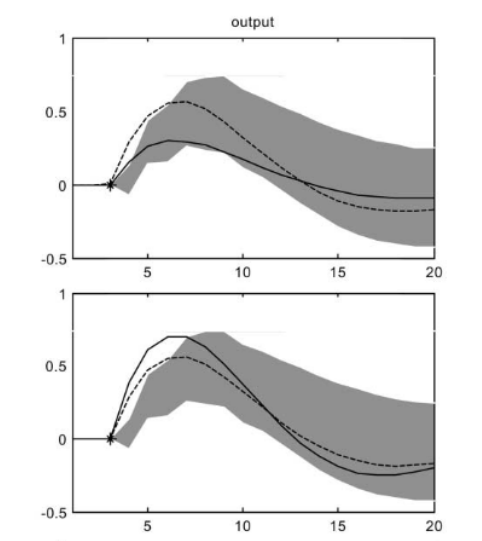
Figure 2: Impulse Response of C to Y



- Solid line: Data impulse response from a VAR.
- Fuhrer's habit formulation is same as Abel (199)'s, with $D = 1$ (endog. habit) and γ in this figure is Abel's α.
- So, as habit is raised, consumption response is delayed and becomes hump-shaped for $\alpha > 0.5$ or so.

Christiano, Eichenbaum, Evans (2005, JPE)

Figure 3: Impulse Response of GDP to money



- Very influential paper in monetary economics, combining RBC & NK models.
- Solid line: Model impulse responses. Each panel is a different model specification. (Ignore dashed lines).
- CEE's formulation is the simple one in (5) shown above with $\gamma = 1$ (log utiliy) and $\theta = 0.65$.
- Same as Fuhrer: You can match the hump-shape in the data with habit formation.

Applications of Habit Preferences: In Finance

- Endogenous/External habit have also been very popular in the asset pricing literature.
- Asset pricing is full of interesting puzzles that defied explanations for a long time:
  - the high equity premium, which is highly volatile, countercyclical, with countercyclical volatility, and Sharpe ratio; predictability of future returns, etc.
- Now there are many papers that can explain these puzzles.
- One strand of literature used endogenous or external habit to explain them: Constantinides (1990), Abel (1990), Jermann (1998), Campbell and Cochrane (1999), Boldrin et al. (2001), Chan and Kogan (2002).

Taking Stock

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- Habit models are both very popular but also quite polarizing.
- On the plus: very powerful modeling tool that can bring models closer to data in important dimensions.
- On the minus:
  - Researchers are wary of explaining hard problems relying just on preferences—since they are unobserved.
  - Especially true for Campbell-Cochrane—recall the discussion above.
  - Strength of habit needed (high θ) lacks empirical support (e.g., De Giorgio, et al (2020) mentioned on next slide).
  - Part of the hesitation due to unusual or undesirable properties mentioned above.

Taking Stock

- An alternative view: Maybe habit is a reduced form for something deeper?
  - Szeidl and Chetty (JPE and ECMA): Consumption commitments, reinterpreting habit formation but different implications.
  - Guvenen (ECMA, 2009): Model with CRRA prefs and limited market participation has reduced form of C-C. Very different policy implications.

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- Other recent work:
  - Christiano, Eichenbaum, and Evans (JPE, 2005): "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy"
  - De Giorgio, Frederiksen, and Pistaferri (RESTUD, 2020): "Consumption Network Effects".
  - Agarwal, Mikhed, Scholnick (RFS, 2020): "Peers' Income and Financial Distress: Evidence from Lottery Winners and Neighboring Bankruptcies"
  - Coibion, Gorodnichenko, Kudlyak, and Mondragon (2014): Banks may be unwilling to lend to poor households in high inequality neighborhoods, concerned about catching-up with Joneses effects.

Key Preference Parameters

I. Back to Risk Aversion:

What Value to Choose?

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- Thus expected utility has difficulty delivering risk aversion behavior consistent with both small and large bets.

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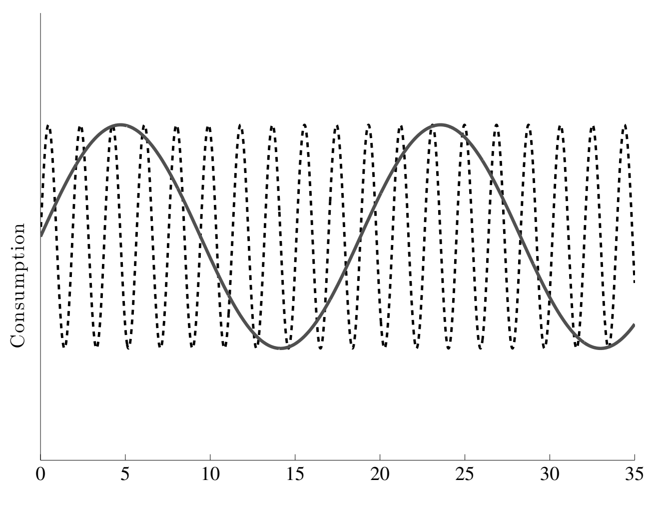
- With CRRA preferences, frequency of fluctuations doesn’t matter for risk premium (putting aside time discounting)

Amplitude vs. Frequency of Fluctuations

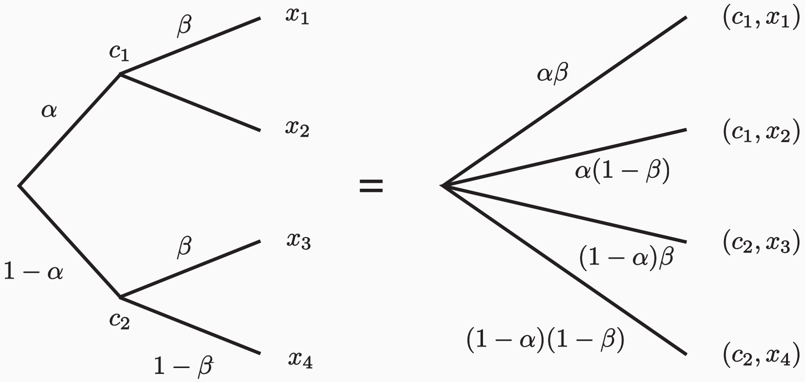
Figure 4: Frequency of Fluctuations Matters with Time Non-Separable Preferences



Epstein-Zin (Recursive) Utility

Key Assumption Behind Expected Utility

Figure 5: Reduction of Compound Lotteries



Epstein-Zin Utility

- Kreps and Porteus (1978) and Epstein and Zin (1989) show that relaxing the "reduction of compound lotteries" assumption delivers a more general preference specification.
- Epstein-Zin use a CES aggregator between current and future utility:

$$\mathcal{V}_t = \left[(1-\beta)c_t^{\rho} + \beta \mathbb{E}_t(\mathcal{V}_{t+1})^{\rho/(1-\gamma)}\right]^{(1-\gamma)/\rho}. \tag{8}$$

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- Epstein, Farhi, and Straleczski (AER 2014): "How Much Would You Pay to Resolve Long-Run Risk?" Turns out a lot: 20%-40% of C.

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$$U(c_0, c_1, ...) = \sum_{t=1}^{\infty} \beta^t \frac{c_t^{1-\gamma}}{1-\gamma} \Rightarrow V(\omega, A) = \phi(A) \times \omega^{1-\gamma}$$

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- This high curvature creates a lot of headache when you try to interpolate the value function.
- The CES formulation as in Epstein-Zin provides a way out.

A Trick to Reduce the Curvature of V(w)

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- Although incomplete markets introduces some curvature, this value function is much easier to interpolate than the one above.
- In fact, I once solved a GE model with asset pricing and a risk aversion of 4 using only 30 points in the wealth grid and linear interpolation.

Curvature of Value Function (Guvenen (ECMA, 2009))

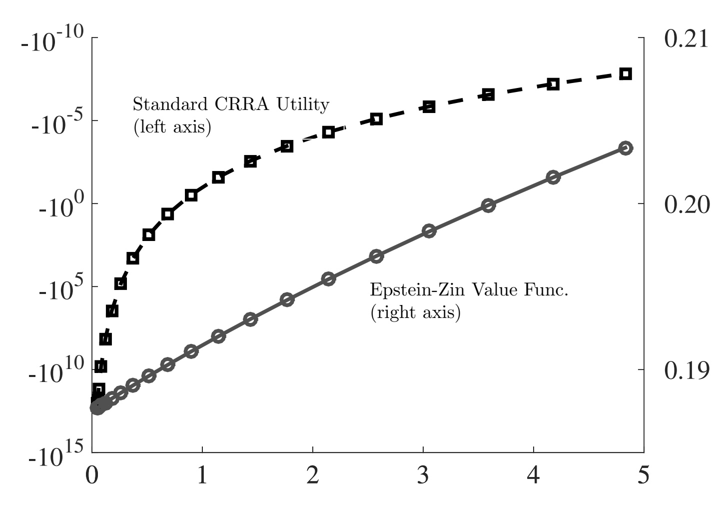

Figure 6: Which Function Would You Rather Interpolate?

II. Elasticity of Intertemporal Substitution

Elasticity of Intertemporal Substitution

- Macroeconomists traditionally used a value of EIS close to 1. Although, this was partly to generate balanced growth (log utility), there is more direct reasoning that also supported this value.
- Rearrange the consumption Euler equation under certainty:

$$R_t^f = \eta + \left(\frac{1}{\text{EIS}}\right) \times \log\left(\frac{C_{t+1}}{C_t}\right), \tag{9}$$

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- This is Weil (1989)'s risk-free rate puzzle. Alternatively, assuming $R^f = 3\%$ and $\Delta \log C = 2\%$ requires EIS to be at least 0.66 for any $\beta < 1$.

Elasticity of Intertemporal Substitution

- Making a similar observation, Lucas (1990) ruled out an elasticity below 0.5 as implausible (in his notation $\sigma \equiv 1/EIS$) :

  If two countries have consumption growth rates differing by one percentage point, their interest rates must differ by σ percentage points (assuming similar time discount rates). A value of σ as high as 4 would thus produce cross-country interest differentials much higher than anything we observe, and from this viewpoint even $\sigma = 2$ seems high.

Econometric Evidence from Aggregate Consumption

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- Kimball and Basu (2003): non-separability between consumption & leisure could create a similar downward bias. Both papers obtained estimates of EIS around 0.35.

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- Other papers focus *directly* on stockholders & non-stockholders (rich/poor): Attanasio et al (2002) obtain EIS around 1 for stockholders & 0.1–0.2 for non-stockholders using UK data. Vissing-Jorgensen (2002) obtains similar estimates from U.S. CEX data.

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- With such heterogeneity, properties of aggregates directly linked to wealth (e.g., investment & output) are mainly determined by wealthy (and high-EIS) stockholders.
- Since consumption is much more evenly distributed, estimation from aggregate consumption uncovers the low EIS of majority (i.e., the poor).

Recent Estimates

- Some researchers estimated EIS values from aggregate data that are as high as 2 (Mulligan (2004), Gruber (2007)).
- Also, a famous paper by Bansal and Yaron (2004) finds that if $EIS \approx 2$, a model with Epstein-Zin utility and other features can explain asset pricing puzzles.
- These made high EIS values more commonly used. So you will see calibrations with $EIS > 1.5$.
- Not clear to me how such large values can be reconciled with macro evidence mentioned above in the Lucas quote.
- Similarly, if EIS is two, ΔC should fluctuate twice as much as R^f, which is inconsistent with US data. For these reasons, my preferred value of EIS is close to 1.0 for rich and a lower value for the majority of households.

Labor Supply Elasticity

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- Labor supply elasticity may be the most important of the three "parameters" in macro.
- One way to think about it is that the labor share of GDP is about two-thirds, so changes in labor supply matter significantly for many macro questions, from income taxation, to business cycle fluctuations, to response to changes in wage inequality, among others.
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- Except that there is not only one notion: Frisch, Hicksian, Marshallian.
- Frisch elasticity is the compensated elasticity in response to a wage change. Compensated: a change in a worker's wage that does not affect his/her lifetime marginal utility of wealth.
- How is this possible? One possibility is that the wage change is transitory, so its effect is small relative to the length of the life time.

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- Micro/empirical work on the Frisch is concerned with the *intensive margin*. They estimate Frisch elasticity values ranging from zero and 0.5.
- READ surveys by Browning-Hansen-Heckman (1999) and Blundell-MaCurdy (2000) for authoritative treatments of labor elasticities.

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- Therefore, the focus of macroeconomists on the extensive margin is justified.
- Labor supply facts from aggregate data suggest a much higher Frisch, when the economy is viewed through a RA model, which led RBC folks to use values as high as 2 or 3. See Prescott (2004) and others.

Aggregation: A Reconciliation?

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- Human capital investment as in Ben-Porath drives a wedge between micro & macro elasticities (Imai and Keane (2004) & Guvenen et al. (2014).
- To sum up, accounting for individual heterogeneity & aggregation brings micro and macro values closer–even if it does not close the gap completely.

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