Consumption & Earnings Dynamics I
Econ 350, The University of Chicago

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Outline

Main Questions

- How do the dynamics of earnings affect consumption choices over the life cycle?
  - How much risk do households face?
  - To what extent does risk affects basic household choices?
  - What types of risk matter in explaining the behavior of households?
- Risk:
  - What we commonly call uncertainty
  - When optimizing, agents are not aware of what the realization of the states is going to be
  - Agents have perfect information on the particular distribution that generates the states
- Uncertainty:
  - Agents ignore the states as well as the distribution that generates them

Basic Concepts

- *Ex-ante* and *ex-post* responses to income variations
- *Transitory* and *permanent* income shocks
- *Predictable* and *unpredictable* income shocks
- Not only technicalities
  - Differ conceptually
  - Need different tools to tract them

Outline

The PIH Model

- Benchmark model in this literature: life-cycle permanent income hypothesis (PIH)
  - Based on Friedman (1957)
  - Quadratic preferences (what does this imply?)
  - Consumers discount and interest rate satisfy $r(1-\beta) = 1$
  - Single risk free bond pays r
  - Perfect capital markets
  - Time horizon: $j = 1, \ldots, A$
  - Information set and income of consumer i, at age a, in time t: $\Omega_{i,a,t}, Y_{i,a,t}$
  - Summary equation of the model:

$$\Delta C_{i,a,t} = \pi_a \sum_{j=0}^{A} \frac{\mathbb{E}\left(Y_{i,a+j,t+j} | \Omega_{i,a,t}\right) - \mathbb{E}\left(Y_{i,a+j,t+j} | \Omega_{i,a-1,t-1}\right)}{(1+r)^j}$$

where $\pi_a = \dfrac{r}{1+r}\left[1 - \dfrac{1}{(1+r)^{A-a+1}}\right]^{-1}$

The PIH Model (contd 1)

- Innovations to current and future income that arrive at a potentially change consumption between a and $a-1$
- Anticipated changes does not change anything: consumption smoothing!
- Key discussion: how to model the income process (lots of papers on this in the reading list)?
- Benchmark in Macro:

$$
\begin{aligned}
Y_{i,a,t} &= p_{i,a,t} + \varepsilon_{i,a,t} \\
p_{i,a,t} &= p_{i,a-1,t-1} + \zeta_{i,a,t}
\end{aligned}
$$

- Permanent shock: $\zeta_{i,a,t}$
- Transitory shock: $\varepsilon_{i,a,t}$

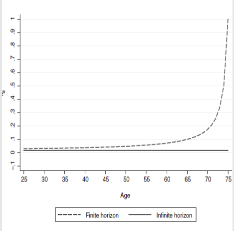
The PIH Model (contd 2)

- Under this specification

$$\Delta C_{i,a,t} = \pi_a \varepsilon_{i,a,t} + \zeta_{i,a,t} \tag{1}$$

  - Consumption responses:
    1. One-to-one for permanent shocks
    2. Proportional-to-π_a for transitory shocks

The Response to Transitory Shocks in the PIH Model



Source: Meghir and Pistaferri (2011)

The PIH Model (contd 3)

- Series of caveats:
  - Consumers tend to follow the theory when expected income changes are large
    - May be due to transaction costs
    - Leads to “smoothing excess”
  - Quadratic preferences
    - Rule out precautionary savings
    - Convenient for analytic terms
    - Euler equations get very complicated with power utility functions (e.g, Blundell et al. (2012))

Outline

Two Approaches to Learn about Risk

1. Identify insurance for a given information set:
   - Assume a process for income, and therefore for consumption
   - The assumptions imply an information set
   - Estimate the parameters of the income and consumption processes
   - Estimate insurance with respect to permanent and transitory shocks
2. Identify an information set given an insurance configuration
   - Basic concern
     - Study superior information
     - Agents may know more about shocks that the econometrician
     - This may cause the econometrician to misinterpret consumption patterns and conclude smoothing excess
   - Various approaches to deal with this
     - Browning et al. (1999): allow for econometrician ignorance in the income process
     - Cunha et al (2005) and Cunha and Heckman (2007): distinguish wage variability and risk; model information

Outline

1. Motivation
2. Benchmark Model
3. Learning about Risk
4. Consumption, Income, and Insurance

The Income Process

- Simple framework to understand insurance against income shocks, based on BPP (2008)
- Permanent-transitory decomposition of residual log- income process

$$\begin{aligned} y_{i,t} &= P_{i,t} + t_{i,t} \\ P_{i,t} &= P_{i,t-1} + \xi_{i,t} \\ t_{i,t} &= \sum_{j=0}^{q} \theta_j \epsilon_{i,t-j} \end{aligned}$$

- Leads to

$$\Delta y_{i,t} = \xi_{i,t} + \Delta t_{i,t}$$

The Consumption Process and Insurance

- Write residual log-consumptions as

$$\Delta c_{i,t} = \phi_{i,t}\xi_{i,t} + \varphi_{i,t}\epsilon_{i,t} + \eta_{i,t}$$

- Insurance Alternatives:
    1. Complete Markets Hypothesis ($\phi_{i,t} = \varphi_{i,t} = 0$): perfectly smooth out permanent and transitory shocks
    2. Autarky ($\phi_{i,t} = \varphi_{i,t} = 1$): change in consumption has a one-to-one response on both permanent and transitory shocks
    3. Incomplete Markets Hypothesis ($0 < \phi_{i,t}, \varphi_{i,t} < 1$): partial insurance against both income shocks

Identification

- Three conditions suffice to identify the insurance coefficients and the variance of the income shocks
  1. Transitory shocks to income are MA(0)

$$t_{i,t} = \epsilon_{i,t}$$

  2. No Advance Information:

$$\mathrm{Cov}(\Delta c_{i,t}, \xi_{i,t+1}) = \mathrm{Cov}(\Delta c_{i,t}, \epsilon_{i,t+1}) = 0$$

  3. Short Memory:

$$\mathrm{Cov}(\Delta c_{i,t}, \xi_{i,t-1}) = \mathrm{Cov}(\Delta c_{i,t}, \epsilon_{i,t-2}) = 0$$

Identification (contd)

- Variance of transitory shocks

$$\text{Var}(\epsilon_t) = -\,\text{Cov}(\Delta y_{i,t}, \Delta y_{i,t+1})$$

- Variance of permanent shocks

$$\text{Var}(\xi_t) = \text{Cov}(\Delta y_{i,t}, \Delta y_{i,t-1} + \Delta y_{i,t} + \Delta y_{i,t+1})$$

- Insurance coefficient against transitory shocks

$$\varphi_{i,t} = \frac{\text{Cov}(\Delta c_{i,t}, \Delta y_{i,t+1})}{\text{Cov}(\Delta y_{i,t}, \Delta y_{i,t+1})}$$

- Insurance coefficient against permanent shocks

$$\phi_{i,t} = \frac{\text{Cov}(\Delta c_{i,t}, \Delta y_{i,t-1} + \Delta y_{i,t} + \Delta y_{i,t+1})}{\text{Cov}(\Delta y_{i,t}, \Delta y_{i,t-1} + \Delta y_{i,t} + \Delta y_{i,t+1})}$$

Evidence

- BPP (2008) use PSID data from the late 1970s to the early 1990s to estimate the insurance coefficients

Evidence on the Insurance Coefficients for the 1970s to the 1990s in the U.S.

TABLE 8—MINIMUM-DISTANCE PARTIAL INSURANCE AND VARIANCE ESTIMATES, VARIOUS SENSITIVITY ANALYSES

Consumption: Income: Sample:	Nondurable net income baseline	Nondurable excluding help baseline	Nondurable net income low wealth	Nondurable net income high wealth	Total net income low wealth	Nondurable net income baseline+SEO
ϕ	0.6423	0.6215	0.8489	0.6248	1.0342	0.7652
(Partial insurance perm. shock)	(0.0945)	(0.0895)	(0.2848)	(0.0999)	(0.3517)	(0.1031)
ψ	0.0533	0.0500	0.2877	0.0106	0.3683	0.1211
(Partial insurance trans. shock)	(0.0435)	(0.0434)	(0.1143)	(0.0414)	(0.1465)	(0.0354)

Notes: This table reports DWMD results of the parameters of interest. We also estimate time-varying variances of measurement error in consumption (results not reported for brevity). See the main text for details. Standard errors in parentheses.

Source: BPP (2008)

Next Steps

- Study two papers that explore theoretical and empirical variations on this paper
  1. Heathcote, Storesletten, and Violante (2013)
  2. Blundell, Pistaferri, and Saporta-Eksten (2013)
- See presentation Consumption & Earnings Dynamics II