Earnings Inequality and Consumption Inequality

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Albert Rees Lecture

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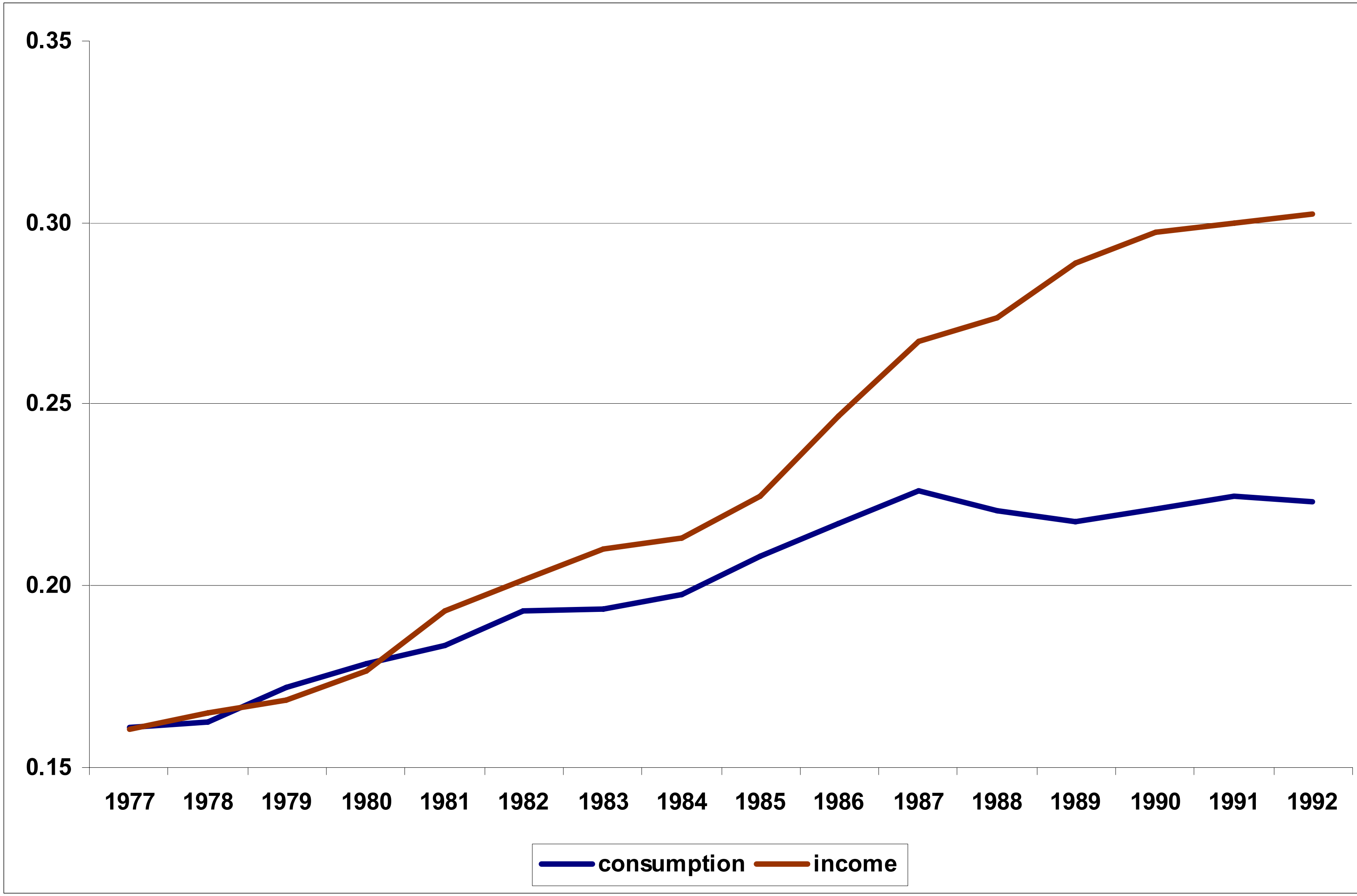
based on joint work with Luigi Pistaferri (Stanford)

Setting the Scene

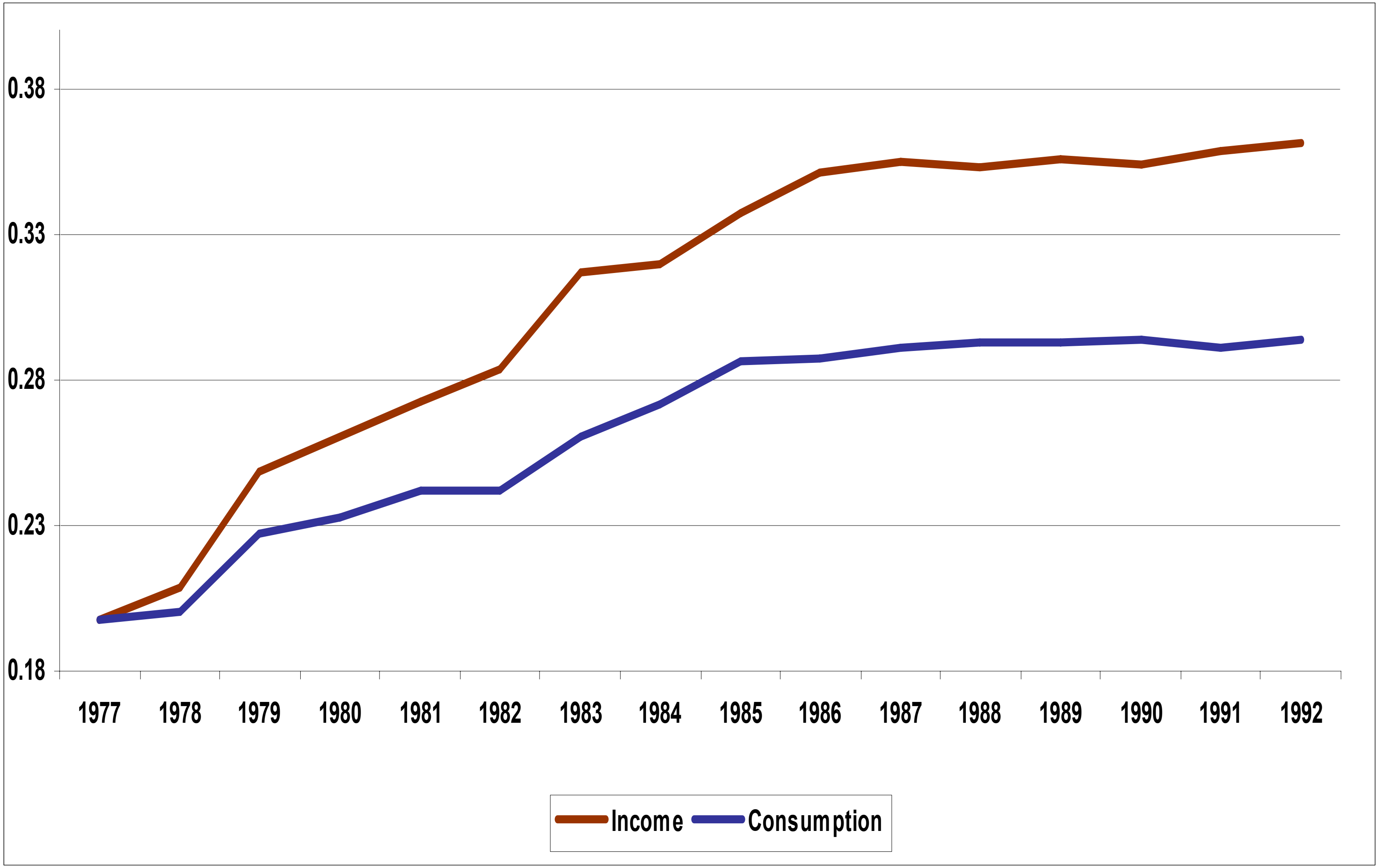
- Inequality has many linked dimensions:
  - wages, income and consumption
- The link between the various types of inequality is mediated by multiple ‘insurance’ mechanisms
  - including labour supply, taxation, consumption smoothing, informal mechanisms, etc
- The manner and scope for insurance depends 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



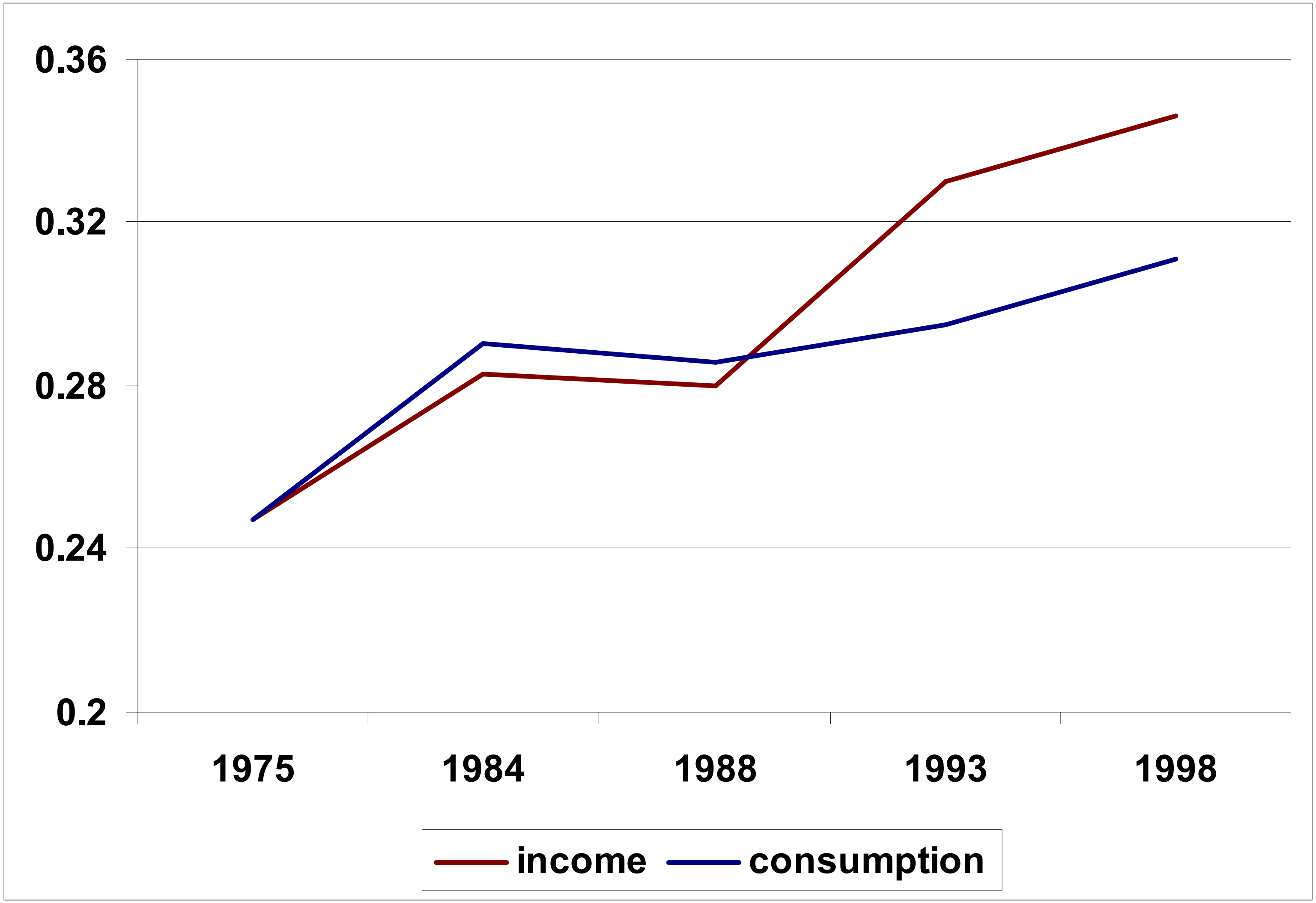
FES: Variance of log equivalised, cons rebased at 1977, smoothed.

Figure 1b: Income and Consumption Inequality in the US



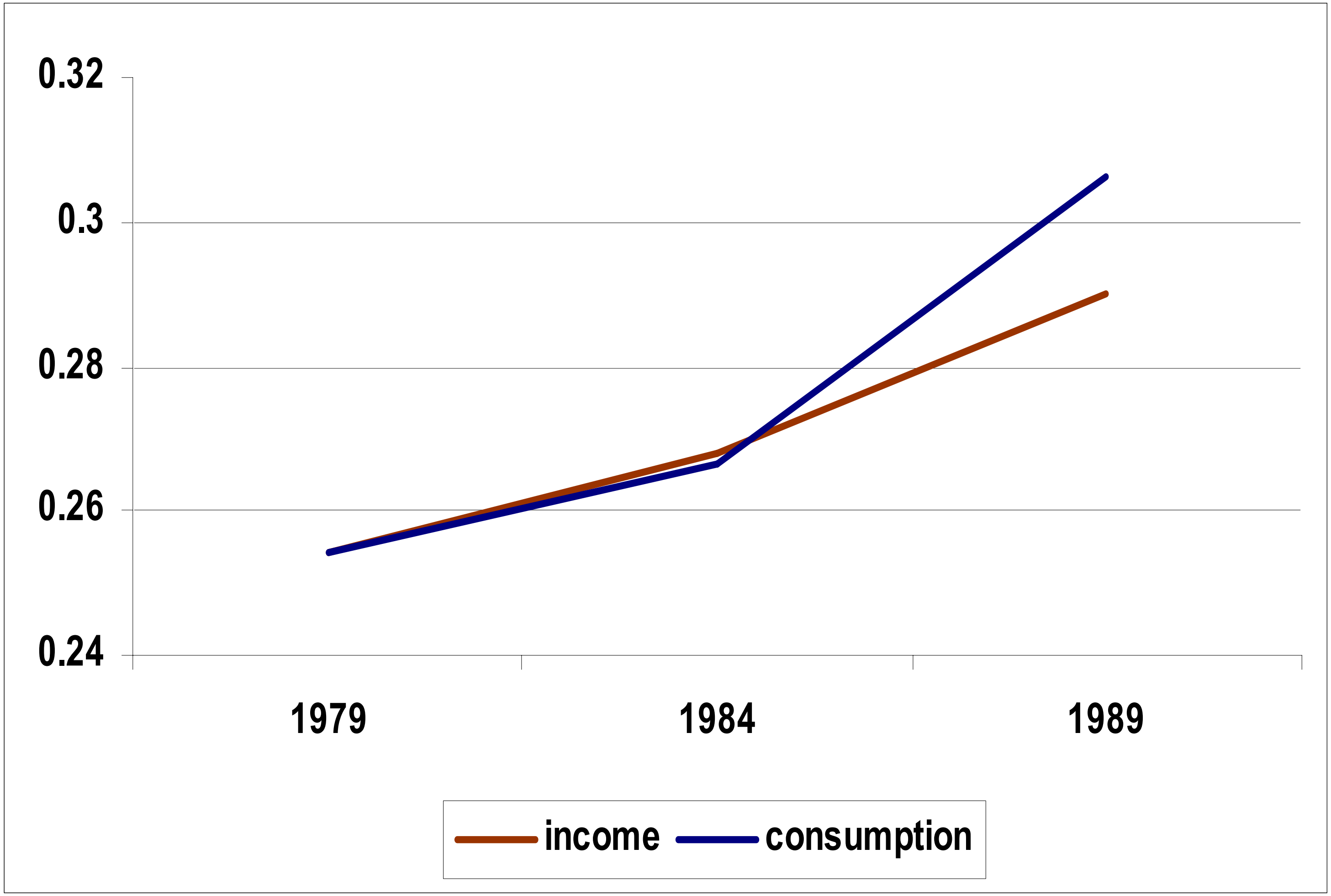
CEX/PSID: Variance of log equivalised, cons rebased at 1977, smoothed

Figure 1c: Income and Consumption Inequality in Australia



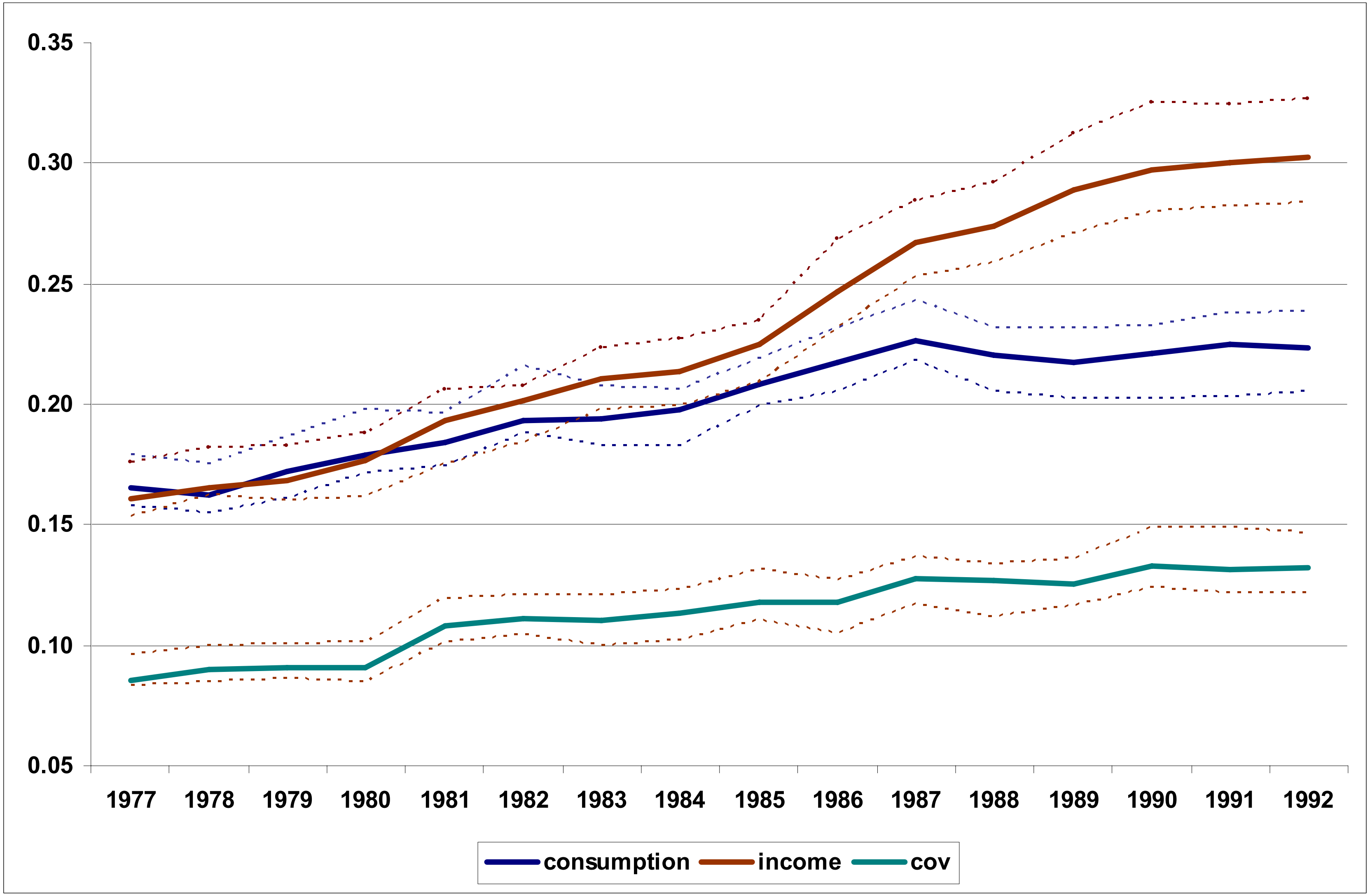
Source: HES; Barrett, and Crossley and Worswick (2000)
Variance of log equivalised (OECD), cons rebased at 1975

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

UK			
Goodman and Oldfield (IFS, 2004)	**1978**	**1986**	**1992**
Income Gini	**.23**	**.29**	**.33**
Consumption Gini	**.20**	**.24**	**.26**
US			
Johnson and Smeeding (BLS, 2005)	**1981**	**1985**	**1990**
Income Gini	**.34**	**.39**	**.41**
Consumption Gini	**.25**	**.28**	**.29**

Both studies bring the figures up to 2001.

Relate to:

- **Atkinson (1997): UK income Gini rises 10 points late 70s to early 90s.**
- **Cutler and Katz (1992): US consumption Gini 65% of income inequality, 80-88.**
- **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

- Lillard and Willis (1978), Lillard and Weiss (1979), MaCurdy(1982), Abowd and Card (1989), Gottschalk and Moffitt (1995, 2004), Baker (1997), Haider (2001), Meghir and Pistaferri (2004), Haider and Solon (2006), etc

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:

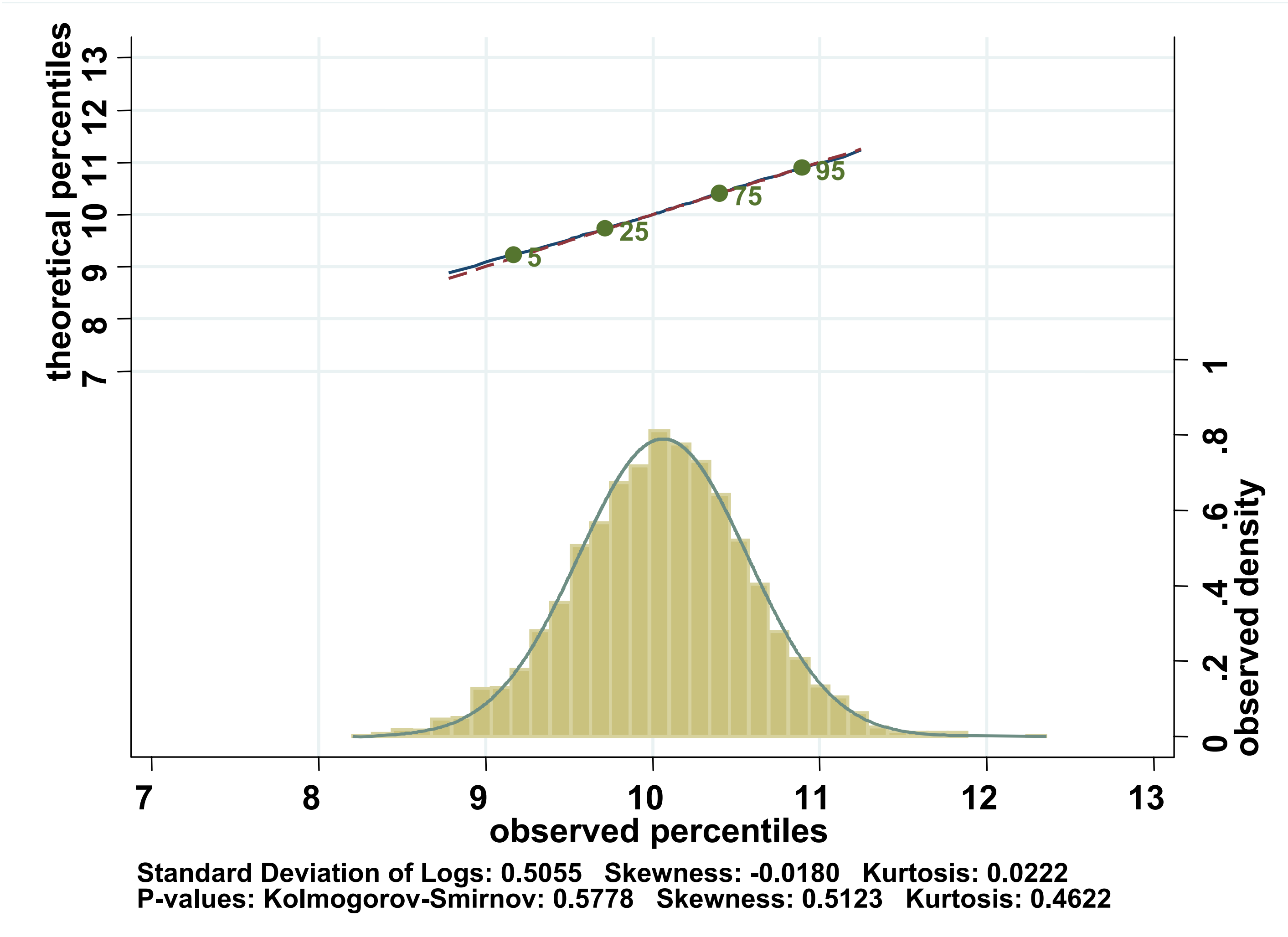
– Hall and Mishkin (1982), Campbell and Deaton (1989), Cochrane (1991), Attanasio and Davis (1996), Krueger and Perri (2006), Attanasio and Pavoni (2006), Blundell, Pistaferri and Preston (2006), etc

– 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

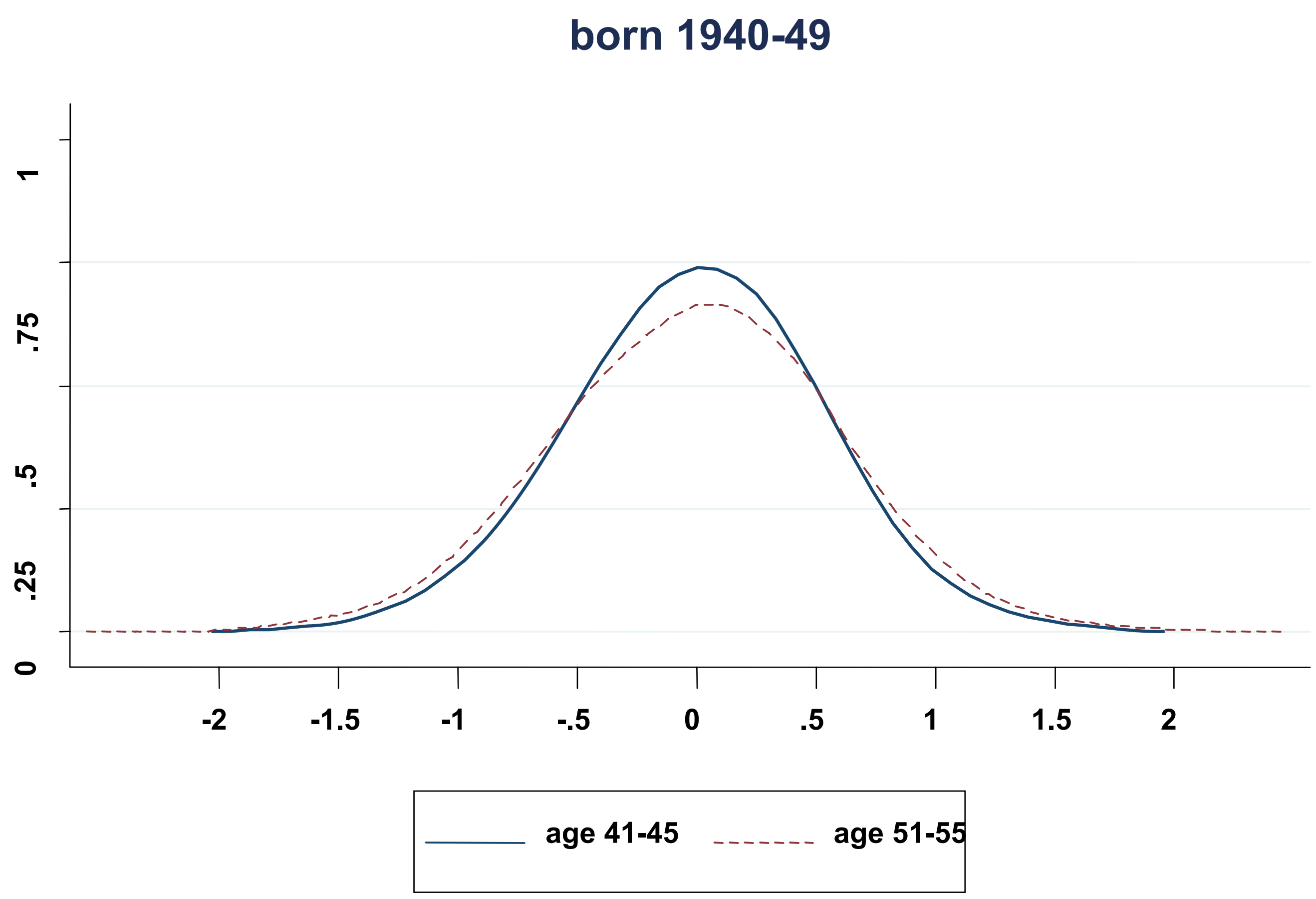
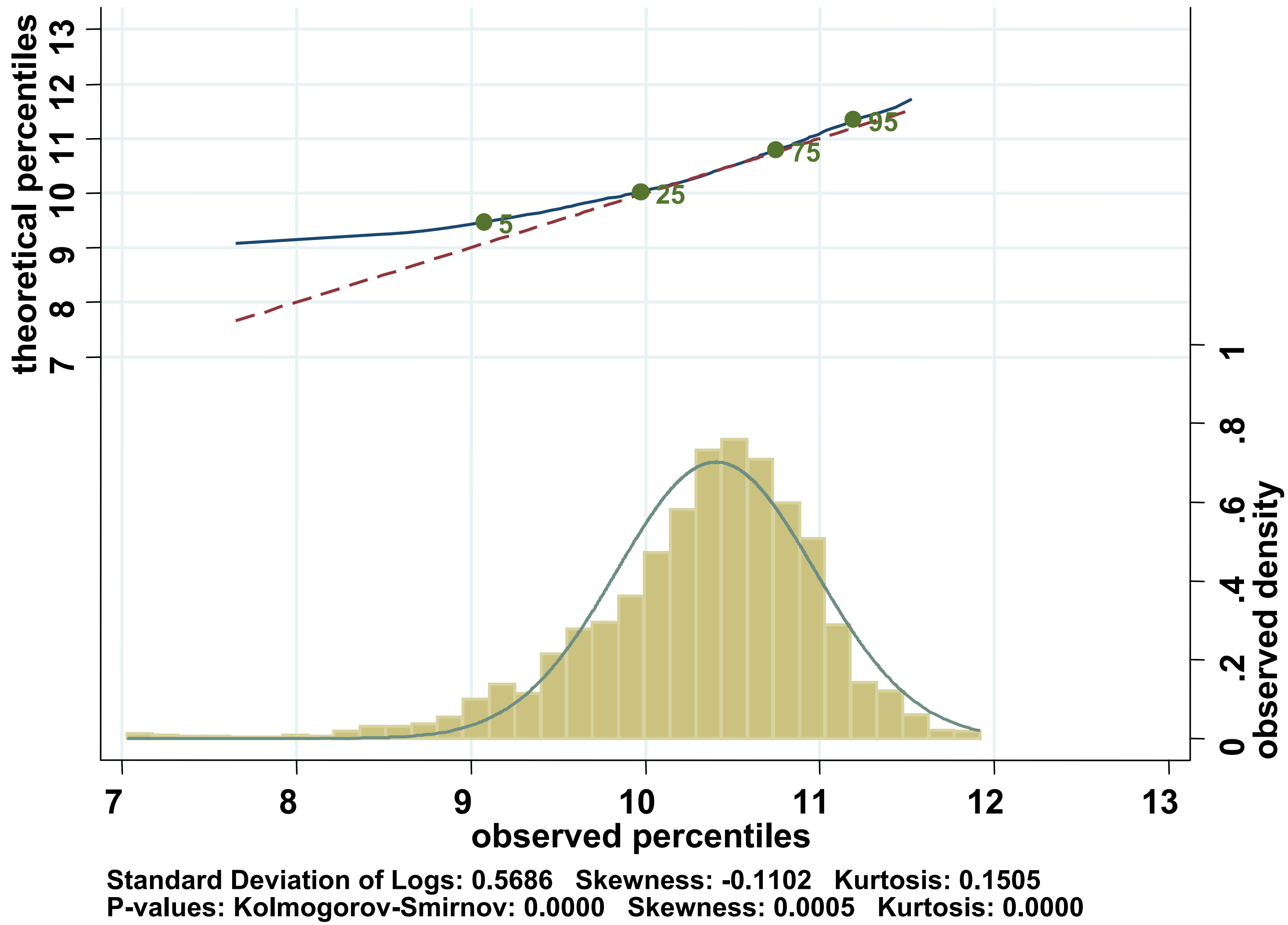


Figure 2c: The distribution of log income



US CEX COHORT 1950-59 Age 31-35

Source: Battistin, Blundell and Lewbel (2005)

Figure 4a: Cohort Income Inequality in the US by Cohort

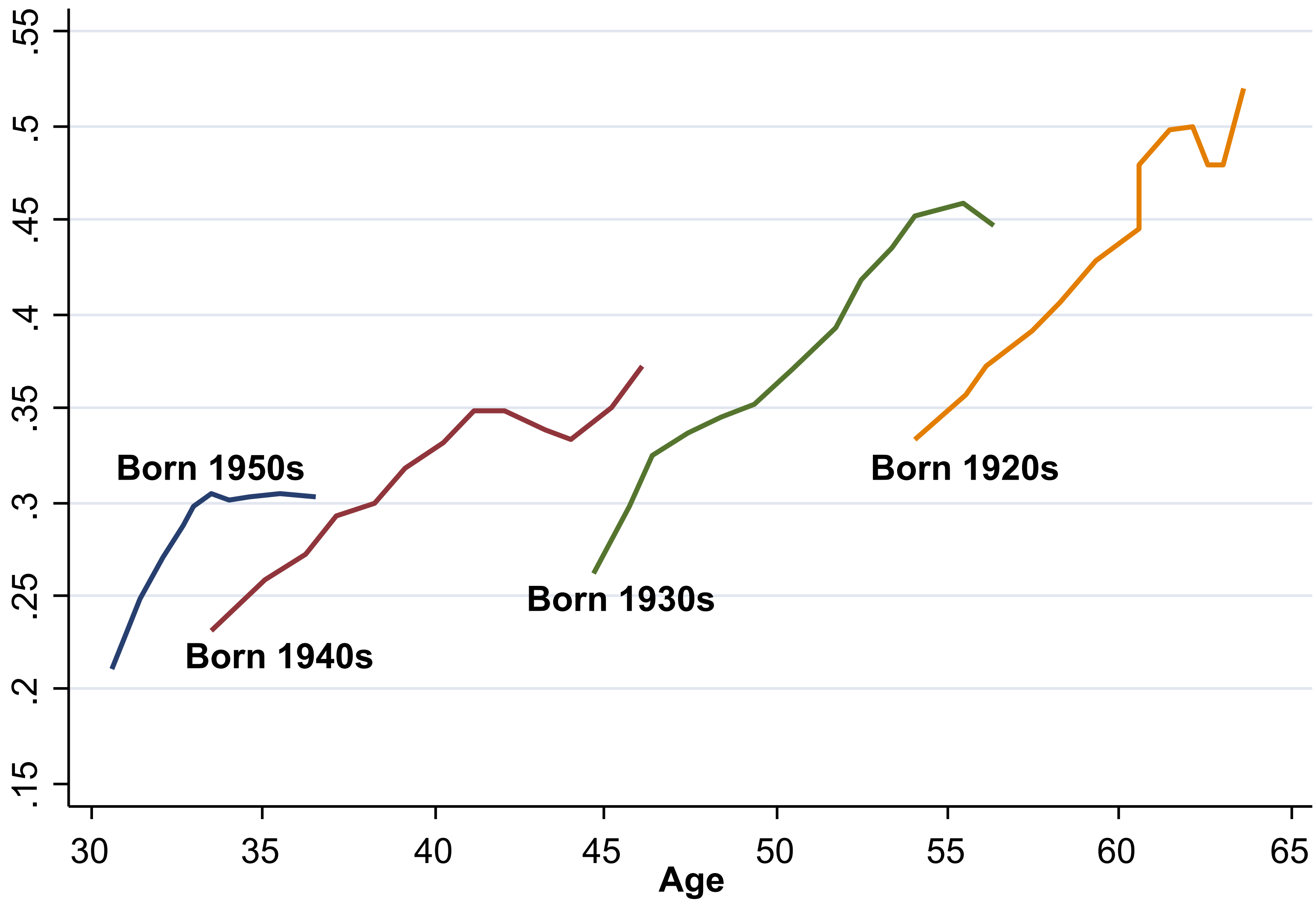


Figure 4a: Cohort Income Inequality in the US by Cohort

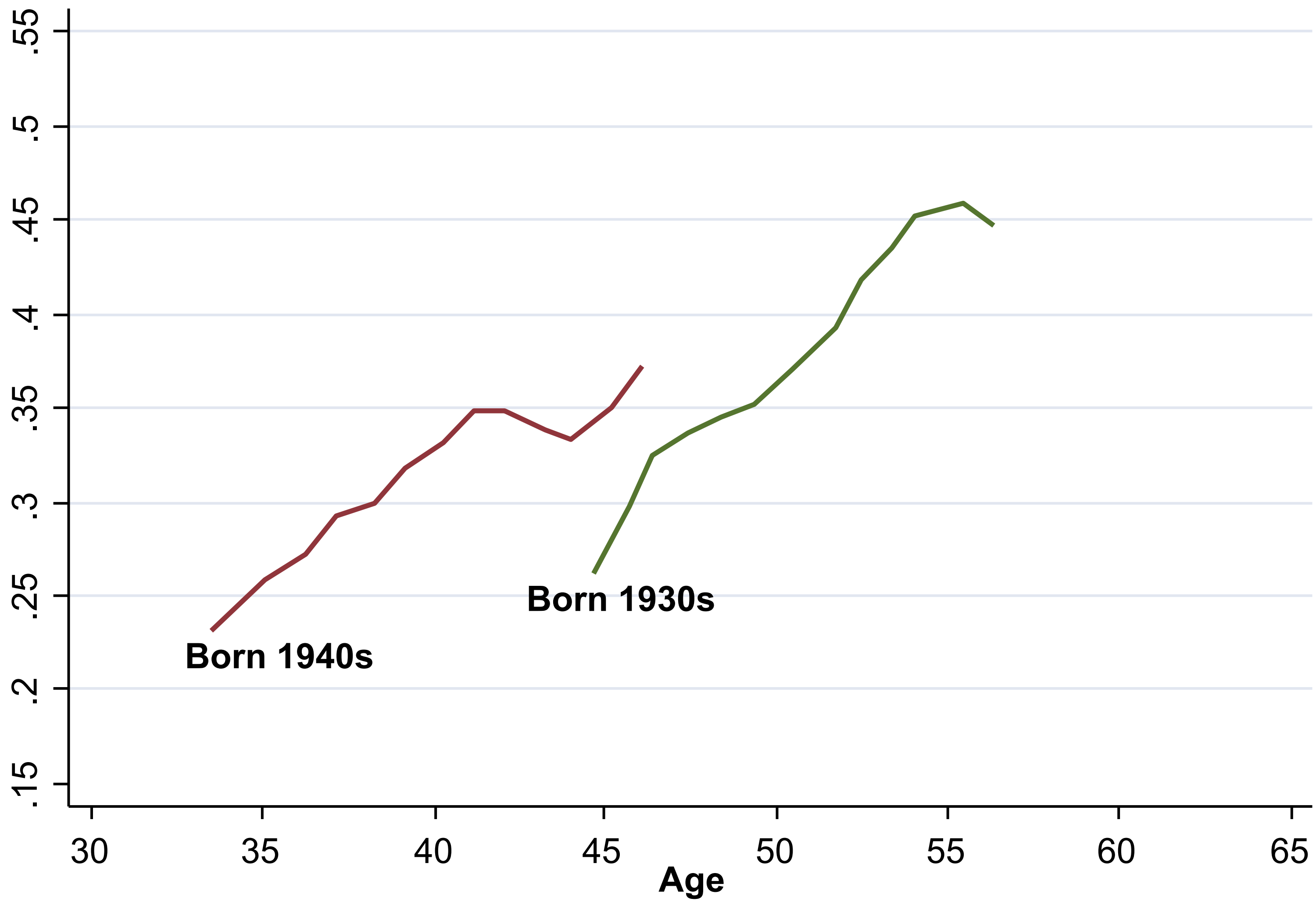
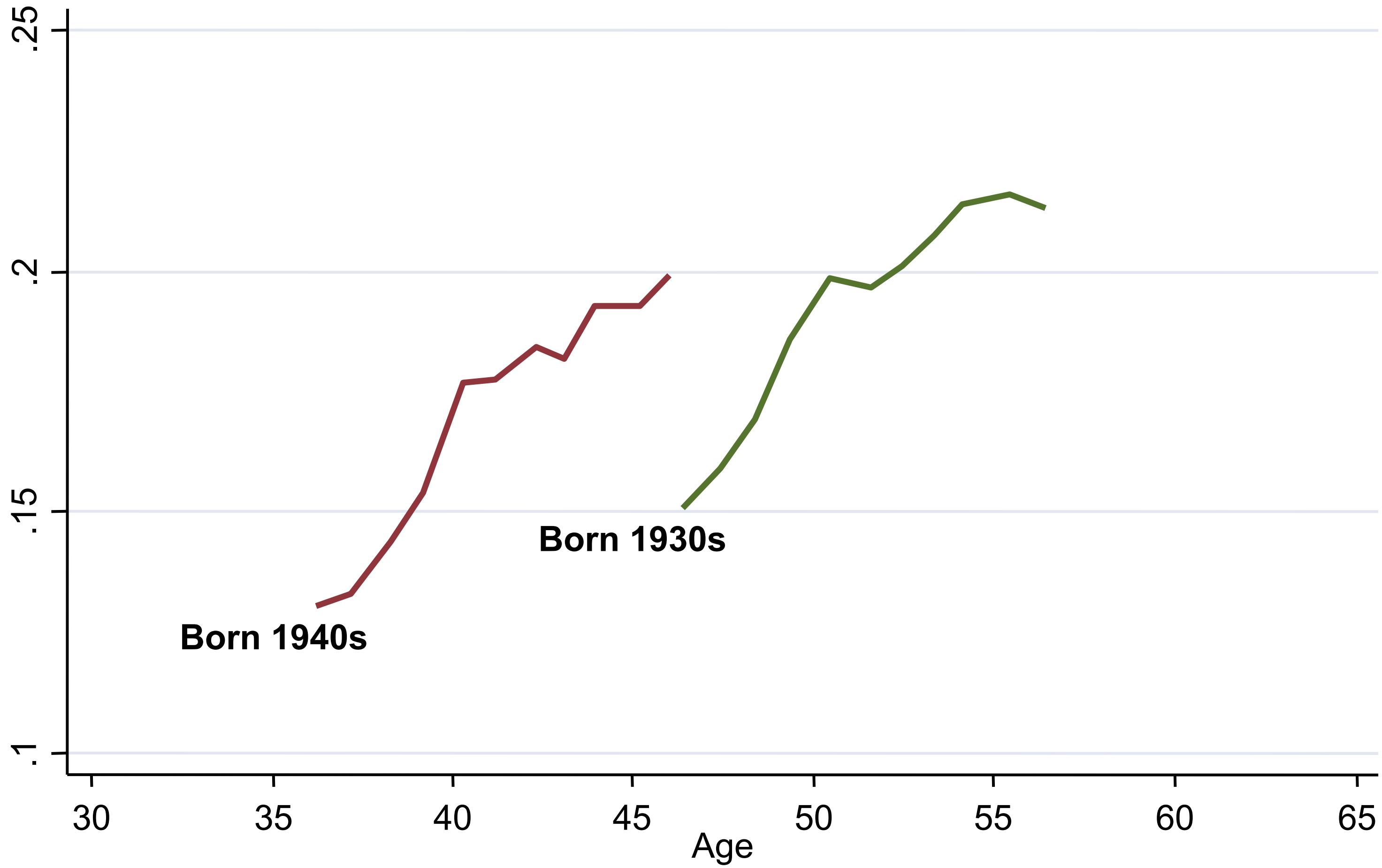
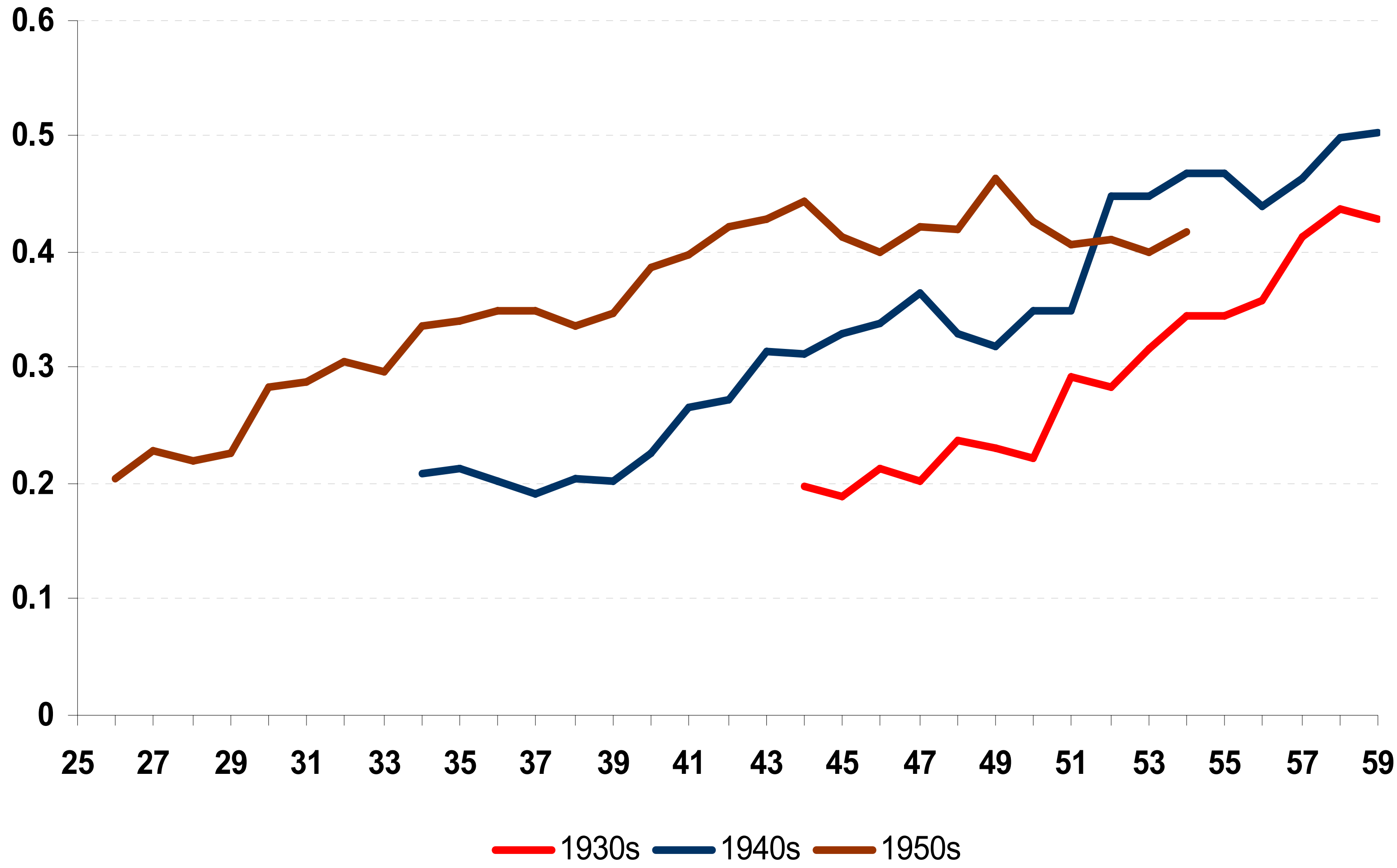


Figure 4b: Cohort Consumption Inequality in the US by Cohort



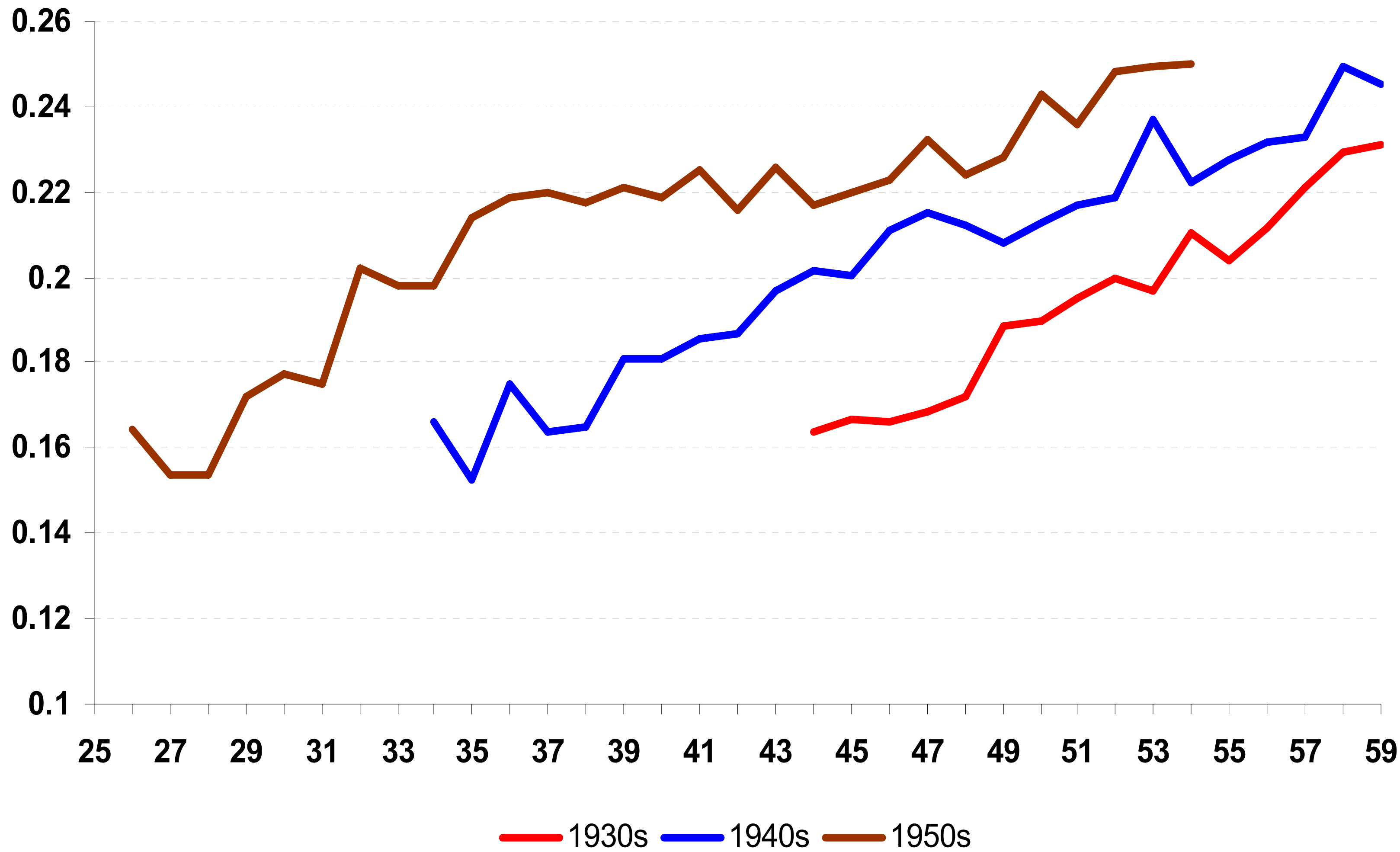
Source: Blundell, Pistaferri and Preston (2005)
Variance of log equivalised, PSID

Figure 4c: Cohort Labour Income Inequality in the UK



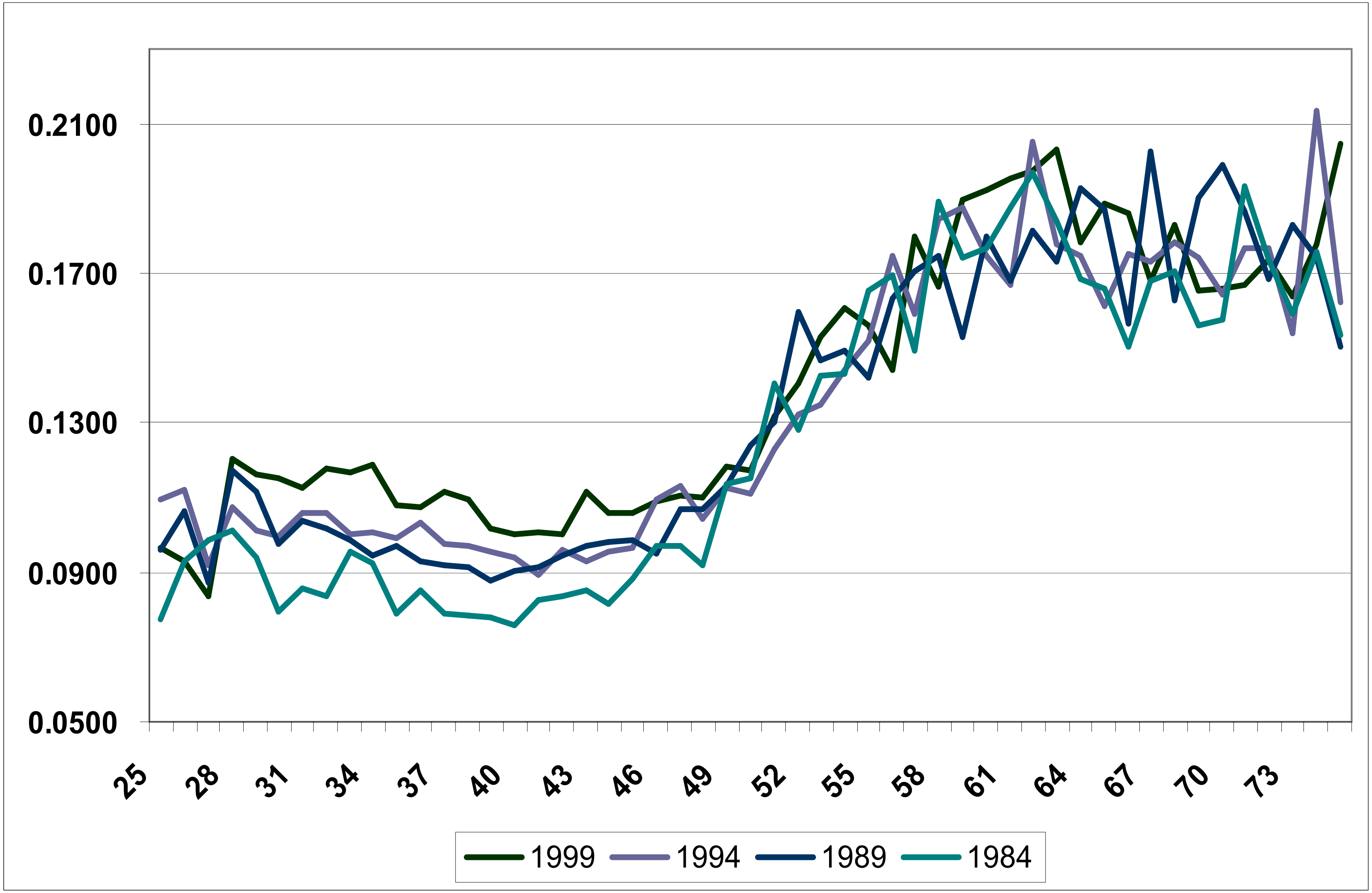
(variance of log equivalised)

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.

$$\ln Y_{i,a,t} = Z_{i,a,t}{}'\lambda + B_{i,a,t}{}' f_i + y^P_{i,a,t} + y^T_{i,a,t}$$
$$y^P_{i,a,t} = \rho y^P_{i,a-1,t-1} + \zeta_{i,a,t}$$

- where y^P is a persistent process of labour income shocks which adds to the individual-specific trend (by age and time) $B_{iat} f_i$ 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:

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

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

- permanent component following a martingale process
- and a transitory or mean-reverting component $y^T = v$

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

- implies a simple structure for the autocovariance of $\Delta y \equiv lnY - Z'\lambda$
- How well does it work?

Table IIIa: The Auto-Covariance Structure of Income

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

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

Table IIIa: The Auto-Covariance Structure of Income

Test $\mathrm{cov}(\Delta y_{t+1}, \Delta y_t) = 0$ for all t:	p-value 0.0048
Test $\mathrm{cov}(\Delta y_{t+2}, \Delta y_t) = 0$ for all t:	p-value 0.0125
Test $\mathrm{cov}(\Delta y_{t+3}, \Delta y_t) = 0$ for all t:	p-value 0.6507
Test $\mathrm{cov}(\Delta y_{t+4}, \Delta y_t) = 0$ 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

- PSID 1968-1996: (main sample 1978-1992)
  - Construct all the possible panels of $5 \leq$ length ≤ 15 years
  - Sample selection: male head aged 30-59, no SEO/Latino subsamples
- CEX 1980-1998: (main sample 1980-1992)
  - 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

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

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)

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

  - 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, α<1

- Self-insurance is driven by the transmission parameter π, 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

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

Partial insurance coefficient w.r.t. *permanent* shocks, 0≤ϕ ≤1

Excess sensitivity coefficient w.r.t. *transitory* shocks, 0≤ψ≤1

- In this notation, the transmission parameters $\boldsymbol{\varphi}$ and ψ subsume π and α 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

$$\mathrm{var}(\Delta y_{it}) = \mathrm{var}(\zeta_{it}) + \mathrm{var}(\Delta\varepsilon_{it})$$

$$\mathrm{cov}(\Delta y_{it}, \Delta y_{it+1}) = -\mathrm{var}(\varepsilon_{it})$$

$$\mathrm{var}(\Delta c_{it}) = \phi_t^2\,\mathrm{var}(\zeta_{it}) + \psi_t^2\,\mathrm{var}(\varepsilon_{it}) + \mathrm{var}(\xi_{it}) + \mathrm{var}(u_{it}^{\ c})$$

$$\mathrm{cov}(\Delta c_{it}, \Delta c_{it+1}) = -\mathrm{var}(u_{it}^{\ c})$$

$$\mathrm{cov}(\Delta c_{it}, \Delta y_{it}) = \phi_t\,\mathrm{var}(\zeta_{it}) + \psi_t\,\mathrm{var}(\varepsilon_{it})$$

$$\mathrm{cov}(\Delta c_{it}, \Delta y_{it+1}) = -\psi_t\,\mathrm{var}(\varepsilon_{it})$$

- 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…

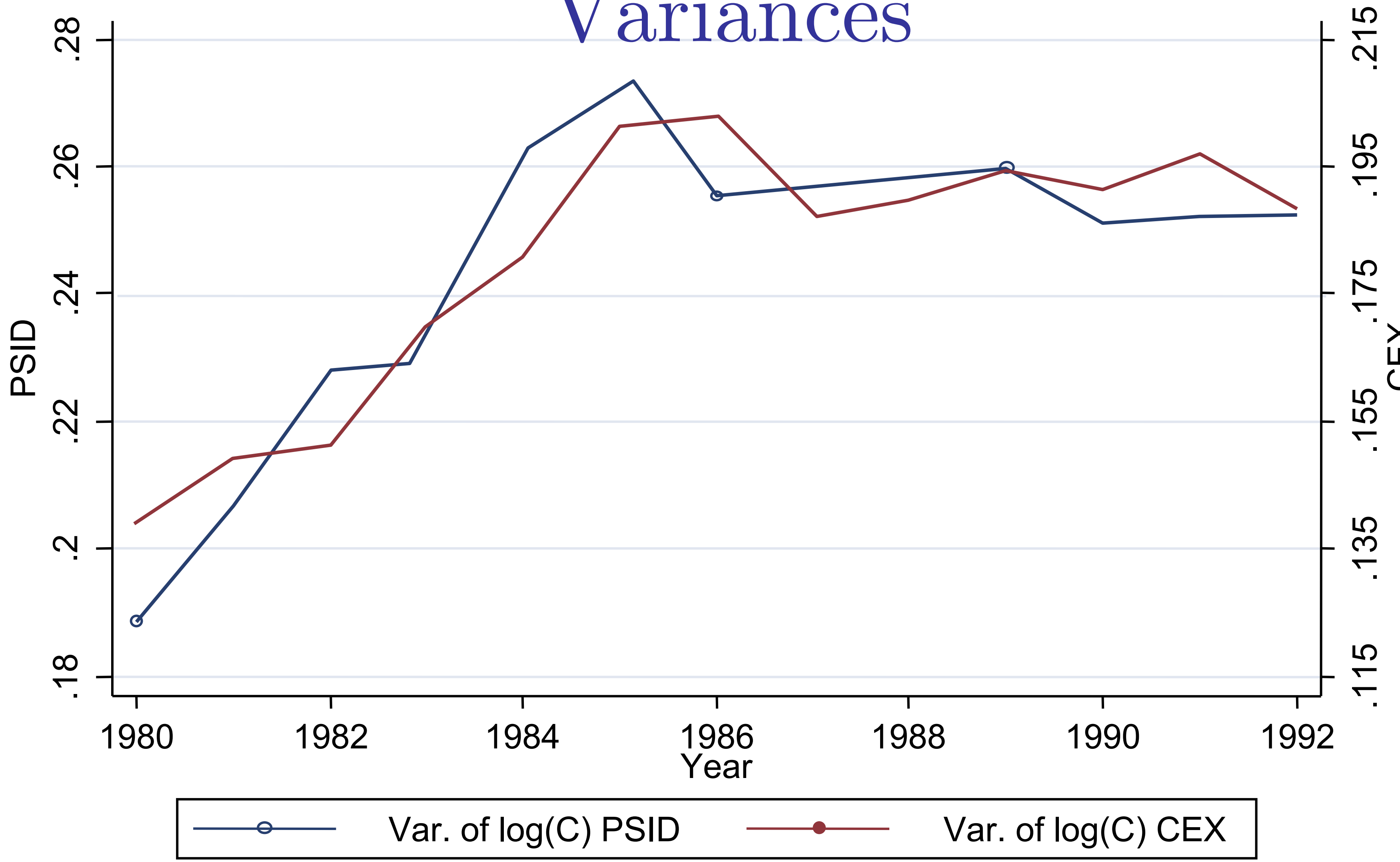
Panel Data

- 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



Source: Blundell, Pistaferri and Preston (2004)

Figure 7 Results: Variance of permanent shocks

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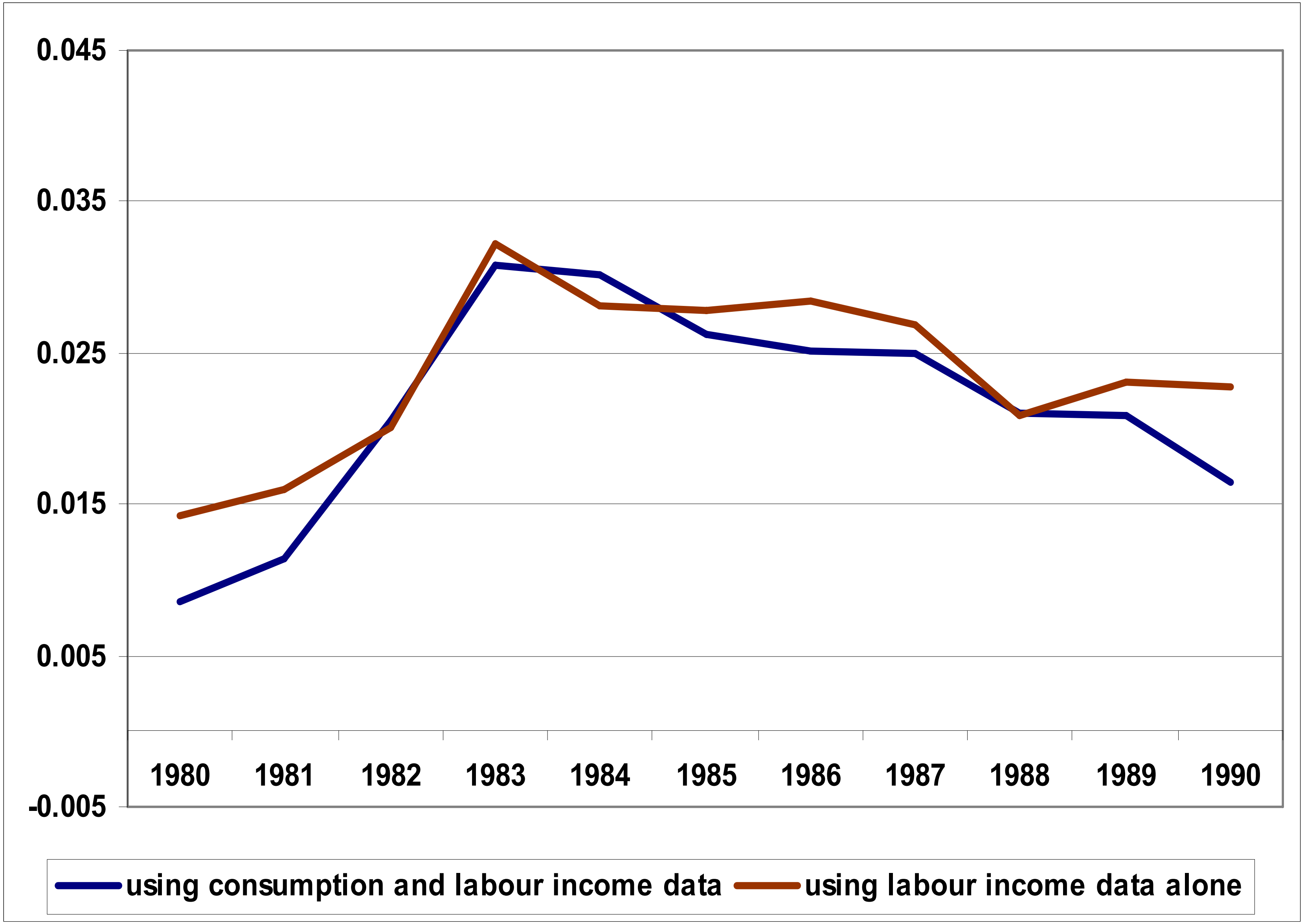

Figure 8 Results: Variance of transitory shocks

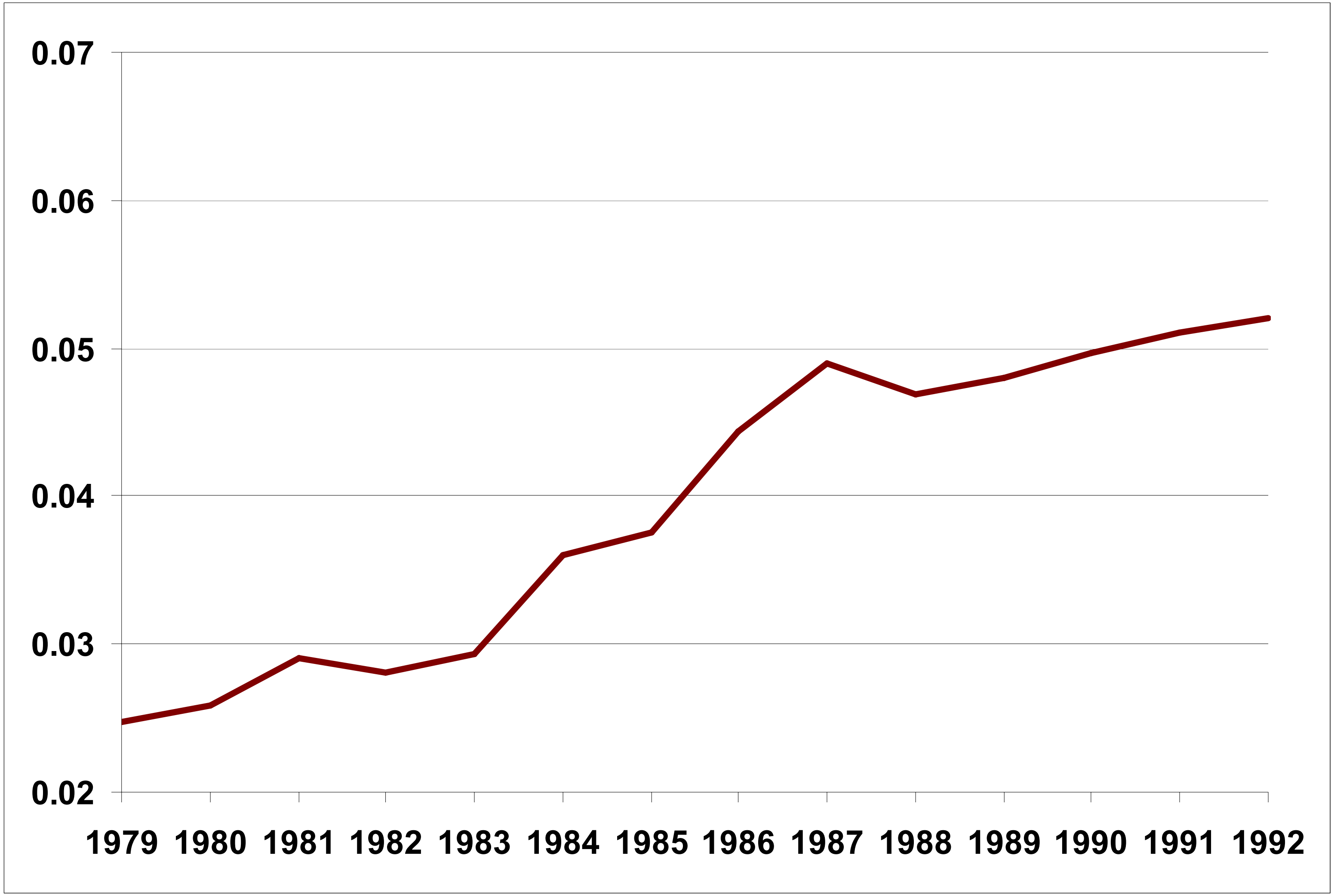

Table VI Results: College and Cohort Decomposition

	Whole sample	George W. Bush cohort (born 1940s)	Donald Rumsfeld cohort (born 1930s)	Low educ.	High educ.
Var. measur. error	0.0632 (0.0032)	0.0582 (0.0049)	0.0609 (0.0061)	0.0753 (0.0055)	0.0501 (0.0032)
Var. preference shocks	0.0122 (0.0038)	0.0151 (0.0064)	0.0164 (0.0073)	0.0117 (0.0067)	0.0156 (0.0042)
Transmission Coeff. perm. shock (ϕ)	0.6167 (0.1118)	0.7445 (0.2124)	0.5626 (0.2535)	0.8211 (0.2232)	0.3262 (0.0867)
Transmission Coeff. trans. shock (ψ)	0.0550 (0.0358)	0.0845 (0.0657)	0.0215 (0.0592)	0.0969 (0.0517)	0.0437 (0.0513)
P-value test equal ϕ	33%	16%	45%	81%	22%
P-value test equal ψ	58%	43%	14%	46%	14%

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:

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

- Household decisions, baseline model:

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

with $\sigma \equiv \mathrm{U'/CU''} < 0$, $\rho \equiv V'/\mathrm{hV''} > 0$

Family Labour Supply

- The key panel data moments become:

$$Var(\Delta c_t) \simeq \beta^2\sigma^2 s^2 Var(\xi_{1t}) + \beta^2\sigma^2(1+\rho)^2(1-s)^2 Var(\xi_{2t})$$
$$+2\beta^2\sigma^2(1+\rho)s(1-s)Cov(\xi_{1t}\xi_{2t})$$
$$Var(\Delta y_{1t}) \simeq Var(\xi_{1t}) + Var(\Delta v_{1t})$$
$$Var(\Delta y_{2t}) \simeq (1+\rho)^2 Var(v_{2t}) + \beta^2\rho^2 s^2 Var(\xi_{1t}) + \beta^2\sigma^2(1+\rho)^2 Var(\xi_{2t})$$
$$+2\beta^2\sigma(1+\rho)sCov(\xi_{1t}\xi_{2t})$$
$$Var(\Delta w_{1t}) \simeq Var(\xi_{2t}) + Var(\Delta v_{2t})$$

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

Table VII Results: Transfers and Family labor supply

Transmission Coefficients	Baseline	Couples earnings	Male earnings
Permanent Shock ϕ	0.6167 (0.1118)	0.4668 (0.0977)	0.2902 (0.0611)
Transitory Shock Ψ	0.0550 (0.0358)	0.0574 (0.0286)	0.0436 (0.0291)

Table VIIIb Results: Low Wealth Households

Transmission Coefficients	Baseline	Low wealth sample Net Labour Income	Low wealth sample Couples earnings	Low wealth sample Male earnings
Permanent Shock ϕ	0.6167 (0.1118)	0.9589 (0.2196)	0.5505 (0.2411)	0.3665 (0.0954)
Transitory Shock Ψ	0.0550 (0.0358)	0.2800 (0.0696)	0.2199 (0.0658)	0.1709 (0.0378)

Table VIIIc Results: Wealth and Durables

Transmission Coefficients	Low wealth sample	Low wealth sample, including durables
Permanent Shock ϕ	0.9589 (0.2196)	0.9300 (0.3131)
Transitory Shock Ψ	0.2800 (0.0696)	0.4259 (0.1153)

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