Inequality in Income and Consumption: Overview

► Inequality has many linked dimensions: wages, incomes and consumption

► Mediated by multiple insurance mechanisms

► Use the time series evolution of the distribution of income and consumption to identify:
  - short-run uncertainty and permanent inequality
  - the sources of insurance to income shocks

► The manner and scope for insurance is dependent upon the durability of shocks

► The objective is to understand the transmission between earnings, income and consumption inequality

► Figure: 1a - f overall inequality; UK, US, China, Japan, Australia.
This lecture is an attempt to reconcile three important literatures:

- the examination of inequality over time via consumption and income
  - e.g. studies from the BLS, Johnson and Smeeding (2005) and at IFS, Goodman and Oldfield (2004); early work in the US by Cutler and Katz (1992) and Dynarski and Gruber (1997), and in the UK by Blundell and Preston (1991) - Table I

- econometric work on the panel data decomposition of income processes

- the work on intertemporal consumption and insurance, especially on ‘excess’ insurance and excess sensitivity

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Insurance to Transitory and Permanent Shocks

- *multiple mechanisms*
  - adjustments in assets
  - informal contracts and gifts
  - individual and household labour supplies
  - social insurance, transfers and taxation
  - durable replacement

- *measuring the welfare cost of risk*
  - CARA preferences and risk aversion
  - within cohort comparisons
Insurance to Transitory and Permanent Shocks

- exploit household panel data on income and consumption
- identify separate impact of permanent and transitory innovations to income
- separate by cohort, by stage of the life-cycle and by education group
- consider the impact of low wealth holdings
- examine the importance of labour supply within the household
- examine the importance of durables:
  - BLS (2005) note that, including durables consumption inequality rises by more than 70% of income inequality rather than around 60% over the 78 to 92 period

Some resilient features of the distribution of consumption

- Log normal distribution of equivalised consumption and income by cohort and time:
  - Figure 2a-d, US; Figure 3a-c, UK.
  - -> relationship between Gini and variance of log under log normality. Under lognormality the Lorenz ordering is a complete ordering coinciding with the ordering by the variance of logs (and therefore also by the Gini).
- Gibrat’s law over the life-cycle for consumption rather than income?
  - Extend the Deaton-Paxson JPE result on the variances of log consumption over the life-cycle
- Figure 4a-d
- will return to panel data features of log consumption, but first log income->
Some resilient features of the dynamic process for income and earnings

For each household $i$, consider a permanent-transitory income decomposition:

$$\log Y_{i,a,t} = Z'_{i,a,t} \varphi + P_{i,a,t} + v_{i,a,t}$$  \hspace{1cm} (1)

where $a$ and $t$ index age and time respectively, $Y$ is real income, and $Z$ is a set of characteristics, observable and known by consumers, $a$ emphasizes the key importance of cohort effects in the evolution of income over the life-cycle.

- Equation (1) decomposes innovations to log income into a permanent component $P_{i,t}$ which follows a martingale process:

$$P_{it} = P_{i,t-1} + \zeta_{it}$$  \hspace{1cm} (2)

and a transitory or mean-reverting component, $v_{i,t}$ which follows an MA($q$) process

$$v_{it} = \sum_{j=0}^{q} \theta_j \varepsilon_{i,t-j} \text{ with } \theta_0 = 1.$$  \hspace{1cm} (3)

It follows that

$$\Delta y_{it} = \zeta_{it} + \Delta v_{it}, \text{ where } y_{it} = \log Y_{it} - Z'_{it} \varphi.$$  \hspace{1cm} (4)

- this latent factor structure aligns well with the autocovariance structure of the PSID, the BHPS and the ECFP

  - 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)

  - we will allow the variances of the permanent and transitory factors to vary nonparametrically with cohort, education and time.

- Tables II a, b and c present the autocovariance structure of the PSID, the BHPS and the ECFP, relate to MaCurdy (1982), Meghir and Pistaferri (2004); note important alternative income models by Baker (2003), Guvenen (2005), Haider (2001).
The Evolution of the Consumption Distribution: The Self-Insurance model

At time $t$ each individual $i$ of age $a$ maximises the conditional expectation of a time separable, differentiable utility function:

$$\max_C E_t \sum_{j=0}^{T-a} u(C_{i,a+j,t+j}, Z_{i,a+j,t+j})$$

where $Z_{i,a+j,t+j}$ incorporates taste shifters and discount rate heterogeneity.

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

$$A_{i,a+j+1,t+j+1} = (1 + r_{t+j}) A_{i,a+j,t+j} + Y_{i,a+j,t+j} - C_{i,a+j,t+j}$$

$$A_{i,T,t+T-a} = 0$$

with $A_{i,a,t}$ given.

- The retirement age is set at $R$, and the end of the life-cycle at age $T$.

The Self-Insurance model specification

With CRRA preferences

$$u(C_{i,a+j,t+j}, Z_{i,a+j,t+j}) = \frac{1}{(1 + \delta)^j} \frac{C_{i,a+j,t+j}^{\beta} - 1}{\beta} e^{Z_{i,a+j,t+j}^\vartheta}$$

the Euler equation becomes

$$C_{i,a-1,t-1}^{\beta-1} = E_{a-1,t-1} \frac{1 + r_{t-1}}{1 + \delta} e^{\Delta Z_{i,a,t}^\vartheta} C_{i,a,t}^{\beta-1}$$

and approximately

$$\Delta \log C_{i,a,t} \simeq \Delta Z_{i,a,t}^\vartheta + \eta_{i,a,t} + \Omega_{i,a,t}$$

- $\eta_{i,a,t}$ is a consumption shock with $E_{a-1,t-1} \eta_{i,a,t} = 0$
- $\Omega_{i,a,t}$ captures any slope in the consumption path due to the interest rate, impatience or precautionary savings.
• Up to order $O(||\nu_t||^2)$, where $\nu_t = (\zeta_t, \varepsilon_t)'$, this can be expressed as:

$$\Delta \ln C_{it} \approx \Gamma_{bt} + \Delta Z_{it}'\phi^c + \xi_{it} + \pi_{bt}\zeta_{it} + \alpha_{bt}\pi_{bt}\varepsilon_{it}$$

where $\alpha_{bt}$ is an annuitisation factor for a finite horizon and $\pi_{bt}$ measures the degree to which ‘permanent’ shocks are insurable with precautionary savings in a finite horizon model.

• This will provide the key panel data moments that link the evolution of distribution of consumption to the evolution of income.

• CLT implies that log consumption is approximately normal and the variance generally does increase with age - as in the figures.

• For second order moments the approximation errors is $O(||\nu_t||^3)$ and below I give some results on this approximation using a simulated economy.

First, consider information, welfare measurement and additional insurance.

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**Information and the income process**

It may be that the consumer cannot separately identify transitory $\varepsilon_{it}$ from permanent $\zeta_{it}$ income shocks. For a consumer who simply observed the income innovation $\varepsilon_{it}$ in $y_{it} = y_{i,t-1} + \varepsilon_{it} - \theta_t\varepsilon_{i,t-1}$ we have consumption innovation:

$$\eta_{it} = \rho_t(1 - \theta_{t+1})\varepsilon_{it} + \frac{r}{1+r}\theta_{t+1}\varepsilon_{it}$$

(5)

where $\rho_t = 1 - (1 + r)^{-(R-t+1)}$. The evolution of $\theta_t$ is directly related to the evolution of the variances of the transitory and permanent innovations to income.

• The permanent effects component in this decomposition can be thought of as capturing news about both current and past permanent effects since

$$E(\sum_{j=0}^{\infty} \zeta_{i,t-j}|\varepsilon_{it}, \varepsilon_{i,t-1}, \ldots) = E(\sum_{j=0}^{\infty} \zeta_{i,t-j}|\varepsilon_{i,t-1}, \ldots) = (1 - \theta_{t+1})\varepsilon_{it}.$$  

• This represents the best prediction of the permanent/ transitory split.
When Does Consumption Inequality Measure Welfare Inequality?

Suppose individual $i$, reaching adulthood in year $b_i$ has lifetime income $Y_i$. The real interest rate in year $s$ is $r_s$ and is assumed to be the same for all individuals.

- The individual seeks to maximise an increasing and quasiconcave lifetime welfare function $U_i = U(C_i)$, with $C_i = (C_{i0}, C_{i1}, ..., C_{iT})$.
- Hicksian demands are $C_{it} = C_t(U_i, p_i)$ where $p_i = (p_{i0}, p_{i1}, ..., p_{iT})$ and $p_{it} = \prod_{s=0}^{t} (1 + r_{s+b_i})^{-1}$.

**PROPOSITION 1** *Comparisons within cohorts at same age*: $C_{it} \geq C_{jt}$ implies $U_i \geq U_j$ whenever individuals $i$ and $j$ share the same year of birth if and only if consumption in all periods is a normal good.

The Welfare Cost of Income Risk

Define $\tilde{Y}_i$ as that certain present discounted value of lifetime income which would allow the individual to achieve the same expected utility. The consumption stream $\tilde{C}_i = \tilde{C}(EU_i)$ that would be chosen given $\tilde{Y}_i$ satisfies

$$\sum_t u_t(\tilde{C}_{it}) = E(\sum_t u_t(C_{it})) = EU_i.$$

**PROPOSITION 2** *Comparisons across individuals facing different income risk*: $C_{it} \geq C_{jt}$ implies $EU_i \geq EU_j$ whenever individuals $i$ and $j$ share the same year of birth if and only if $C_i = \tilde{C}(EU_i)$ whatever the distribution of future income. This is so if and only if $u_t(C_{it}) = -\alpha_t \exp(-\beta_t C_{it}) \quad \alpha_t, \beta_t > 0, t > 0$.

- This holds exactly iff CARA. The sufficiency part is a special case of a more general result that decreasing absolute risk aversion (DARA) implies $C_{i0} < \tilde{C}_{i0}$, i.e. that there is excess precautionary saving if higher incomes decrease risk aversion.
The Evolution of the Consumption Distribution: The Partial Insurance model

- The stochastic Euler equation is consistent with many stochastic processes for consumption. It does not say anything about the variance of consumption.

- In the full information perfect market model with separable preferences the variance of consumption is zero. In comparison with the self-insurance model the intertemporal budget constraint based on a single asset is violated.

- Partial insurance allows some additional insurance. For example, Attanasio and Pavoni (2005) consider an economy with moral hazard and hidden asset accumulation - individuals now have hidden access to a simple credit market. They show that, depending on the cost of shirking and the persistence of the income shock, some partial insurance is possible. A linear insurance rule can be obtained as an ‘exact’ solution in a dynamic Mirrlees model with CRRA utility.

The introduction of two ‘transmission parameters’:

To capture the possibility of ‘excess insurance’ and also ‘excess sensitivity’, we define:

- $\phi_{bt}$ the degree to which permanent shocks $\zeta_{it}$ for individual $i$ in birth cohort $b$ in period $t$ are ‘insured’

- $\psi_{bt}$ the degree to which transitory shocks $\varepsilon_{it}$ are ‘insured’

- in fact $1 - \phi_{bt}$ and $1 - \psi_{bt}$ are the fractions insured

implying:

$$\Delta c_{it} \equiv \Gamma_{bt} + \xi_{it} + \phi_{bt}\zeta_{it} + \psi_{bt}\varepsilon_{it}$$

where $\Delta c_{it} = \Delta \ln C_{it} - \Delta Z_{it}\varphi_e$.

In this notation $\phi_{bt}$ and $\psi_{bt}$ subsume $\pi_{bt}$ and $\alpha_{bt}$ from the self-insurance model.
The key panel data moments

The panel data moments for log income are

\[
\text{cov} \left( \Delta y_{a,t}, \Delta y_{a+s,t+s} \right) = \begin{cases} 
\text{var} \left( \zeta_{a,t} \right) + \text{var} \left( \Delta v_{a,t} \right) & \text{for } s = 0 \\
\text{cov} \left( \Delta v_{a,t}, \Delta v_{a+s,t+s} \right) & \text{for } s \neq 0
\end{cases}
\]  

(6)

The covariance term \( \text{cov} \left( \Delta v_{a,t}, \Delta v_{a+s,t+s} \right) \) depends on the serial correlation properties of \( v \). If \( v \) is an MA(\( q \)) serially correlated process, then \( \text{cov} \left( \Delta v_{a,t}, \Delta v_{a+s,t+s} \right) \) is zero whenever \(|s| > q + 1\).

Allowing for an MA(\( q \)) process, for example, adds \( q - 1 \) extra parameter (the \( q - 1 \) MA coefficients) but also \( q - 1 \) extra moments, so that identification is unaffected.

The panel data moments for log consumption are

\[
\text{cov} \left( \Delta c_{a,t}, \Delta c_{a+s,t+s} \right) = \phi_{b,t}^2 \text{var} \left( \zeta_{a,t} \right) + \psi_{b,t}^2 \text{var} \left( \varepsilon_{a,t} \right) + \text{var} \left( \xi_{a,t} \right)
\]  

(7)

for \( s = 0 \) and zero otherwise.

The covariance between income growth and consumption growth is:

\[
\text{cov} \left( \Delta c_{a,t}, \Delta y_{a+s,t+s} \right) = \begin{cases} 
\phi_{b,t} \text{var} \left( \zeta_{a,t} \right) + \psi_{b,t} \text{var} \left( \varepsilon_{a,t} \right) & \text{for } s = 0, \text{ and } s > 0 \text{ respectively.}
\end{cases}
\]  

(8)

If \( v \) is serially uncorrelated (\( v_{i,a,t} = \varepsilon_{i,a,t} \)), then \( \text{cov} \left( \Delta c_{a,t}, \Delta y_{a+s,t+s} \right) = -\psi_{b,t} \text{var} \left( \varepsilon_{a,t} \right) \) for \( s = 1 \) and 0 otherwise.
• A simple summary the panel data moments:

\[
\text{var} (\Delta y_t) = \text{var} (\zeta_t) + \text{var} (\varepsilon_t) + \text{var} (\varepsilon_{t-1})
\]

\[
\text{cov} (\Delta y_t, \Delta y_{t-1}) = -\text{var} (\varepsilon_{t-1})
\]

\[
\text{cov} (\Delta y_{t+1}, \Delta y_t) = -\text{var} (\varepsilon_t)
\]

\[
\text{var} (\Delta c_t) = \phi_t^2 \text{var} (\zeta_t) + \psi_t^2 \text{var} (\varepsilon_t)
\]

\[
\text{cov} (\Delta c_t, \Delta y_t) = \phi_t \text{var} (\zeta_t) + \psi_t \text{var} (\varepsilon_t)
\]

\[
\text{cov} (\Delta c_t, \Delta y_{t+1}) = -\psi_t \text{var} (\varepsilon_t)
\]

• Under additional assumptions, Blundell and Preston (1998) turn these into identifying moments for repeated cross-section data.

Note that there is a degree of overidentification

• For example,

\[
\phi_t = \frac{\text{var} (\Delta c_t)}{\text{cov} (\Delta y_t, \Delta c_t)}
\]

and

\[
\phi_t = \frac{\text{cov} (\Delta c_t, \Delta y_t)}{\text{cov} (\Delta y_t, \Delta y_t + \Delta y_t + \Delta y_{t+1})}
\]

• Thus \( \phi_t \) is generally overidentified (note measurement error case).

• In estimation use optimal weighted moment estimator and allow for MA(1) in the transitory component.
Assessing the identification strategy

- To judge the ability of this model to identify the underlying parameters and processes, Blundell, Low and Preston (2004) simulate a stochastic dynamic economy.
- In the base case the subjective discount rate $\delta = 0.02$, also allow $\delta$ to take values 0.04 and 0.01. Also a mixed population with half at 0.02 and a quarter each at 0.04 and 0.01.
- In such cases the permanent variance follows a two-state, first-order Markov process with the transition probability between alternative variances, $\sigma^2_{\zeta,L}$ and $\sigma^2_{\zeta,H}$
- For each experiment, BLP simulate consumption, earnings and asset paths for 50,000 individuals. To obtain estimates of the variance for each period, a random cross sectional samples of 2000 individuals for each of 20 periods is drawn

See Figure 5.

THE US PSID/CEX DATA

  - Construct all the possible panels of $2 \leq$ length $\leq$ 15 years
  - Sample selection: male head aged 30-62, no SEO/Latino subsamples
  - Total family income and food at home are dated 1978-1992.

  - Focus on 5-quarters respondents only (annual expenditure measures)
  - Sample selection similar to the PSID
  - Eliminate those with zero income/expenditure

A comparison of both data sources is in Blundell, Pistaferri and Preston (2004)
  - Note also the source for the UK BHPS and Spanish ECFP panel data.
Using a structural demand relationship to link consumption data in the CEX with the Income panel data in the PSID

- Food consumption, income and total expenditure in CEX, but a repeated cross-section

- Food consumption and income in the PSID panel.
  - Plus lots of demographic and other matching information in each year.

- Inverse structural demand equation acts as an ‘imputation’ equation - Table III.

- Implications for consumption and income inequality - Figure 6

- Covariance structure of consumption and income - Table IV

Partial Insurance and the other ‘structural’ parameters

- “excess smoothness” or “excess insurance” relative to self-insurance

Table Va:
- College-no college comparison
- Younger versus older cohorts

Figures 7a,b: show implications for variances of permanent and transitory shocks
- Within cohort and education analysis changes the balance between the distribution of permanent and transitory shocks but not the value of the transmission parameters.
  - Younger in the sample also display less insurance: $\hat{\phi} = .87 (.11)$
  - Strongly reject constancy of $\phi$ and $\psi$ when food in PSID is used
- Table Vb Results for the Spanish and the British data.
Partial Insurance and 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

  \[
  \Delta \ln Y_{1t} = \gamma_{1t} + \Delta u_{1t} + v_{1t} \\
  \Delta \ln Y_{2t} = \gamma_{2t} + \Delta u_{2t} + v_{2t}
  \]

- Household decisions to be taken to maximise a household utility function

  \[
  \sum_k (1 + \delta)^{-k}[U(C_{t+k}) - V(h_{t+k})].
  \]

  \[
  \Delta \ln C_{t+k} \approx \sigma_{t+k} \Delta \ln \lambda_{t+k} \\
  \Delta \ln h_{t+k} \approx -\rho_{t+k}[\Delta \ln \lambda_{t+k} + \Delta \ln W_{t+k}]
  \]

  with $\sigma_t \equiv U_t' / C_t U''_t < 0$, $\rho_t \equiv -V'_t / h_t V''_t > 0$.

The key panel data moments become:

\[
\begin{align*}
Var(\Delta c_t) & \approx \beta^2 \phi^2 s^2 Var(v_{1t}) + \beta^2 \phi^2 (1 - \rho)^2(1 - s)^2 Var(v_{2t}) \\
& \quad + 2\beta^2 \phi^2 (1 - \rho)s(1 - s) Cov(v_{1t}, v_{2t}) \\
Var(\Delta y_{1t}) & \approx Var(v_{1t}) + \Delta Var(u_{1t}) \\
Var(\Delta y_{2t}) & \approx (1 - \psi)^2 Var(u_{2t}) - \beta^2 \rho^2 s^2 Var(v_{1t}) \\
& \quad + \beta^2 \phi^2 (1 - \rho)^2 Var(v_{2t}) - 2\beta^2 \phi \rho (1 - \rho)s Cov(v_{1t}, v_{2t}) \\
Var(\Delta w_t) & \approx Var(v_{2t}) + \Delta Var(u_{2t})
\end{align*}
\]

where

- $\beta = 1/(\phi + \rho(1 - s))$.

- $s_t$ is the ratio of the mean value of the primary earner's earnings to that of the household $\overline{Y}_{1t}/\overline{Y}_t$
• When the labour supply elasticity $\rho > 0$ then the secondary worker provides insurance for shocks to $y_1$

• **Figure 8:** shows interesting implications for the variance of transitory shocks to household income reconciles the *Gottshalk and Moffitt results* and relates to recent references:
  
  • Attanasio, Berloffa, Blundell and Preston (2002, EJ), ‘From Earnings Inequality to Consumption Inequality’
  
  • Attanasio, Sanchez-Marcos and Low (2005, JEEA), ‘Female labor Supply as an Insurance Against Idiosyncratic Risk’
  
  • Heathcote, Storesletten and Violante (2006), ‘Consumption and Labour Supply with Partial Insurance’

(● All references on webpage)

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**Partial Insurance: Family Transfers and Taxes**

**Table VI:**

• **Tax system and transfers** provide some insurance to permanent shocks
  
  ▶ food stamps for low income households studied in Blundell and Pistaferri (2003), ‘Income volatility and household consumption: The impact of food assistance programs’, special conference issue of JHR,
  
  ▶ also contains the Meyer and Sullivan paper, ‘Measuring the Well-Being of the Poor Using Income and Consumption’
Partial Insurance: Wealth and Durables

- Excess sensitivity among low wealth households: select (30%) initial low wealth. also consider
- Impact of durable purchases as a smoothing mechanism?
BLS and IFS studies have noted the increased variance when durable purchases are included.

Table VII

- Excess sensitivity among low wealth households
- For poor households at least - absence of simple credit market
  - Excess sensitivity among low wealth households - even more impressive use of durables among low wealth households: - Browning, and Crossley (2003), “Shocks, stocks and socks: Consumption smoothing and the replacement of durables”

Summary

- Objective to understand the relationship between income and consumption inequality
- Reconcile the results in three literatures:
  - inequality over time in consumption, income and earnings
  - econometric work on panel data income and earnings processes
  - the work on intertemporal consumption and insurance, especially on ‘excess’ insurance and excess sensitivity
- Important role for two transmission parameters that identify generalisations of the self-insurance model
- Identify the contribution of both transitory and permanent shocks
What has been found?

- Distinctive and resilient features in the dynamics of income and consumption distributions
- The relationship between consumption and income inequality over the 1980s can be explained by the dramatic change in the mix of permanent and transitory income shocks over this period.
- A predominance of uninsured permanent shocks in early 1980s in US and UK, and early 1990s in Spain - other countries?
- Liquidity distortions among lower wealth groups
- Durable purchases as insurance to transitory shocks among lower wealth groups
- Evidence of ‘secondary worker’ labour supply as insurance to primary workers transitory earnings shocks in early 1980s - Gottshalk and Moffitt.

What of future research?

- Differential persistence across the distribution: optimal welfare results for low wealth/low human capital groups: optimal earned income tax-credits.
- Advance information and/or predictable life-cycle income trends - Cuhna, Heckman and Navarro (2005), see also Primiceri and van Rens (2006).
- Alternative panel data income processes e.g. Guvenen (2005).
- The specific use of credit and durables - Davis, Kubler and Willen (2005), Browning and Crossley (2004)
Figure 1a: Consumption and Income Inequality in the UK

Authors calculations.
Variance of log equivalised, cons rebased at 1977, smoothed.

Figure 1b: Consumption and Income Inequality in the US

Variance of log equivalised, cons rebased at 1977, smoothed
Figure 1c: Consumption and Income Inequality in Japan

Source: Othake and Saito (1998); NSFIE
Var (log) with cons rebased at 1979

Figure 1d: Consumption and Income Inequality in Australia

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

![Graph showing consumption and income inequality from 1977 to 1992.](image)

(variance of log equivalised, cons rebased at 1978)

Table I: Consumption and Income Inequality 1978-1992

<table>
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<th></th>
<th>1978</th>
<th>1986</th>
<th>1992</th>
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<td>Goodman and Oldfield (IFS, 2004)</td>
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<td>Income Gini</td>
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<tr>
<td>Consumption Gini</td>
<td>0.25</td>
<td>0.28</td>
<td>0.29</td>
</tr>
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</table>

Both studies bring the figures up to 2001.

Relate to:
- Atkinson (1997): UK income Gini rises 10 points late 70s to early 90s.

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.
COHORT 1950-59 Age 31-35

Source: Battistin, Blundell and Lewbel (2005)

Figure 2a: The distribution of log consumption: US CEX

Figure 2b: The distribution of log income: US CEX

Source: Battistin, Blundell and Lewbel (2005)

Age 31-35, income
**Figure 2c: The distribution of log consumption: US CEX**

COHORT 1950-59 Age 36-40

Source: Battistin, Blundell and Lewbel (2005)

**Figure 2d: The distribution of log consumption: US CEX**

COHORT 1950-59 age 41-45

Source: Battistin, Blundell and Lewbel (2005)
Figure 3a: The distribution of log consumption: UK FES

COHORT 1940-49, AGE 41-45

Source: Battistin, Blundell and Lewbel (2005)

Figure 3b: The distribution of log consumption: UK FES

COHORT 1940-49, AGE 51-55

Source: Battistin, Blundell and Lewbel (2005)
**Figure 3c: The distribution of log income: UK FES**

Standard Deviation of Logs: 0.4774  Skewness: -0.0130  Kurtosis: 0.1610  
P-values: Kolmogorov-Smirnov: 0.0000  Skewness: 0.5705  Kurtosis: 0.0000

**COHORT 1940-49, AGE 41-45**

Source: Battistin, Blundell and Lewbel

**Figure 4a: The cohort evolution of log consumption distribution: US CEX**

Source: Battistin, Blundell and Lewbel
Figure 4b: Cohort Consumption Inequality in the US by Cohort

Source: Blundell, Pistaferri and Preston (2005)
Variance of log equivalised, PSID

Figure 4c: Consumption Inequality over the Life-Cycle in Japan

Source: Othake and Saito (1998)
Var (log); NSFIE
Figure 4d: Cohort Inequality in the UK

Blundell and Preston (1998)

Figure 4e: Cohort Consumption Inequality in the UK

(variance of log equivalised)
### Table IIa: The Covariance Structure of Income - PSID

<table>
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<tr>
<th>Year</th>
<th>var($\Delta y_t$)</th>
<th>$\text{cov}(\Delta y_{t+1}, \Delta y_t)$</th>
<th>$\text{cov}(\Delta y_{t+2}, \Delta y_t)$</th>
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<td></td>
<td>(0.0088)</td>
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<td>1981</td>
<td>0.0813</td>
<td>-0.0291</td>
<td>-0.0038</td>
</tr>
<tr>
<td></td>
<td>(0.0090)</td>
<td>(0.0049)</td>
<td>(0.0035)</td>
</tr>
<tr>
<td>1985</td>
<td>0.0927</td>
<td>-0.0321</td>
<td>-0.0012</td>
</tr>
<tr>
<td></td>
<td>(0.0069)</td>
<td>(0.0053)</td>
<td>(0.0042)</td>
</tr>
<tr>
<td>1986</td>
<td>0.1153</td>
<td>-0.0440</td>
<td>-0.0078</td>
</tr>
<tr>
<td></td>
<td>(0.0120)</td>
<td>(0.0094)</td>
<td>(0.0061)</td>
</tr>
<tr>
<td>1987</td>
<td>0.1185</td>
<td>-0.0402</td>
<td>0.0014</td>
</tr>
<tr>
<td></td>
<td>(0.0115)</td>
<td>(0.0052)</td>
<td>(0.0046)</td>
</tr>
<tr>
<td>1992</td>
<td>0.1196</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>(0.0079)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Blundell, Pistaferri and Preston (2005)
Variance of log equivalised, PSID

### Table IIb: The Covariance Structure of Income - BHPS

<table>
<thead>
<tr>
<th>Year</th>
<th>var($\Delta y_t$)</th>
<th>$\text{cov}(\Delta y_{t+1}, \Delta y_t)$</th>
<th>$\text{cov}(\Delta y_{t+2}, \Delta y_t)$</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>
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<tr>
<td></td>
<td>(.0074)</td>
<td>(.0041)</td>
<td>(.0040)</td>
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</tbody>
</table>

Source: Etheridge (2006)
Variance of log equivalised, BHPS
Table IIc: The Covariance Structure of Income - ECFP

<table>
<thead>
<tr>
<th>Year</th>
<th>$\text{var}(\Delta y_t)$</th>
<th>$\text{cov}(\Delta y_{t+1}, \Delta y_t)$</th>
<th>$\text{cov}(\Delta y_{t+2}, \Delta y_t)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>0.0890</td>
<td>-0.0387</td>
<td>0.0041</td>
</tr>
<tr>
<td></td>
<td>(0.0088)</td>
<td>(0.0041)</td>
<td>(0.0030)</td>
</tr>
<tr>
<td>1988</td>
<td>0.09123</td>
<td>-0.0411</td>
<td>0.0103</td>
</tr>
<tr>
<td></td>
<td>(0.0090)</td>
<td>(0.0049)</td>
<td>(0.0035)</td>
</tr>
<tr>
<td>1990</td>
<td>0.0817</td>
<td>-0.0370</td>
<td>0.0092</td>
</tr>
<tr>
<td></td>
<td>(0.0069)</td>
<td>(0.0053)</td>
<td>(0.0042)</td>
</tr>
<tr>
<td>1992</td>
<td>0.0851</td>
<td>-0.0380</td>
<td>0.0101</td>
</tr>
<tr>
<td></td>
<td>(0.0120)</td>
<td>(0.0094)</td>
<td>(0.0061)</td>
</tr>
<tr>
<td>1995</td>
<td>0.0895</td>
<td>-0.0411</td>
<td>0.0090</td>
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<tr>
<td></td>
<td>(0.0115)</td>
<td>(0.0052)</td>
<td>(0.0046)</td>
</tr>
</tbody>
</table>

Source: Casado García, Labeaga and Preston (2005)
Variance of log equivalent, ECFP

Figure 5: A Simulated Economy, permanent shock variance estimates

### Table III: The Demand For Food

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>Variable</th>
<th>Estimate</th>
<th>Variable</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(c)</td>
<td>0.8503 (0.1511)</td>
<td>ln(c) * 1992</td>
<td>0.0037 (0.0056)</td>
<td>Family size</td>
<td>0.0272 (0.0090)</td>
</tr>
<tr>
<td>ln(c) * High School dropout</td>
<td>0.0730 (0.0718)</td>
<td>ln(c) * One child</td>
<td>0.0202 (0.0336)</td>
<td>ln(pfood)</td>
<td>-0.9784 (0.2160)</td>
</tr>
<tr>
<td>ln(c) * High School graduate</td>
<td>0.0827 (0.0890)</td>
<td>ln(c) * Two children</td>
<td>-0.0250 (0.0383)</td>
<td>ln(ptransports)</td>
<td>5.5376 (0.0500)</td>
</tr>
<tr>
<td>High school dropout</td>
<td>-0.7030 (0.6741)</td>
<td>ln(c) * Three children+</td>
<td>0.0087 (0.0430)</td>
<td>ln(pfuel-utils)</td>
<td>-0.6670 (0.7351)</td>
</tr>
<tr>
<td>High school graduate</td>
<td>-0.8458 (0.8298)</td>
<td>Age</td>
<td>0.0122 (0.0085)</td>
<td>White</td>
<td>0.0769 (0.0129)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age²</td>
<td>-0.0001 (0.0001)</td>
<td>Constant</td>
<td>-0.6404 (0.9206)</td>
</tr>
</tbody>
</table>

**OID test**

20.92 (d.f. 18, χ²-p-value 28%)

Test that income elasticity does not vary over time

27.69 (d.f. 18, χ²-p-value 0.6%)


---

**Figure 6: Variance of log C in the PSID and in the CEX**

![Graph showing variance of log C over years](chart.png)

### Table IVa: The Covariance Structure of Consumption

<table>
<thead>
<tr>
<th>Year</th>
<th>var(Δct)</th>
<th>cov(Δct, Δct+1)</th>
<th>cov(Δct, Δct+2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>0.1319</td>
<td>-0.0599</td>
<td>0.0021</td>
</tr>
<tr>
<td></td>
<td>(0.0111)</td>
<td>(0.0092)</td>
<td>(0.0057)</td>
</tr>
<tr>
<td>1981</td>
<td>0.1231</td>
<td>-0.0576</td>
<td>0.0030</td>
</tr>
<tr>
<td></td>
<td>(0.0121)</td>
<td>(0.0077)</td>
<td>(0.0045)</td>
</tr>
<tr>
<td>1982</td>
<td>0.1316</td>
<td>-0.0624</td>
<td>0.0004</td>
</tr>
<tr>
<td></td>
<td>(0.0106)</td>
<td>(0.0085)</td>
<td>(0.0052)</td>
</tr>
<tr>
<td>1983</td>
<td>0.1476</td>
<td>-0.0676</td>
<td>-0.0017</td>
</tr>
<tr>
<td></td>
<td>(0.0140)</td>
<td>(0.0074)</td>
<td>(0.0063)</td>
</tr>
<tr>
<td>1984</td>
<td>0.1656</td>
<td>-0.0781</td>
<td>-0.0129</td>
</tr>
<tr>
<td></td>
<td>(0.0136)</td>
<td>(0.0125)</td>
<td>(0.0087)</td>
</tr>
<tr>
<td>1985</td>
<td>0.1816</td>
<td>-0.0866</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>(0.0221)</td>
<td>(0.0192)</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>0.1676</td>
<td>-0.0601</td>
<td>-0.0062</td>
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<tr>
<td></td>
<td>(0.0206)</td>
<td>(0.0060)</td>
<td>(0.0065)</td>
</tr>
<tr>
<td>1991</td>
<td>0.1520</td>
<td>-0.0649</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>(0.0104)</td>
<td>(0.0088)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Blundell, Pistaferri and Preston (2005)

Variance of log equivalised, PSID and CEX

### Table IVb: The Covariance of Consumption and Income

<table>
<thead>
<tr>
<th>Year</th>
<th>cov(Δyt, Δct)</th>
<th>cov(Δyt, Δct+1)</th>
<th>cov(Δyt, Δct+2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>0.0104</td>
<td>-0.0054</td>
<td>-0.0051</td>
</tr>
<tr>
<td></td>
<td>(0.0037)</td>
<td>(0.0036)</td>
<td>(0.0033)</td>
</tr>
<tr>
<td>1982</td>
<td>0.0165</td>
<td>-0.0015</td>
<td>-0.0056</td>
</tr>
<tr>
<td></td>
<td>(0.0038)</td>
<td>(0.0041)</td>
<td>(0.0033)</td>
</tr>
<tr>
<td>1983</td>
<td>0.0212</td>
<td>-0.0057</td>
<td>-0.0078</td>
</tr>
<tr>
<td></td>
<td>(0.0045)</td>
<td>(0.0043)</td>
<td>(0.0048)</td>
</tr>
<tr>
<td>1984</td>
<td>0.0226</td>
<td>-0.0107</td>
<td>-0.0055</td>
</tr>
<tr>
<td></td>
<td>(0.0050)</td>
<td>(0.0045)</td>
<td>(0.0045)</td>
</tr>
<tr>
<td>1985</td>
<td>0.0181</td>
<td>-0.0034</td>
<td>-0.0023</td>
</tr>
<tr>
<td></td>
<td>(0.0064)</td>
<td>(0.0064)</td>
<td>(0.0056)</td>
</tr>
<tr>
<td>1986</td>
<td>0.0166</td>
<td>NA</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.0049)</td>
<td></td>
<td>(0.0053)</td>
</tr>
</tbody>
</table>

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

Source: Blundell, Pistaferri and Preston (2005)
Table Va: Structural Estimates: College and Cohort Decomposition: PSID/CEX

<table>
<thead>
<tr>
<th>Year</th>
<th>$\sigma^2_{\epsilon}$</th>
<th>Whole sample</th>
<th>No College</th>
<th>Born 1940s</th>
<th>Born 1930s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>0.0076</td>
<td>0.0052</td>
<td>0.0065</td>
<td>0.0072</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0036)</td>
<td>(.0044)</td>
<td>(.0049)</td>
<td>(.0072)</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>0.0206</td>
<td>0.0156</td>
<td>0.0208</td>
<td>0.0197</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0052)</td>
<td>(.0065)</td>
<td>(.0063)</td>
<td>(.0100)</td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>0.0252</td>
<td>0.0244</td>
<td>0.0219</td>
<td>0.0181</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0077)</td>
<td>(.0094)</td>
<td>(.1114)</td>
<td>(.0666)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>$\sigma^2_{\xi}$</th>
<th>Whole sample</th>
<th>No College</th>
<th>Born 1940s</th>
<th>Born 1930s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>0.0318</td>
<td>0.0332</td>
<td>0.0282</td>
<td>0.0282</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0043)</td>
<td>(.0057)</td>
<td>(.0059)</td>
<td>(.0066)</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>0.0351</td>
<td>0.0402</td>
<td>0.0218</td>
<td>0.0311</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0042)</td>
<td>(.0063)</td>
<td>(.0048)</td>
<td>(.0117)</td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>0.0444</td>
<td>0.0446</td>
<td>0.0542</td>
<td>0.0442</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0103)</td>
<td>(.0081)</td>
<td>(.0247)</td>
<td>(.0186)</td>
<td></td>
</tr>
</tbody>
</table>

| Year | $\phi$         |              |            |            |            |
|------|----------------|--------------|------------|------------|
| 1980 | 0.6167         | 0.8211       | 0.7445     | 0.5626     |
|      | (.1118)        | (.2232)      | (.2124)    | (.2535)    |
| 1986 | 0.0550         | 0.0969       | 0.0845     | 0.0215     |
|      | (.0358)        | (.0417)      | (.0457)    | (.0592)    |

| Year | $\psi$         |              |            |            |            |
|------|----------------|--------------|------------|------------|
| 1980 | 0.58%          | 46%          | 43%        | 14%        |

Source: Blundell, Pistaferri and Preston (2005)

Figure 7a: Variance of permanent shocks

Source: Blundell, Pistaferri and Preston (2005)
Figure 7b: Variance of transitory shocks

![Graph showing variance of transitory shocks over years 1980 to 1990. The graph compares the variance using consumption and income data to using only income data.]

Source: Blundell, Pistaferri and Preston (2005)

Table Vb: Structural Estimates: Cohort Decomposition: ECFP

<table>
<thead>
<tr>
<th>Year</th>
<th>Cohort</th>
<th>1965-1955</th>
<th>1955-1945</th>
<th>1945-1935</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\sigma^2_{\xi})</td>
<td>1987</td>
<td>0.021</td>
<td>0.013</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>1991</td>
<td>0.045</td>
<td>0.037</td>
<td>0.023</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>0.054</td>
<td>0.039</td>
<td>0.031</td>
</tr>
<tr>
<td>(\sigma^2_{\xi})</td>
<td>1987</td>
<td>0.013</td>
<td>0.019</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>1991</td>
<td>0.033</td>
<td>0.024</td>
<td>0.020</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>0.049</td>
<td>0.043</td>
<td>0.042</td>
</tr>
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<td>(\theta)</td>
<td></td>
<td>0.101</td>
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<tr>
<td>(\sigma^2_{\xi})</td>
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<td>0.016</td>
<td>0.012</td>
<td>0.011</td>
</tr>
<tr>
<td>(\phi)</td>
<td></td>
<td>0.981</td>
<td>0.923</td>
<td>0.851</td>
</tr>
<tr>
<td>(\psi)</td>
<td></td>
<td>0.221</td>
<td>0.137</td>
<td>0.097</td>
</tr>
<tr>
<td>P-value test of equal (\phi)</td>
<td></td>
<td>17%</td>
<td>41%</td>
<td>61%</td>
</tr>
<tr>
<td>P-value test of equal (\psi)</td>
<td></td>
<td>22%</td>
<td>29%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Source: Casado-Garcia, Labeaga and Preston (2005)
Figure 8: Variance of transitory shocks for male earnings and for family income

Source: Blundell, Pistaferri and Preston (2005)

Table VI: Structural Estimates: Family Transfers, Taxes and Earnings

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Excluding help from relatives</th>
<th>Earnings rather than Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\phi$</td>
<td>0.6167</td>
<td>0.6531</td>
<td>0.4368</td>
</tr>
<tr>
<td></td>
<td>(0.1118)</td>
<td>(0.1187)</td>
<td>(0.0977)</td>
</tr>
<tr>
<td>$\psi$</td>
<td>0.0550</td>
<td>0.0532</td>
<td>0.0574</td>
</tr>
<tr>
<td></td>
<td>(0.0358)</td>
<td>(0.0359)</td>
<td>(0.0286)</td>
</tr>
</tbody>
</table>

Source: Blundell, Pistaferri and Preston (2005)
Table VII: Structural Estimates: Wealth and Durables

<table>
<thead>
<tr>
<th></th>
<th>Non. dur.</th>
<th>Inc. dur.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low wealth</td>
<td>Low wealth</td>
</tr>
<tr>
<td>$\phi$</td>
<td>0.9589 (0.3696)</td>
<td>0.8800 (0.3131)</td>
</tr>
<tr>
<td>$\psi$</td>
<td>0.2800 (0.0896)</td>
<td>0.4159 (0.1153)</td>
</tr>
</tbody>
</table>

Source: Blundell, Pistaferri and Preston (2005)
References


[40] Crossley, T. and K. Pendakur (2004), ‘Consumption Inequality’ mimeo McMaster University, February.


[69] Hurst, E., and F. Stafford (2003), “Home is where the equity is: Liquidity constraints, refinancing and consumption”, *Journal of Money, Credit, and Banking*, forthcoming.


