Individual Preferences over \((c, \ell)\)

1. Separable power utility (POW):

\[
U(c, \ell) = \frac{c^{1-\sigma}}{1-\sigma} + \psi \times \frac{\ell^{1-\gamma}}{1-\gamma}.
\] (1)

2. Cobb-Douglas (CD) preferences:

\[
U(c, \ell) = \frac{(c^\alpha \ell^{1-\alpha})^{1-\sigma}}{1-\sigma}.
\] (2)

3. The third one is newer than the previous two and has been proposed Greenwood et al (1988), often abbreviated as GHH preferences:

\[
U(c, \ell) = \left(\frac{c - \psi(1 - \ell)^{1+\gamma}}{1+\gamma}\right)^{1-\sigma}.
\] (3)

No wealth/income effect on leisure: labor supply only depends on wages only, which makes it tractable and convenient in certain applications (e.g., aggregation).
Time- and/or State-Nonseparable Preferences
### Habit Formation

- Habit Formation: A simple formulation is

\[ U = \frac{(c_t - \theta c_{t-1})^{1-\gamma}}{1 - \gamma} \tag{4} \]

- A more general specification (which contains this simple one as a special case) is:

\[ U = \frac{(c_t - \theta x_{t-1})^{1-\gamma}}{1 - \gamma} \tag{5} \]

where

\[ x_t = \phi x_{t-1} + (1 - \phi)c_t. \tag{6} \]

- When \( \phi = 0 \), this reduces to (4). When \( \phi > 0 \), the habit stock is the geometrically discounted average of past consumption levels:

\[ x_t = (1 - \phi) \sum_{s=0}^{\infty} \phi^s c_{t-s}. \]
A very general question in economics is concerned with understanding risk premia of various kinds.

Spectral analysis of economic data show that the bulk of fluctuations are at frequencies much longer than typical business cycles:

- Fama and French (1989) termed “business conditions” to refer to these latter to distinguish from business cycles.
- Comin and Gertler (2006) review further evidence on this point and build a macro model to generate such fluctuations.
Amplitude vs. Frequency of Fluctuations
**External Habit (Benchmark Cons.)**

- Utility is derived from consumption relative to an “external” benchmark, e.g., average consumption, $C_{t-1}$.

$$U^i = \frac{(c^i_t - \theta C_{t-1})^{1-\gamma}}{1 - \gamma},$$  \hspace{1cm} (7)

- This is a major difference relative to habit formation: now the individuals views $\bar{C}_t$ beyond his control and ignores any impact his own choices has on this benchmark level. This has two main effects:

1. Simplifies the dynamic problem substantially as utility now becomes essentially time-separable and today’s choices have no effect on future utility, at least as the individual perceives it.

2. Because the individual ignores his effect on the benchmark level, benchmarking creates an *externality effect*. Consequently, individual consumption choice is typically not socially optimal. (Lettau and Uhlig (AER, 2000))
Endogenous and external habit formulations are widely used in macroeconomics and finance applications today.

They generate high risk premia and other plausible properties, including sluggish response of consumption to shocks.

However, many calibrations leading to these behavior have strange properties.

- See Chapman (1998, ECMA), Otrok et al (JME, 2003), Ljunqvist and Uhlig (201X, JPE)
Three Key Parameters
1. **Relative Risk Aversion**

- Empirical evidence regarding risk aversion is not settled.
- Lucas (2003): figures used in the literature range from 1 and 100. While this is certainly true even today, values above 10 are still viewed controversial.
- First, with a differentiable utility function, agents will behave as if they are risk neutral for small bets (Arrow (1971)).
- Rabin (2000) takes this one step further:
  - For example, if a person turns down a bet that offers a 50-50 chance of losing $1000 and gaining $1050, she will also turn down a bet that offers a 50-50 chance of losing $20,000 and gaining *any sum* of money!
- Thus expected utility has difficulty delivering risk aversion behavior consistent with both small and large bets.
1. RRA: What is a Reasonable Value?

- Cohen and Einav (2007, AER):
  - Data on insurance deductible to measure absolute risk aversion.
  - Then multiply with average wealth to get RRA.
  - Mean estimate: 100+, median around 0.4.
  - Bet in the order of $100 per year, so likely that a small fraction make errors or do not pay much attention.

  - Tight bound less than 2 or 3.

- Large experimental literature estimating RRA.
  - Evidence from TV game shows, RRA<5.

- Compensating differential across jobs: Finds small values, implying small RRA
  - Caveat: RRA might be correlated with occupation risk, so inference must be done carefully (See Schulhofer-Wohl (2011, JPE)).
2. EIS (in Consumption)

- EIS measures the responsiveness of “consumption growth” to changes in interest rates.

- Crucial for at least two policy questions:
  - Monetary policy: ability to boost consumption in a recession
  - Fiscal policy: effectiveness of tax policy that changes returns to savings (capital income tax, etc.)
2. EIS (in Consumption)

- Macroeconomists have traditionally used a value of EIS close to 1. Partly driven by the desire to generate BGP, there is quite a bit of direct reasoning that also supported this value.

- Consider the Euler equation in such a model can be rearranged to obtain:

\[ R_t^f = \eta + \left( \frac{1}{EIS} \right) \times \log \left( \frac{C_{t+1}}{C_t} \right), \]  

where \( \eta \) is the time preference rate.

- Given an annual consumption growth of 2% and assuming a positive time discount rate (\( \eta > 0 \)) an EIS of 0.1 (Hall (1988)) implies a lower bound of 20% for \( R_t^f \).

- This is Weil (1989)’s risk-free rate puzzle. Alternatively, assuming interest rate of 3% and a consumption growth of 2% requires the EIS to be at least 0.66 for any \( \beta < 1 \).
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 $\sigma$ percentage points (assuming similar time discount rates). A value of $\sigma$ 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.
Evidence from Aggregate Consumption

- Hall (1988) argued that earlier estimates (some of which found values around 1.0) were biased upward because of the time aggregation. His “corrected” estimates turned out to be around zero.

- Campbell and Mankiw (1990)’s detailed analysis concurred with this conclusion.

- More recently, Ogaki and Reinhart (1998) have argued that non-separability between durables and non-durables could bias the estimates of EIS, such as Hall’s (1988) in the opposite direction—downward—if not accounted for.

- Similarly, Kimball and Basu (2003) have shown that non-separability between consumption and leisure could create a similar downward bias. Both papers obtained estimates of the EIS around 0.35.
My take: Heterogeneity

- There is a fairly large and active literature documenting heterogeneity in the EIS.

- First, from a theoretical standpoint, Browning and Crossley (2000) proved that when individuals consume a bundle of goods with different income elasticities, their total consumption will display an EIS that increases with consumption level.

- A number of empirical papers study individual- and household-level consumption behavior and find supporting evidence (Blundell et al (1994), Attanatio and Browning (1995)).

- A second group of papers focus directly on stockholders and non-stockholders. For example, Attanasio et al (2002) obtain elasticity values around 1 for stockholders, and between 0.1 to 0.2 for non-stockholders using UK data. Vissing-Jorgensen (2002) obtains very similar estimates from the U.S. CE data.
My take

- In Guvenen (2006), I proposed a middle ground by combining two pieces of evidence.
- First, as just noted, the EIS increases with income, wealth, and consumption.
- Second, there is substantial wealth inequality in the United States, and a much smaller degree of consumption inequality. So, I built a model that delivered the correct degree of these two inequalities (using limited stock market participation as the underlying source of heterogeneity).
- With such heterogeneity, the properties of aggregates directly linked to wealth (e.g., investment and output) are mainly determined by the wealthy (and high-EIS) stockholders.
- Since consumption is much more evenly distributed than is wealth, estimation from aggregate consumption uncovers the low EIS of the majority (i.e., the poor).
More recently, some researchers have estimated EIS values from aggregate data that are as high as two (Mulligan (2004), Gruber (2007)).

It is not clear how such large values can be reconciled with the macro evidence mentioned above in the Lucas quote.

Similarly, if the EIS is two, consumption growth fluctuations should be twice as large as interest rate fluctuations, which is inconsistent with the US data. For these reasons, my preferred value of EIS is close to 1.0 for the rich and a lower value for the majority of households.
3. Frisch Elasticity

- Frisch 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.

- The Frisch elasticity is the compensated elasticity in response to a wage change. By compensated we mean, 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.
3. Frisch Elasticity

- There is some controversy and a bit of a confusion that surrounds the proper value of the Frisch elasticity.
- A cursory reading of work suggests a big disagreement between labor economists and macroeconomists.
- This disagreement is partly on the surface and results from the loose terminology employed by some writers. Let’s take a closer look at the issues.
- Micro/empirical work on the Frisch is concerned with the *intensive margin*. They estimate Frisch elasticity values ranging from zero and 0.5.
- See the surveys by Browning et al (1999) and Blundell and MaCurdy (2000) for extensive reviews of this literature.
- Furthermore, it is well documented that other groups of workers, such as young and old workers, as well as female workers display higher Frisch elasticities even along the intensive margin.
3. **Frisch Elasticity**

- Macroeconomists, on the other hand, are mostly concerned with the *aggregate* labor supply response to wage changes.
- But clearly, such changes in labor supply involve changes along both the intensive *and* the extensive margin.
- In the US data, about 2/3 of the hours variation over the business cycle is due to changes in employment (i.e., extensive margin) and only 1/3 is due to changes in hours of employed workers (intensive margin).
- Similarly, the labor supply of married women increased tremendously in the US and, again, the bulk of the rise happened through changes in labor force participation of women.
- Therefore, the focus of macroeconomists on the extensive margin is well 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.
So, how can the two values be reconciled? by aggregation.

In other words, there are a variety of microfounded general equilibrium models that assume very low individual Frisch elasticity, yet imply very high aggregate Frisch elasticity.

A seminal paper by Rogerson (1988) showed that one can build a model with zero Frisch elasticity at the individual level and infinite elasticity at the aggregate level!

Many others have written plausible models with heterogeneity that preserved the same feature (Chang and Kim (2006), Rogerson and Wallenius (2009), and Heathcote et al (2010)).

Others have emphasized human capital that drives a wedge between micro and macro elasticities (Imai and Keane (2004) and Guvenen et al (forthcoming)).

To sum up, once individual heterogeneity and aggregation is properly accounted for, there is no disagreement between micro and macro values.