Earnings, Consumption and Lifecycle Choices

Costas Meghir
(UCL and IFS)

Luigi Pistaferri
(Stanford, NBER and CEPR)
Objectives

- Discuss recent developments in the literature that studies how the dynamics of earnings and wages affect consumption choices over the life cycle.

- Theme of interest: Labor Market Risk
  - What’s the impact on behavior?
    - Ex-ante vs. ex-post responses
  - What types of risks matter?
    - Unemployment
    - Productivity (health, demographics, etc.)
    - Firm
    - Poor matching
    - Skill prices
Outline

1. What theory has to say about effect of income changes on consumption
   - Persistent vs. transient
   - Anticipated vs. unanticipated
   - Small vs. large
   - Insurable vs. uninsurable

2. Modeling the dynamics of (exogenous) earnings
   - Random walk
   - Random growth
   - Other models & enrichments
   - Identification, inference, etc.

3. Use consumption data jointly with income data
   - Identification of features of income process
   - Identification of information set
   - Identification of extent of partial insurance

4. Different approaches/data to address same questions
   - Quasi-experiments
   - Subjective expectations
   - Multiple choices

5. Modeling the dynamics of (endogenous) earnings
Ex-ante vs. ex-post responses

- **Ex-ante**
  - Precautionary savings
  - Precautionary labor supply
  - Delay durable adjustment
  - Portfolio re-allocation
  - Background risk
  - Implicit contracts with employer

- **Ex-post**
  - Cut consumption, leisure
  - Run down assets or borrow at high(er) cost
  - Sell durables
  - Social & family networks, charities, etc.
  - Migration
  - Government insurance
Relevance

• Important for macroeconomics: Effects on aggregate saving, consumption, growth

• Policy I
  – Most risks are hard to insure privately due to moral hazard, limited commitment problems
  – Government interventions
  – Issue of optimal social insurance design

• Policy II
  – Predicting the impact of “stimulus packages”

• Policy III
  – Recent rise in wage & earnings inequality
    • More risk?
    • Welfare: Permanent or transitory?
    • What about consumption inequality?
Income and consumption inequality over time...

Italy

Germany

Sweden

UK

US

Source: Various authors, RED Special Issue (January 2010)
...and over the life cycle

![Graph showing var(log(c)), smoothed and var(log(y)), smoothed over age of head]

- Why the attenuation?
  - Income inequality increase is primarily due to “wage instability”?
  - Income inequality increase is mostly due to “changes in wage structure” but people have ways of insuring/smooth persistent shocks?
  - Or most of the increase in inequality was anticipated, regardless of its source?
Theory

• Take the simplest possible case: Quadratic preferences, $\beta(1+r)=1$, finite horizon (life cycle), no BC, income only source of uncertainty

• Consumption changes

$$\Delta c_{i,a} = \pi_a \sum_{j=0}^{A} \frac{E(y_{i,a+j} | \Omega_{i,a}) - E(y_{i,a+j} | \Omega_{i,a-1})}{(1+r)^j}$$

• Four key issues:
  – News vs. expected changes
  – Persistence of innovations
  – Life cycle horizon
  – Credit markets
Following Friedman’s PIH

• Popular income process with 3 components:

\[ y_{i,a} = X_{i,a}' \beta + P_{i,a} + \varepsilon_{i,a} \]

\[ P_{i,a} = P_{i,a-1} + \zeta_{i,a} \]

• The change in consumption in the simple case:

\[ \Delta c_{i,a} = \zeta_{i,a} + \pi_a \varepsilon_{i,a} \]

\[ \text{MPC}_{\text{pe}=1} \quad \text{MPC}^{\text{tr}} \]

• Note: If the permanent component were \textit{literally} permanent \((p_{it}=p_i)\), it would affect the \textit{level} of consumption – not its change (unless there was some learning going on)
Beyond the PIH

• Quadratic preferences have problems
  – Increasing risk aversion
  – Lack of a precautionary motive for saving

• CRRA preferences
  – Are more realistic, but don’t provide closed form solutions for consumption
    • Hence: Euler equations
  – Approximations
    • Blundell and Stoker (2000), Blundell, Pistaferri and Preston (2008)
  – Numerical solutions
    • Carroll (2008), Kaplan and Violante (2009)
Approximations

• Assume log income follows the process

\[
\ln y_{i,a} = X_{i,a} \beta + P_{i,a} + \epsilon_{i,a}
\]

\[
P_{i,a} = P_{i,a-1} + \zeta_{i,a}
\]

• With CRRA preferences and finite lives, BPP (2008) show that

\[
\Delta \ln c_{i,a} \equiv \ldots + \Gamma_{i,a} + \gamma_{i,a} \left( \zeta_{i,a} + \pi_a \epsilon_{i,a} \right)
\]

• Where \( \gamma_{i,a} \) is the share of future labor income in current human and financial wealth

• Hence, the effect of an income shock on consumption depends not only on the persistence of the shock and the planning horizon, but also on preference parameters.
  – *Ceteris paribus*, more prudent households will respond less to income shocks - \( \text{MPC}^{pe} \leq 1 \)
Numerical solutions

• Kaplan and Violante (2009)
  – Bewley economy (CCRA preferences)
  – Social security after age 60, same income process as above
  – Uncertainty about life expectancy
  – Liquidity constraints
    • “Natural” Borrowing Constraint
    • “Zero” Borrowing Constraint
Figure 1: Life cycle profiles for means and variances in the NBC and ZBC economies.

Source: Kaplan and Violante (2009)
• Average $\text{MPC}^{tr}$ in NBC: 0.06

Source: Kaplan and Violante (2009)

• Average $\text{MPC}^{pe}$ in NBC: 0.77

Source: Kaplan and Violante (2009)
Modeling earnings

• Exogenous earnings
  – Univariate models (Lillard and Willis, 1978; MaCurdy 1982; Moffitt-Gottschalk, 1995; Guvenen, 2008)
  – Multivariate models (Geweke and Keane, 2000; Altonji, Smith and Vidangos, 2008)
  – Conditional heteroskedasticity (Chamberlain and Hirano 1998; Meghir and Pistaferri 2004; Alvarez, Browning and Ejrnaes 2007)

• Endogenous earnings
  – Labor supply (Abowd and Card, 1989; Hyslop, 2000; Rendon, 2005)
  – Job mobility (Low, Meghir and Pistaferri, 2009)
  – Human capital accumulation (Huggett, Ventura and Yaron, 2008)
  – Search (Postel-Vinay and Thuron, 2008)
Modeling the earnings process

• Popular characterization (but not universally accepted)

\[
\ln y_{i,a} = X_{i,a} \beta + P_{i,a} + \epsilon_{i,a} + u_{i,a}
\]
\[
P_{i,a} = P_{i,a-1} + \zeta_{i,a}
\]
\[
P_{i,0} = h_i
\]
\[
\epsilon_{i,a} = \sum_{j=0}^{q} \theta_j v_{i,a-j} \ (\theta_0 \equiv 1)
\]

• **Appeal**: Implicitly or explicitly, motivated by Friedman’s PIH

• Work with FD residuals: “Unexplained” growth term

\[
g_{i,a} = \Delta (\ln y_{i,a} - X_{i,a} \beta) = \zeta_{i,a} + \Delta u_{i,a} + \Delta \epsilon_{i,a}
\]

• **Issues**
  - Order of MA(q) process?
  - Cannot separately identify transitory shocks from measurement error
  - Inference, attrition, etc.
Identification

• Meghir and Pistaferri (2004) use orthogonality condition
  \[ E(g_{i,a} \mid \Omega_{a-q-2}) = 0 \]
  sequentially, starting from q=0 to identify order of MA process.

• Use
  \[ E\left( g_{i,a} \sum_{j=-(1+q)}^{(1+q)} g_{i,a+j} \right) = E(\zeta_{i,a}^2) \]
  to identify the variance of the permanent shock at each age (or time)

• Use findings of validation data (Bound and Krueger, 1994) to separately identify variance of transitory shocks from noise

• Posits an ARCH process for shocks with unobserved heterogeneity
Popular Alternative: Random growth model

- Write unexplained earnings growth as

  \[ g_{i,a} = \Delta (\ln y_{i,a} - X_{i,a}' \beta) = \zeta_i + \Delta u_{i,a} + \Delta \varepsilon_{i,a} \]

- **Appeal**: Human capital story

- Assume for simplicity \( q=0 \). Then in the RG model

  \[ E(g_{i,a} g_{i,a-j}) = E(\zeta_i^2) \quad \text{for} \ j \geq 2 \]

- While in the RW model

  \[ E(g_{i,a} g_{i,a-2}) = 0 \quad \text{for} \ j \geq 2 \]
Autocovariances

• Estimated ACVs of growth rates can be used to discriminate between alternative models

• In most data sets, 2\textsuperscript{nd} and higher order autocovariances are economically small and statistically insignificant
  – Interpret this as evidence that there is no random growth term
Bias from ACVs evidence

• Recently, the RW model has come under attack, reviving the debate
  – Criticisms
    • Fewer individuals contribute to high order ACVs + noise
    • The test of zero autocovariances at long lags has little power – $\sigma_h^2$ is small (Baker)
    • If the true process is AR(1)+fixed effect+random growth term, then a positive autocovariance will emerge only at very (very) long lags (Guvenen)

\[
E(g_{i,a}g_{i,a-j}) = \sigma_h^2 - \rho^{j-1} \frac{1 - \rho}{1 + \rho} \sigma_\zeta^2 \quad (j > 0)
\]
• It’s hard to distinguish between these two models
  – Haider and Solon (2006)
  • Consider (1) \( \log y_{i,a} = f_i + a h_i \) and (2) \( \log V_i = k + f_i + r^{-1}h_i \)
  • The slope of a regression of \( \log y_{i,a} \) onto \( \log V_i \) is:

\[
\lambda_a = \frac{\text{cov}(\log y_{ia}, \log V_i)}{\text{var}(\log V_i)} = \frac{\sigma_f^2 + a\sigma_h^2}{\sigma_f^2 + r^{-1}\sigma_h^2}, \quad \text{with} \quad \frac{\partial \lambda_a}{\partial a} = \frac{r^{-1}\sigma_h^2}{\sigma_f^2 + r^{-1}\sigma_h^2}
\]
Two other examples

• Hrysko (2008)
  – In MC experiment, assume the true process is RW+MA(1)+fixed effect
  – Estimate a model: fixed effect+random growth term+AR(1) and finds stat. sig. random growth term and a low AR(1) coefficient

• Baker and Solon (2003)
  – Use large, long tax records data from Canada
  – Richest model to date (apart from Alvarez et al. 2007)
  – Find evidence of both RW and RG
Other models

- Assume earnings reflect time-varying pricing of unobserved skills:
  \[
  \ln y_{i,a,t} = X_{i,a,t}' \beta + P_{i,a,t} + \varepsilon_{i,a,t} + u_{i,a,t}
  \]
  \[
  P_{i,a,t} = \phi_t h_i
  \]

  \[
  g_{i,a,t} = (\phi_t - \phi_{t-1})h_i + \Delta \varepsilon_{i,a,t} + \Delta u_{i,a,t}
  \]

  **Appeal**: Fits SBTC story

  **Then**:
  \[
  E(g_{i,a,t} g_{i,a-j,t-j}) = (\phi_t - \phi_{t-1})(\phi_{t-j} - \phi_{t-j-1})E(h_i^2)
  \]
  for \( j \geq 2 \)

- Hard to use in macro models – need to know the entire sequence of prices, GE issues, etc.
Other enrichments

• Firm or match effects
  – Matched employer-employee data could be used to address these issues (Abowd, Margolis and Kramarz; Postel-Vinay and Robin; Guiso, Pistaferri and Schivardi)

• “Scarring” effects
  – Wages fall dramatically at job displacement (Jacobson, Lalonde and Sullivan; von Vachter and Song)

• “Jumps” effects
<table>
<thead>
<tr>
<th>Author</th>
<th>Sample</th>
<th>Measure</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hause (1987)</td>
<td>1964-69 Swedish males aged 21-26</td>
<td>Annual Earnings</td>
<td>FE+RG+AR(1)</td>
</tr>
<tr>
<td>Lillard and Willis (1978)</td>
<td>1967-73 PSID Males</td>
<td>Annual Earnings</td>
<td>RG+AR(1)</td>
</tr>
<tr>
<td>MaCurdy (1982)</td>
<td>1967-76 PSID continuously married white males</td>
<td>Annual Earnings and avg. hourly earnings (FD and lev)</td>
<td>RW+ARMA(1,1)RW+MA(2)</td>
</tr>
<tr>
<td>Abowd and Card (1989)</td>
<td>1969-79 PSID Males (w/ and w/o SEO) SEO 1966-75 NLS males 1971-75 SIME/DIME control group</td>
<td>Annual earnings and annual hours in FD</td>
<td>RW+MA(1)</td>
</tr>
<tr>
<td>Topel and Ward (1992)</td>
<td>1957-72 LEED file (matched firm-worker administrative records)</td>
<td>Quarterly SS earnings from a single employer (FD)</td>
<td>RW+MA(0)</td>
</tr>
<tr>
<td>Author</td>
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<td>Measure</td>
<td>Findings</td>
</tr>
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</tr>
<tr>
<td>Farber and Gibbons (1995)</td>
<td>1979-91 NLSY men and women</td>
<td>Hourly wage</td>
<td>RW+AR(1)</td>
</tr>
<tr>
<td>Baker and Solon (2003)</td>
<td>1975-83 Canadian men (administrative income tax records)</td>
<td>Annual Earnings</td>
<td>FE+RG+RW+AR(1)</td>
</tr>
<tr>
<td>Browning, Alvarez, &amp; Ejrnæs (2009)</td>
<td>1968-93 PSID white males</td>
<td>Annual Earnings</td>
<td>Heterogeneous AR(1)+MA(1)+FE</td>
</tr>
<tr>
<td>Guvenen (2009)</td>
<td>1968-93 PSID males</td>
<td>Annual earnings</td>
<td>FE+RG+AR(1)</td>
</tr>
</tbody>
</table>
Using choices to learn about risk

- We learned that it’s difficult to distinguish between alternative earnings processes.

- Could use forward looking “choices” (consumption, labor supply, human capital investment decisions, etc.) to learn about features of the earnings process.
  - Consumption choices reflect information about the income process that consumers have at the time decisions are made (Hall and Mishkin; Cunha, Heckman and Navarro; Primiceri and van Rens).
  - Consumption choices should also reflect nature of income changes (i.e., if consumption response is big → income change must be persistent) (Blundell and Preston; Guvenen and Smith).
A Simple Example

- Income is the sum of a random walk, a transitory shock ($\varepsilon$) and a measurement error ($\nu$, which may even reflect “superior information”)

$$\Delta y = \zeta + \Delta \varepsilon + \Delta \nu$$

- Hard to distinguish between $\varepsilon$ and $\nu$ using income data alone
- Assume quadratic preferences, infinite horizon. Consumption is

$$\Delta c = \zeta + (r/1+r)\varepsilon$$

- Keys to identification idea:
  1. consumption responds to signal, not noise (or predictable innovations);
  2. we know (impose?) that the structure of markets is such that econometrician can perfectly predict response of consumption to shocks

  - If this is accepted, then

$$\text{var}(\varepsilon) = \left(\frac{r}{1+r}\right)^2 \left[\text{var}(\Delta c) - \text{var}(\Delta y) - 2\text{cov}(\Delta y, \Delta y_{-1})\right]$$
Covariance restrictions on joint consumption-income behavior

• Long history (with micro data)
  • Errors-in-variables characterization – Observe current income, not permanent income
    • Use PSID food data
    • Assume consumers have “advance information” about shocks to income (partly due to data structure)
    • Find 25% of future innovations are known in advance
    • Imposes PIH on MPC wrt permanent shocks – leaves MPC wrt transitory shocks free
    • Finds excess sensitivity wrt transitory shocks (0.3)
Blundell and Preston (1998)

• Here there is a different problem, data-related
• Suppose that the true income process is the usual

\[ y_{i,a} = X_{i,a}' \beta + P_{i,a} + \varepsilon_{i,a} \]
\[ P_{i,a} = P_{i,a-1} + \zeta_{i,a} \]

• Welfare question: Is the UK increase in earnings inequality due to the permanent or transitory component?
• With repeated cross-sectional data (and neglecting dem’s), can’t answer this question:

\[ \Delta \text{var}(y_{i,a}) = \text{var}(\zeta_{i,a}) + \Delta \text{var}(\varepsilon_{i,a}) \]
• Suppose now that you have repeated cross-sectional data on consumption as well.

• In the simple PIH case

\[ \Delta c_{i,a} = \pi_a \varepsilon_{i,a} + \zeta_{i,a} \]

• For large horizon and small \( r \)

\[ \Delta \text{var}(c_{i,a}) \approx \text{var}(\zeta_{i,a}) \]

• Moreover, obtain OID restriction useful to test model

\[ \Delta \text{cov}(c_{i,a}, y_{i,a}) = \text{var}(\zeta_{i,a}) \]
Guvenen & Smith (2009)

• Assume income process is

\[ y_{i,a} = X_{i,a}'\beta + f_i + ah_i + z_{i,a} + \varepsilon_{i,a} \]

\[ z_{i,a} = \rho z_{i,a-1} + u_{i,a} \]

• If \( f, h \) are known at the start of life-cycle, problem not very interesting
  – And would fit consumption inequality over the life cycle rather poorly

• So add Bayesian learning about \( h \) and \( z \)

\[ E(h_i \mid \Omega_{a+1}) - E(h_i \mid \Omega_a) = \zeta_{i,a+1} \]

• And use income and (imputed) consumption data to estimate \( \sigma_h^2 \) and \( \rho \) (income process) as well as preference pars. and learning speed
• How much learning is going on?
• How much is known about profile heterogeneity at the start of the life cycle?

Table 3: Structural Estimation of the Consumption-Savings Model Using Real Data

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho$</td>
<td>0.756</td>
<td>0.029</td>
</tr>
<tr>
<td>$\sigma_\eta$</td>
<td>0.189</td>
<td>0.005</td>
</tr>
<tr>
<td>$\sigma_x$</td>
<td>0.019</td>
<td>0.027</td>
</tr>
<tr>
<td>$\sigma_B(\times100)$</td>
<td>1.785</td>
<td>0.392</td>
</tr>
<tr>
<td>$\sigma_\alpha$</td>
<td>0.383</td>
<td>0.029</td>
</tr>
<tr>
<td>$\text{cor}_{\alpha\beta}$</td>
<td>-0.178</td>
<td>0.074</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>0.191</td>
<td>0.124</td>
</tr>
<tr>
<td>$\sigma_{\mu_\eta}$</td>
<td>0.145</td>
<td>0.010</td>
</tr>
<tr>
<td>$\sigma_{\mu_\phi}$</td>
<td>0.355</td>
<td>0.002</td>
</tr>
<tr>
<td>$\omega_\pi$</td>
<td>0.494</td>
<td>0.009</td>
</tr>
<tr>
<td>$\mu_\pi$</td>
<td>0.042</td>
<td>0.014</td>
</tr>
<tr>
<td>$\delta$</td>
<td>0.958</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Degree of uncertainty about $h_i$ at the beginning of the life cycle

Source: Guvenen and Smith (2009)
Cunha, Heckman and Navarro (2005)

• Estimate what components of measured lifetime income variability are due to *uncertainty* realized after college decision time, and what components are due to *heterogeneity* (known at the time the decision is made).

• Cunha and Heckman (2006) do the dynamic equivalent
  – Estimate the fraction of future earnings that is forecastable and how this fraction has changed over time using college decision choices
  – For less skilled workers, roughly 60% of the increase in wage variability is due to uncertainty. For more skilled workers, only 8% of the increase in wage variability is due to uncertainty.
Example

• Take 2 ages, a and a+1; no initial assets; PIH

\[
c_{i,a} = \frac{r}{1+r} y_{i,a} + \frac{r}{(1+r)^2} E(y_{i,a+1} | \Omega_{i,a})
\]

\[
y_{i,a+1} = X_{i,a+1}' \beta + \zeta_{i,a+1}^A + \zeta_{i,a+1}^U
\]

• Form ex-post deviations

\[
z_{i,a}^c = c_{i,a} - \frac{r}{1+r} y_{i,a} - \frac{r}{(1+r)^2} X_{i,a+1}' \beta
\]

\[
z_{i,a+1}^y = y_{i,a+1} - X_{i,a+1}' \beta
\]

• If \( \text{cov}(z_{i,a}^c, z_{i,a+1}^y) \neq 0 \), there is evidence of "superior information", i.e., the consumer used more than just \( X_{i,a+1}' \beta \) to decide how much to consume at age a.
Primiceri and Van Rens (2009)

• Assume income and consumption unexplained growth can be written as

\[ \Delta \ln y_{i,a} = \zeta_{i,a}^A + \zeta_{i,a}^U + \Delta \varepsilon_{i,a} \]

\[ \Delta \ln c_{i,a} = \zeta_{i,a}^U + \pi_a \varepsilon_{i,a} \]

• Use repeated cross-section data moments from CEX

• Find that the share of permanent inequality that is predictable is around 85%
Is it just information?
Or insurance?

• Nobody believes in full insurance
  – Theoretical problems: *Private information, Limited enforcement*, etc.

• But perhaps there is more insurance than predicted by the strict PIH version with just a risk-free bond ($\text{MPC}_{pe}=1$, $\text{MPC}_{tr} = \pi_a$)
  – Self-insurance (BPP, KV - $\text{MPC}_{pe}=0.77$)
  – Partial insurance (Attanasio and Pavoni, 2009)

• More broadly, identification of information set requires taking a stand on structure of (formal and informal) credit and insurance markets
  – What looks like “lack of information” may be “liquidity constraints” in disguise (consumer responds too much to negative transitory shock)
  – What looks like “superior information” may be “insurance” in disguise (consumer responds too little to permanent shock)
Case I: Information, no insurance

- Suppose income and consumption changes can be written as
  \[
  \Delta y_{i,a} = \zeta_{i,a}^A + \zeta_{i,a}^U + \Delta \varepsilon_{i,a}
  \]
  \[
  \Delta c_{i,a} = \zeta_{i,a}^U + \pi_a \varepsilon_{i,a}
  \]

- Suppose goal is to estimate extent of permanent changes in income that are unanticipated, i.e.,
  \[
  \lambda = \frac{\sigma_{\zeta^U}^2}{\sigma_{\zeta^A}^2 + \sigma_{\zeta^U}^2}
  \]
• Can do IV:

\[
\frac{\text{cov}(\Delta c_{i,a}, \Delta y_{i,a-1} + \Delta y_{i,a} + \Delta y_{i,a+1})}{\text{cov}(\Delta y_{i,a}, \Delta y_{i,a-1} + \Delta y_{i,a} + \Delta y_{i,a+1})} = \frac{\sigma^2_{\xi_U}}{\sigma^2_{\xi^A} + \sigma^2_{\xi^A}} = \lambda
\]

• In this model one makes assumptions about structure of credit, insurance markets

• Identifies extent of “superior information”
  
  – \( \lambda = 0 \) signals consumer knows everything about permanent income changes
  
  – \( \lambda = 1 \) signals consumer knows nothing about permanent income changes
Case II: Insurance, no information

• Suppose now that income and consumption changes can be written as

\[ \Delta y_{i,a} = \xi_{i,a}^U + \Delta \varepsilon_{i,a} \]
\[ \Delta c_{i,a} = \phi \xi_{i,a}^U + \pi_a \varepsilon_{i,a} \]

• Suppose goal is to estimate extent of “insurance” against permanent shocks, i.e., \( \phi \)
• Can use the *identical* IV moment:

\[
\frac{\text{cov}(\Delta c_{i,a}, \Delta y_{i,a-1} + \Delta y_{i,a} + \Delta y_{i,a+1})}{\text{cov}(\Delta y_{i,a}, \Delta y_{i,a-1} + \Delta y_{i,a} + \Delta y_{i,a+1})} = \phi
\]

• In this model there is no superior information
• Identifies extent of “partial insurance” against permanent shocks
  – \( \phi=0 \) signals consumer can perfectly insure against such shock (Complete markets)
  – \( \phi=1 \) signals no insurance whatsoever (strict PIH version)
  – Intermediate cases more realistic and interesting
• If both information and insurance are present, easy to show that IV moment above identifies the combination of the two, \( \phi \lambda \)
Blundell, Pistaferri, Preston (2008)

- Estimate

\[ \Delta \ln C_{it} \approx \Gamma_{it} + \Delta Z_{it} \theta + \phi \zeta_{it} + \psi \varepsilon_{it} + \zeta_{it} \]

- Impatience, Precautionary savings, intertemporal substitution
- Deterministic preference shifts
- Impact of permanent income shocks, \(0 \leq \phi \leq 1\)
- Impact of shocks to higher income moments
- Impact of transitory income shocks

- Constructs imputed consumption data from estimation of food demand equation from CEX
Income and consumption growth variances

- From our income-consumption model we have a set of covariance restrictions (allowing for measurement error)

\[
\begin{align*}
\text{var}(\Delta y_{it}) &= \text{var}(\xi_{it}) + \text{var}(\Delta \varepsilon_{it}) \\
\text{cov}(\Delta y_{it}, \Delta y_{it+1}) &= -\text{var}(\varepsilon_{it}) \\
\text{var}(\Delta c_{it}) &= \phi_t^2 \text{var}(\xi_{it}) + \psi_t^2 \text{var}(\varepsilon_{it}) + \text{var}(\xi_{it}) + \text{var}(u_{it}^c) \\
\text{cov}(\Delta c_{it}, \Delta c_{it+1}) &= -\text{var}(u_{it}^c) \\
\text{cov}(\Delta c_{it}, \Delta y_{it}) &= \phi_t \text{var}(\xi_{it}) + \psi_t \text{var}(\varepsilon_{it}) \\
\text{cov}(\Delta c_{it}, \Delta y_{it+1}) &= -\psi_t \text{var}(\varepsilon_{it})
\end{align*}
\]
### Some results

<table>
<thead>
<tr>
<th></th>
<th>Whole sample</th>
<th>George W. Bush cohort (born 1940s)</th>
<th>Donald Rumsfeld cohort (born 1930s)</th>
<th>Low educ.</th>
<th>Low initial wealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA parameter</td>
<td>0.11</td>
<td>0.13</td>
<td>0.17</td>
<td>0.13</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.04)</td>
<td>(0.05)</td>
<td>(0.03)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Var. preference shocks</td>
<td>0.01</td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Coeff. partial insur. perm. shock ($\phi$)</td>
<td>0.64</td>
<td>0.79</td>
<td>0.69</td>
<td>0.94</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.18)</td>
<td>(0.24)</td>
<td>(0.18)</td>
<td>(0.28)</td>
</tr>
<tr>
<td>Coeff. partial insur. trans. shock ($\psi$)</td>
<td>0.05</td>
<td>0.07</td>
<td>-0.04</td>
<td>0.08</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.06)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>P-value test equal $\phi$</td>
<td>23%</td>
<td>81%</td>
<td>18%</td>
<td>99%</td>
<td>32%</td>
</tr>
<tr>
<td>P-value test equal $\psi$</td>
<td>75%</td>
<td>76%</td>
<td>4%</td>
<td>33%</td>
<td>22%</td>
</tr>
</tbody>
</table>
Test of superior information

Test $\text{cov}(\Delta y_{t+1}, \Delta c_t) = 0$ for all $t$: p-value 0.3305
Test $\text{cov}(\Delta y_{t+2}, \Delta c_t) = 0$ for all $t$: p-value 0.6058
Test $\text{cov}(\Delta y_{t+3}, \Delta c_t) = 0$ for all $t$: p-value 0.8247
Test $\text{cov}(\Delta y_{t+4}, \Delta c_t) = 0$ for all $t$: p-value 0.7752

- Find little evidence of anticipation.
- This suggests the shocks that were experienced in the 1980s were not anticipated.
- These were largely changes in the returns to skills, shifts in government transfers and the shift of insurance from firms to workers.
How to approach the insurance/information identification problem?

- Quasi-experiments
  - Identify episodes in which changes in income are
    - Unanticipated
    - Easy to characterize (i.e., persistent or transient)
    - (Possibly) large
  - This provides a test of insurance
    - …and neat identification idea
  - Example: Bodkin (1959)
    - Look at consumption behavior of WWII veterans after the receipt of unexpected dividend payments from the National Service Life Insurance.
    - MPC\(^{tr}=0.72\!\)
    - But Friedman (1961) claim that people believed payments to be permanent
• Subsequently, people have looked at:
  – Disability (Stephens)
    • Ideal: Match job accident data with consumption data
  – Unemployment (Gruber; Browning and Crossley)
    • Ideal: Match firm closure data with consumption data
  – Weather shocks (Wolpin; Paxson)
  – Crop loss (Cameron and Worswick)

• Role of liquidity constraints
  – Asymmetry
    • Response to positive or negative permanent shock is the same
    • Response to negative transitory shock is larger in abs value (cannot borrow to smooth) than response to positive transitory shock (saving is unaffected)

• Problems:
  – Hard to identify shock episodes neatly
  – Hard to argue exogeneity
  – Nature of shocks not always clear
• Quasi-experiments also useful to test whether consumption is orthogonal to anticipated changes
• Identify episodes in which income is expected to change
  – Expected income Increases
    • Reaching the annual social security payroll cap (Parker 1999)
    • Tax refunds (Souleles 1999, Souleles 2002, Johnson, Parker and Souleles 2006)
    • Christmas bonuses (Browning and Collado 2001)
    • Last mortgage payment (Stephens 2008)
    • Alaska permanent Fund (Hsieh 1999)
  – Expected income decreases
    • Retirement “puzzle” (Banks, Blundell and Tanner 1998; Aguiar and Hurst 2007)
    • College tuition (Souleles 2000)
• Asymmetry again: Excess sensitivity to expected income increases can’t be explained by LC
• Salience? Transaction costs?
Another solutions? Subjective expectations

• Nail down the “information” issue directly
• Forcefully advocated by Manski (particularly, quantitative expectations)
• Hayashi (1985)
  – Uses a panel of Japanese households containing respondents' expectations about expenditure and income
  – Estimates covariances between expected and unexpected changes in consumption and expected and unexpected changes in income.
  – Results are in line with Hall and Mishkin (1982), suggesting a relatively high sensitivity of consumption to income shocks.
Pistaferri (2000)

- Use panel of Italian households
  - Income realizations and (quantitative) expectations about next year’s income

- Write income as

\[ \Delta y_{i,a} = \zeta_{i,a} + \varepsilon_{i,a} - \varepsilon_{i,a-1} \]

- Obtain \textit{point identification} of shocks using combination of realizations and expectations:

\[
\begin{align*}
E(\Delta y_{i,a} \mid \Omega_{i,a-1}) &= -\varepsilon_{i,a-1} \\
E(\Delta y_{i,a+1} \mid \Omega_{i,a}) &= -\varepsilon_{i,a} \\
\Delta y_{i,a} + E(\Delta y_{i,a+1} \mid \Omega_{i,a}) - E(\Delta y_{i,a} \mid \Omega_{i,a-1}) &= \zeta_{i,a}
\end{align*}
\]
• Use consumption change equation:

\[ \Delta c_{i,a} = \phi \zeta_{i,a} + \psi \varepsilon_{i,a} \]

\[ = \phi \left[ \Delta y_{i,a} + E(\Delta y_{i,a+1} | \Omega_{i,a}) - E(\Delta y_{i,a} | \Omega_{i,a-1}) \right] - \psi E(\Delta y_{i,a+1} | \Omega_{i,a}) \]

**Table 4. — The Consumption Change Equation**

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transitory shock(t)</td>
<td>0.0874</td>
<td>0.0812</td>
</tr>
<tr>
<td>Permanent shock(t)</td>
<td>0.5746</td>
<td>0.1089</td>
</tr>
<tr>
<td>Conditional variance, (1000)</td>
<td>0.1421</td>
<td>0.3188</td>
</tr>
<tr>
<td>Age</td>
<td>23.02</td>
<td>18.40</td>
</tr>
<tr>
<td>ΔFamily size</td>
<td>3603.68</td>
<td>699.75</td>
</tr>
<tr>
<td>ΔChildren aged 0–5</td>
<td>-466.46</td>
<td>969.35</td>
</tr>
<tr>
<td>ΔChildren aged 6–13</td>
<td>-157.74</td>
<td>814.94</td>
</tr>
<tr>
<td>ΔChildren aged 14–17</td>
<td>-227.77</td>
<td>771.13</td>
</tr>
<tr>
<td># of observations</td>
<td>1,102</td>
<td></td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.0828</td>
<td></td>
</tr>
</tbody>
</table>

The sample includes 1,044 heads (94.74% of the sample) and 58 (5.26%) spouses. The dependent variable is the change in nondurable consumption. Standard errors robust to heteroskedasticity of unknown form are reported in parenthesis. The regression includes a constant.
Kaufmann and Pistaferri (2009)

• Write income as:

\[ y_{it} = X_{it}' \beta + P_{it} + \epsilon_{it} \]

\[ P_{it} = P_{it-1} + \zeta_{it} \]

• Assume

\[ \epsilon_{it} = \epsilon_{it}^U + \epsilon_{it}^A \]

\[ \zeta_{it} = \zeta_{it}^U + \zeta_{it}^A \]

• With

\[ E(\epsilon_{it} | \Omega_{t-1}^i) = \epsilon_{it}^A \]

\[ E(\zeta_{it} | \Omega_{t-1}^i) = \zeta_{it}^A \] (individual's perspective)

\[ E(\epsilon_{it} | \Omega_{t-1}^e) = 0 \]

\[ E(\zeta_{it} | \Omega_{t-1}^e) = 0 \] (econometrician’s perspective)
Kaufmann and Pistaferri (2009)

- Use joint covariance restrictions on consumption, income and income expectations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Income data</th>
<th>Income and Consumption data</th>
<th>Income, Consumption and expectations data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Var. unant. trans. shock</td>
<td>0.1056</td>
<td>0.1172</td>
<td>0.0197</td>
</tr>
<tr>
<td>Var. ant. trans. shock</td>
<td>0</td>
<td>0</td>
<td>0.0541</td>
</tr>
<tr>
<td>Var. mea. error income</td>
<td>0</td>
<td>0</td>
<td>0.0342</td>
</tr>
<tr>
<td>Var. unant. perm. shock</td>
<td>0.0301</td>
<td>0.0253</td>
<td>0.0208</td>
</tr>
<tr>
<td>Var. ant. perm. shock</td>
<td>0</td>
<td>0</td>
<td>0.0127</td>
</tr>
<tr>
<td>Var. mea. error cons.</td>
<td>0.0537</td>
<td></td>
<td>0.0474</td>
</tr>
<tr>
<td>V. mea. error subj. exp.</td>
<td>0.1442</td>
<td></td>
<td>0.3120</td>
</tr>
<tr>
<td>MPC trans. shock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPC perm. shock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\chi^2$ (df; p-value)</td>
<td>3.2440</td>
<td>16.4171</td>
<td>36.4001</td>
</tr>
<tr>
<td></td>
<td>(1; 7 percent)</td>
<td>(5; 0.6 percent)</td>
<td>(12; 0.03 percent)</td>
</tr>
</tbody>
</table>
Problems

• Validity of subjective data
  – Reliability
  – Informational content
    • Experiment: Consider 1989-91 SHIW (where we asked pdf-like questions) and 1995-98 (where we asked cdf-like questions)
    • Response rate by panel subjects were much higher in 1995-98 (learning? Or wording of question matters?)

• Rarely available alongside consumption and income data or confined to special survey modules.
Endogenous earnings

- The income processes analyzed so far do not distinguish between fluctuations in income caused by exogenous shocks and those caused by endogenous responses to shocks.

- Various examples in the literature
  - Abowd and Card; Hyslop
    - Individual, Family labor supply
  - Low, Meghir and Pistaferri
    - Labor supply and mobility across firms
  - Huggett, Ventura and Yaron
    - Human capital investments
  - Postel-Vinay and Thuron
    - On-the-job search + renegotiation by mutual agreement
  - Lise, Meghir and Robin
    - Labor market equilibrium (shocks to firms and shocks to workers)
Main issues

• With endogenous labor supply, “primitive shocks” are on (offered) wages

• Abowd and Card (1989) extend earlier literature to consider joint movements of hours and wages
  – Data: Hours and earnings growth follow MA(2) processes
  – The two are linked via lifecycle model
  – Show how much of the variation in earnings comes from genuine shocks to wages and how much due to responses of these shocks through hours of work
• Low, Meghir and Pistaferri (2009)
  – Shocks to general productivity and match effects, labor market frictions
  – Response is partly through consumption, partly through labor supply or mobility across firms, and consumption response depends on non-separability issues etc.
  – The concept of risk itself needs rethinking
    • Volatility in annual earnings induced by changes in employment status (some due to voluntary quits, some due to job destruction)
      – UI insures against the latter, not the former
    • Volatility in annual earnings induced by changes in productivity (some due to shocks – health- some due to pursuing better matches - mobility)
      – Upside vs. downside risk
    • Volatility of offered vs. accepted wages
Conclusions

• Labor market risks
  – What’s their impact on behavior?
  – What types of risks matter?

• It has proved difficult to answer these questions
  – Data are less than ideal
  – Identifying the “correct” income process is not easy
    • Yet key to the issue of permanent vs. transitory changes
    • Can’t observe these changes in survey data, so need to use statistical procedure to extract them from data on income changes
  – But even if we knew the right income process, we may not know what the consumer knows
    • Key to the anticipated vs. unanticipated distinction
    • Proposed solution: joint use of income and consumption data
  – But: Need to make assumptions about structure of credit, insurance markets, role of insurance over and above self-insurance
    • What is identified as “anticipated” change could be “insurable” change
    • Serious identification problem – only partial solutions so far