Earnings Inequality and Consumption Inequality

Richard Blundell
University College London
and
Institute for Fiscal Studies

Albert Rees Lecture
SOLE, May 2007

based on joint work with Luigi Pistaferri (Stanford)
Setting the Scene

• Inequality has many linked dimensions:
  – wages, income and consumption

• The link between the various types of inequality is mediated by multiple ‘insurance’ mechanisms
  – including labour supply, taxation, consumption smoothing, informal mechanisms, etc

• The manner and scope for insurance depends on the durability of labour income shocks

• The aim is to show that measuring the transmission of earnings shocks through to consumption enhances our understanding of income dynamics
Figure 1a: Income and Consumption Inequality in the UK

FES: Variance of log equivalised, cons rebased at 1977, smoothed.
Figure 1b: Income and Consumption Inequality in the US

CEX/PSID: Variance of log equivalised, cons rebased at 1977, smoothed
Figure 1c: Income and Consumption Inequality in Australia

Source: HES; Barrett, and Crossley and Worswick (2000)
Variance of log equivalised (OECD), cons rebased at 1975
Figure 1d: Income and Consumption Inequality in Japan

Source: Othake and Saito (1998); NSFIE Var (log) with cons rebased at 1979
Figure 1a: Income and Consumption Inequality in the UK

(variance of log equivalised, cons rebased at 1978)
This lecture is an attempt to reconcile three key literatures

I. Examination of inequality over time in consumption and in labour income
   – In particular, studies from the BLS, Johnson and Smeeding (2005); early work in the US by Cutler and Katz (1992) and in the UK by Blundell and Preston (1991) and Atkinson (1997), etc
Table I: Income and Consumption Inequality 1978-1992

<table>
<thead>
<tr>
<th></th>
<th>1978</th>
<th>1986</th>
<th>1992</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UK</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income Gini</td>
<td>.23</td>
<td>.29</td>
<td>.33</td>
</tr>
<tr>
<td>Consumption Gini</td>
<td>.20</td>
<td>.24</td>
<td>.26</td>
</tr>
<tr>
<td><strong>US</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income Gini</td>
<td>.34</td>
<td>.39</td>
<td>.41</td>
</tr>
<tr>
<td>Consumption Gini</td>
<td>.25</td>
<td>.28</td>
<td>.29</td>
</tr>
</tbody>
</table>

Both studies bring the figures up to 2001.

Relate to:

- Atkinson (1997): UK income Gini rises 10 points late 70s to early 90s.
- Gottschalk and Moffitt (1994): 1980s transitory shocks account for 50% growth

Note: In comparison with the Gini, a small transfer between two individuals a fixed income distance apart lower in the distribution will have a higher effect on the variance of logs.
This lecture is an attempt to reconcile three key literatures

I. Examination of inequality over time via consumption and income

II. Econometric work on the panel data decomposition of the labour income process

This lecture is an attempt to reconcile three key literatures

I. Examination of inequality over time via consumption and income

II. Econometric work on panel data income dynamics

III. Work on intertemporal decisions under uncertainty, especially on partial insurance, information and excess sensitivity:
   - Cuhna, Heckman and Navarro (2005), Cuhna and Heckman (2007) and also Guvenen (2006), on information updating.
Features of the distribution of consumption

• Log normal distribution for consumption?
  – Figure 2a-b, US; UK, Japan, Italy, etc on website.
Figure 2a: The distribution of log consumption

US CEX COHORT 1950-59 age 41-45

Source: Battistin, Blundell and Lewbel (2005)
Figure 2b: The evolution of log consumption distribution: US CEX

born 1940-49
Figure 2c: The distribution of log income

Source: Battistin, Blundell and Lewbel (2005)
Figure 4a: Cohort Income Inequality in the US by Cohort
Figure 4a: Cohort Income Inequality in the US by Cohort

The figure shows a line graph comparing cohort income inequality in the US based on age. Two cohorts are highlighted: those born in the 1930s and those born in the 1940s. The graph illustrates how income inequality changes over age for these two groups.
Figure 4b: Cohort Consumption Inequality in the US by Cohort

Source: Blundell, Pistaferri and Preston (2005)
Variance of log equivalised, PSID
Figure 4c: Cohort Labour Income Inequality in the UK

(variance of log equivalised)
Figure 4d: Cohort Consumption Inequality in the UK

(variance of log equivalised)
Figure 4f: Consumption Inequality over the Life-Cycle in Japan

Source: Authors calculations
Var (log); NSFIE
Income dynamics

General specification for labour income dynamics for consumer $i$ of age $a$ in time period $t$.

$$
\ln Y_{i,a,t} = Z_{i,a,t}' \lambda + B_{i,a,t}' f_i + y_{i,a,t}^P + y_{i,a,t}^T
$$

$$
y_{i,a,t}^P = \rho y_{i,a-1,t-1}^P + \zeta_{i,a,t}
$$

- where $y^P$ is a persistent process of labour income shocks which adds to the individual-specific trend (by age and time) $B_{i,a,t}' f_i$ and where $y^T$ is a transitory shock represented by some low order MA process.
- allow variances of $y^P$ and $y^T$ to vary with cohort, time,..
Income dynamics

• Consider the simple decomposition:

\[
\ln Y_{i,a,t} = Z'_{i,a,t} \lambda + f_i + y^P_{i,a,t} + y^T_{i,a,t}
\]

where

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

• permanent component following a martingale process
• and a transitory or mean-reverting component \( y^T = v \)

with \( v_{it} = \sum_{j=0}^{q} \theta_j \varepsilon_{i,a-j,t-j} \) and \( \theta_0 \equiv 1. \)

• implies a simple structure for the autocovariance of \( \Delta y \equiv \ln Y - Z' \lambda \)
• How well does it work?
Table IIIa: The Auto-Covariance Structure of Income

<table>
<thead>
<tr>
<th>Year</th>
<th>Var ($\Delta y_t$)</th>
<th>s.e.</th>
<th>Cov ($\Delta y_{t+1} \Delta y_t$)</th>
<th>s.e.</th>
<th>Cov ($\Delta y_{t+2} \Delta y_t$)</th>
<th>s.e.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>0.0801</td>
<td>0.0085</td>
<td>-0.0375</td>
<td>0.0077</td>
<td>0.0019</td>
<td>0.0037</td>
</tr>
<tr>
<td>1980</td>
<td>0.0830</td>
<td>0.0088</td>
<td>-0.0224</td>
<td>0.0041</td>
<td>-0.0019</td>
<td>0.0030</td>
</tr>
<tr>
<td>1981</td>
<td>0.0813</td>
<td>0.0090</td>
<td>-0.0291</td>
<td>0.0049</td>
<td>-0.0038</td>
<td>0.0035</td>
</tr>
<tr>
<td>1982</td>
<td>0.0785</td>
<td>0.0064</td>
<td>-0.0231</td>
<td>0.0039</td>
<td>-0.0059</td>
<td>0.0029</td>
</tr>
<tr>
<td>1983</td>
<td>0.0859</td>
<td>0.0092</td>
<td>-0.0242</td>
<td>0.0041</td>
<td>-0.0093</td>
<td>0.0053</td>
</tr>
<tr>
<td>1984</td>
<td>0.0861</td>
<td>0.0059</td>
<td>-0.0310</td>
<td>0.0038</td>
<td>-0.0028</td>
<td>0.0038</td>
</tr>
<tr>
<td>1985</td>
<td>0.0927</td>
<td>0.0069</td>
<td>-0.0321</td>
<td>0.0053</td>
<td>-0.0012</td>
<td>0.0042</td>
</tr>
<tr>
<td>1986</td>
<td>0.1153</td>
<td>0.0120</td>
<td>-0.0440</td>
<td>0.0094</td>
<td>-0.0078</td>
<td>0.0061</td>
</tr>
<tr>
<td>1987</td>
<td>0.1185</td>
<td>0.0115</td>
<td>-0.0402</td>
<td>0.0052</td>
<td>0.0014</td>
<td>0.0046</td>
</tr>
<tr>
<td>1988</td>
<td>0.0930</td>
<td>0.0084</td>
<td>-0.0314</td>
<td>0.0041</td>
<td>-0.0017</td>
<td>0.0032</td>
</tr>
<tr>
<td>1989</td>
<td>0.0922</td>
<td>0.0071</td>
<td>-0.0303</td>
<td>0.0075</td>
<td>-0.0010</td>
<td>0.0043</td>
</tr>
<tr>
<td>1990</td>
<td>0.0988</td>
<td>0.0135</td>
<td>-0.0304</td>
<td>0.0058</td>
<td>-0.0060</td>
<td>0.0046</td>
</tr>
</tbody>
</table>

Source: Blundell, Pistaferri and Preston (2005)
Variance of log, PSID: after tax labour income
Table IIIa: The Auto-Covariance Structure of Income

| Test cov(Δy_{t+1}, Δy_t) = 0 for all t: | p-value 0.0048 |
| Test cov(Δy_{t+2}, Δy_t) = 0 for all t: | p-value 0.0125 |
| Test cov(Δy_{t+3}, Δy_t) = 0 for all t: | p-value 0.6507 |
| Test cov(Δy_{t+4}, Δy_t) = 0 for all t: | p-value 0.9875 |

relate to Baker, Haider, Solon, etc

Source: Blundell, Pistaferri and Preston (2005)
Variance of log, PSID: after tax labour income
Panel Data

  – Construct all the possible panels of $5 \leq \text{length} \leq 15$ years
  – Sample selection: male head aged 30-59, no SEO/Latino subsamples

  – Focus on 5-quarters respondents only (annual expenditure measures)
  – Sample selection similar to the PSID

• A comparison of both data sources is in Blundell, Pistaferri and Preston (2004)
  – Note also BHPS, ECFP and Japanese panel
Table IIIb: The Covariance Structure of Income - BHPS

<table>
<thead>
<tr>
<th>Year</th>
<th>var($\Delta y_t$)</th>
<th>cov($\Delta y_{t+1}, \Delta y_t$)</th>
<th>cov($\Delta y_{t+2}, \Delta y_t$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>0.0685</td>
<td>-0.0205</td>
<td>0.0019</td>
</tr>
<tr>
<td></td>
<td>(.0049)</td>
<td>(.0034)</td>
<td>(.0029)</td>
</tr>
<tr>
<td>1997</td>
<td>0.0832</td>
<td>-0.0219</td>
<td>-0.0029</td>
</tr>
<tr>
<td></td>
<td>(.0070)</td>
<td>(.0036)</td>
<td>(.0036)</td>
</tr>
<tr>
<td>1998</td>
<td>0.0802</td>
<td>-0.0235</td>
<td>-0.0008</td>
</tr>
<tr>
<td></td>
<td>(.0063)</td>
<td>(.0036)</td>
<td>(.0032)</td>
</tr>
<tr>
<td>1999</td>
<td>0.0844</td>
<td>-0.0179</td>
<td>-0.0006</td>
</tr>
<tr>
<td></td>
<td>(.0074)</td>
<td>(.0041)</td>
<td>(.0040)</td>
</tr>
</tbody>
</table>

Source: Etheridge (2006)
Variance of log equivalised, BHPS
Income dynamics

- latent factor structure aligns well with the autocovariance structure of the PSID: note age selection, the BHPS(UK), JPID(Japan) and the ECFP(Spain)

\[ \Delta y_{it} = \zeta_{it} + \Delta v_{it}, \text{ where } \Delta y_{it} = \Delta \ln Y_{it} - \Delta Z_{it} ' \lambda_t \]

- allows for general fixed effects and initial conditions
- regular deconvolution arguments lead to identification of variances and complete distributions, e.g. Bonhomme and Robin (2006)
- the key idea is to allow the variances (or loadings) of the factors to vary nonparametrically with cohort, education and time: - the relative variance of these factors is a measure of persistence or durability of labour income shocks.
Consumption dynamics

- Baseline model: Individuals can self-insure using a simple credit market, consumption and labour income are linked through the intertemporal budget constraint.

- Consumption dynamics are linked to income shocks by:

$$\Delta \ln C_{it} \approx \Gamma_{it} + \Delta Z_{it} ' \vartheta + \pi_{it} \zeta_{it} + \alpha_t \pi_{it} \varepsilon_{it} + \xi_{it}$$

- Impatience, Precautionary savings, intertemporal substitution

- Impact of permanent income shocks

- Impact of transitory income shocks, $\alpha<1$

- Self-insurance is driven by the transmission parameter $\pi$, which is the ratio of human capital wealth to total wealth.
Consumption dynamics (2)

Need to generalise to account for additional ‘insurance’ mechanisms liquidity constraints

\[
\Delta \ln C_{it} \approx \Gamma_{it} + \Delta Z_{it} ' \vartheta + \phi_t \zeta_{it} + \psi_t \epsilon_{it} + \xi_{it}
\]

- In this notation, the transmission parameters \( \phi \) and \( \psi \) subsume \( \pi \) and \( \alpha \) from the self-insurance model
- This factor structure provides the key panel data moments that link the evolution of distribution of consumption to the evolution of labour income distribution
- It describes how consumption updates to income shocks
Panel Data Moments

\[ \text{var}(\Delta y_{it}) = \text{var}(\zeta_{it}) + \text{var}(\Delta \varepsilon_{it}) \]
\[ \text{cov}(\Delta y_{it}, \Delta y_{it+1}) = -\text{var}(\varepsilon_{it}) \]
\[ \text{var}(\Delta c_{it}) = \phi_t^2 \text{var}(\zeta_{it}) + \psi_t^2 \text{var}(\varepsilon_{it}) + \text{var}(\xi_{it}) + \text{var}(u_{it}^c) \]
\[ \text{cov}(\Delta c_{it}, \Delta c_{it+1}) = -\text{var}(u_{it}^c) \]
\[ \text{cov}(\Delta c_{it}, \Delta y_{it}) = \phi_t \text{var}(\zeta_{it}) + \psi_t \text{var}(\varepsilon_{it}) \]
\[ \text{cov}(\Delta c_{it}, \Delta y_{it+1}) = -\psi_t \text{var}(\varepsilon_{it}) \]

- Additional moments providing overidentifying restrictions and allowing for measurement error
- To assess the identifying strategy for the underlying parameters and processes, simulate a stochastic economy…
Panel Data

- **CEX**: Provides consumption and income, but it’s not a panel
- **PSID**: Provides panel data on income and earnings but limited information on consumption (food)
  - Use a structural demand relationship for food in the CEX (monotonic)
    \[
    \ln f_{it} = Z_{it}'\gamma + \beta_t \ln C_{it} + \ln p_t'\nu + e_{it}
    \]
- It can be inverted in the PSID to obtain an imputed measure of consumption
Does the method work?

Variances

Figure 7 Results: Variance of permanent shocks

using consumption and labour income data
Figure 7 Results: Variance of permanent shocks

-0.005 to 0.045


Using consumption and labour income data vs. using labour income data alone.
Figure 8 Results: Variance of transitory shocks
Table VI Results: College and Cohort Decomposition

<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>High educ.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Var. measur. error</strong></td>
<td>0.0632</td>
<td>0.0582</td>
<td>0.0609</td>
<td>0.0753</td>
<td>0.0501</td>
</tr>
<tr>
<td></td>
<td>(0.0032)</td>
<td>(0.0049)</td>
<td>(0.0061)</td>
<td>(0.0055)</td>
<td>(0.0032)</td>
</tr>
<tr>
<td><strong>Var. preference shocks</strong></td>
<td>0.0122</td>
<td>0.0151</td>
<td>0.0164</td>
<td>0.0117</td>
<td>0.0156</td>
</tr>
<tr>
<td></td>
<td>(0.0038)</td>
<td>(0.0064)</td>
<td>(0.0073)</td>
<td>(0.0067)</td>
<td>(0.0042)</td>
</tr>
<tr>
<td><strong>Transmission Coeff. perm. shock (φ)</strong></td>
<td>0.6167</td>
<td>0.7445</td>
<td>0.5626</td>
<td>0.8211</td>
<td>0.3262</td>
</tr>
<tr>
<td></td>
<td>(0.1118)</td>
<td>(0.2124)</td>
<td>(0.2535)</td>
<td>(0.2232)</td>
<td>(0.0867)</td>
</tr>
<tr>
<td><strong>Transmission Coeff. trans. shock (ψ)</strong></td>
<td>0.0550</td>
<td>0.0845</td>
<td>0.0215</td>
<td>0.0969</td>
<td>0.0437</td>
</tr>
<tr>
<td></td>
<td>(0.0358)</td>
<td>(0.0657)</td>
<td>(0.0592)</td>
<td>(0.0517)</td>
<td>(0.0513)</td>
</tr>
<tr>
<td><strong>P-value test equal φ</strong></td>
<td>33%</td>
<td>16%</td>
<td>45%</td>
<td>81%</td>
<td>22%</td>
</tr>
<tr>
<td><strong>P-value test equal ψ</strong></td>
<td>58%</td>
<td>43%</td>
<td>14%</td>
<td>46%</td>
<td>14%</td>
</tr>
</tbody>
</table>
Family Labour Supply

• Total income $Y_t$ is the sum of two sources, $Y_{1t}$ and $Y_{2t}$
  $$\equiv W_t h_t$$

• Assume the labour supplied by the primary earner to be fixed. Income processes:

$$\Delta \ln Y_{1t} = \gamma_{1t} + \xi_{1t} + \Delta \nu_{1t}$$
$$\Delta \ln W_t = \gamma_{2t} + \xi_{2t} + \Delta \nu_{2t}$$

• Household decisions, baseline model:

$$\Delta \ln C_t \approx \sigma_t \Delta \ln \lambda_t$$
$$\Delta \ln h_t \approx \rho_t [\Delta \ln \lambda_t + \Delta \ln W_t]$$

with $\sigma \equiv U'/CU'' < 0$, $\rho \equiv V'/hV'' > 0$
Family Labour Supply

• The key panel data moments become:

\[
\text{Var}(\Delta c_t) = \beta^2 \sigma^2 s^2 \text{Var}(\xi_{1t}) + \beta^2 \sigma^2 (1 + \rho)^2 (1 - s)^2 \text{Var}(\xi_{2t}) \\
+ 2 \beta^2 \sigma^2 (1 + \rho)s(1 - s)\text{Cov}(\xi_{1t}, \xi_{2t}) \\
\text{Var}(\Delta y_{1t}) = \text{Var}(\xi_{1t}) + \text{Var}(\Delta v_{1t}) \\
\text{Var}(\Delta y_{2t}) = (1 + \rho)^2 \text{Var}(\nu_{2t}) + \beta^2 \rho^2 s^2 \text{Var}(\xi_{1t}) + \beta^2 \sigma^2 (1 + \rho)^2 \text{Var}(\xi_{2t}) \\
+ 2 \beta^2 \sigma(1 + \rho)s\text{Cov}(\xi_{1t}, \xi_{2t}) \\
\text{Var}(\Delta w_{1t}) = \text{Var}(\xi_{2t}) + \text{Var}(\Delta v_{2t})
\]

where \( \beta = 1/(\sigma - \rho(1 - s)) \)

\( s_t \) is the ratio of the mean value of the primary earner's earnings to that of the household
Figure 8’ Results: Variance of transitory shocks

Using male earnings
## Table VII Results: Transfers and Family labor supply

<table>
<thead>
<tr>
<th>Transmission Coefficients</th>
<th>Baseline</th>
<th>Couples earnings</th>
<th>Male earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Permanent Shock</strong></td>
<td>0.6167 (0.1118)</td>
<td>0.4668 (0.0977)</td>
<td>0.2902 (0.0611)</td>
</tr>
<tr>
<td>( \phi )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transitory Shock</strong></td>
<td>0.0550 (0.0358)</td>
<td>0.0574 (0.0286)</td>
<td>0.0436 (0.0291)</td>
</tr>
<tr>
<td>( \Psi )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table VIIIb Results: Low Wealth Households

<table>
<thead>
<tr>
<th>Transmission Coefficients</th>
<th>Baseline</th>
<th>Low wealth sample Net Labour Income</th>
<th>Low wealth sample Couples earnings</th>
<th>Low wealth sample Male earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Shock $\phi$</td>
<td>0.6167 (0.1118)</td>
<td>0.9589 (0.2196)</td>
<td>0.5505 (0.2411)</td>
<td>0.3665 (0.0954)</td>
</tr>
<tr>
<td>Transitory Shock $\psi$</td>
<td>0.0550 (0.0358)</td>
<td>0.2800 (0.0696)</td>
<td>0.2199 (0.0658)</td>
<td>0.1709 (0.0378)</td>
</tr>
</tbody>
</table>
Table VIIIc Results: Wealth and Durables

<table>
<thead>
<tr>
<th>Transmission Coefficients</th>
<th>Low wealth sample</th>
<th>Low wealth sample, including durables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Shock $\phi$</td>
<td>0.9589 (0.2196)</td>
<td>0.9300 (0.3131)</td>
</tr>
<tr>
<td>Transitory Shock $\Psi$</td>
<td>0.2800 (0.0696)</td>
<td>0.4259 (0.1153)</td>
</tr>
</tbody>
</table>

Source: Blundell, Pistaferri and Preston (2005)
Summary

- The aim was to show the importance of using consumption information in examining labour income dynamics.
- Specifically to examine the disjuncture in the evolution of labour income and consumption inequality in the US (& UK).
- Found the key driving force is the nature and the durability of shocks to labour market earnings.
- The growth in the persistent factor during this episode carries through into consumption.
- Also found a key role for family labour supply and durables, especially for low wealth households.
- Need to collect better consumption and wealth data in income panels.
Further Issues

• Alternative income dynamics: robustness?
• What if we ignore the distinction between permanent and transitory shocks?
• What if we use food consumption data alone?
• Is there evidence of anticipation?
Anticipation

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

• We find little evidence of anticipation.
• This suggests the persistent labour income 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.
The Permanent-Transitory Distinction

• Suppose we ignore the durability distinction between permanent and transitory shocks
  – The transmission coefficient for labour income shocks is now a weighted average of the coefficients $\phi$ and $\psi$, with weights given by the importance of the variance of permanent (transitory) shocks
  – Thus, one will have the impression that ‘insurance’ is growing.
Food Data in the PSID

• Food data alone?
  – This means there's no need to impute
  – The coefficients of partial insurance now are the product of two things: partial insurance of non-durable consumption and the budget elasticity of food
  – These coefficients fall over time
The End