Has Consumption Inequality Mirrored Income Inequality?

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Aguiar and Bils 2015: research question

**Are income (before/after tax and transfer)
and consumption spending inequality rising jointly?**

- Many papers on evolution of US income and consumption
- One view: consumption inequality less pronounced
  - prominent example: Krueger and Perri, 2006 (use CE data)

- However, the empirical evidence remains disputed
  - CE data inconsistent with NIPA [Parker et al, 2009]
  - mis-measurement of CE data [Attanasio et al, 2007]
  - PSID points at rising consumption inequality [Attanasio et al, 2012]

Aguiar and Bils 2015: contribution and structure

- AB find that income and consumption inequality increase jointly

- Their paper
  1. provides strong support for measurement errors in CE data
  2. estimates consumption inequality instead of taking CE at face value
  3. checks the robustness of the estimation procedure

- It remains mute on consumption inequality with respect to its
  - sources (labor and capital earnings distribution, transfers, etc.)
  - nature (transitory or permanent)

The Consumer Expenditure Survey: description and content

- ▶ survey with emphasis on household consumption expenditures
- ▶ annual waves starting in 1980 (in AB: up to 2010)
- ▶ more than 5,000 households in most waves
- ▶ repeated cross-section (not panel)
- ▶ weights to aggregate CE households into US population
- ▶ expenditure on hundreds of items (AB sort in 20 groups)
- ▶ four interviews per wave
    - ▶ consumption spending for quarters (reported at end of quarter)
    - ▶ earnings, income and taxes for year (reported at end of 4th quarter)

- ▶ AB create five income groups:
  5-20; 20-40; 40-60; 60-80; 80-95 percentiles of before-tax income
- ▶ AB's inequality measure = mean of top/mean of bottom groups

  Inequality in the CE

The CE data: inconsistencies

- External inconsistency
  - CE 'implied savings' = 1 - mean consumption/mean after-tax income
  - at odds with personal savings rate from Flow of Funds (and NIPA)
- Internal inconsistency
  - CE 'savings rate' = mean of reported savings/mean after tax income
  - at odds with implied savings constructed from CE as shown above

  `Two inconsistencies in one graph`

★ To sum up
  - CE inconsistencies point to systematic trends in measurement errors
  - consumption inequality measures based on raw CE data 'problematic'
    → AB provide estimate which accounts for measurement error

Econometric approach: intuition, notation and assumptions

- ▶ Intuition `Engel's Law`
- ▶ Notation
  - ▶ Households: $h = 1, ..., H$
  - ▶ Income groups: $i = 1, ..., I = 5$
  - ▶ Goods: $j = 1, ..., J = 20$
  - ▶ Years: $t \in [1980 - 2010]$
  - ▶ Observed spending on good j by household h in year t: x_{hjt}
  - ▶ Total spending by household h in t: X_{ht}
- ▶ Assume household expenditures are measured with errors

$$x_{hjt} = x_{hjt}^* e^{\psi_t^j + \phi_t^i + \nu_{hjt}} \tag{1}$$

  - ▶ ψ_t^j for good j in year t *across households*
  - ▶ ϕ_t^i for income group i year t *across goods*
  - ▶ ν_{hjt} for good j in year t of household h
    - ▶ WLOG: Normalize $\bar{\nu}_{jt} = 0 \ \forall t$
    - ▶ Identifying assumption: ν_{hjt} is classical measurement error

1. Estimate total expenditure elasticities for each good

- ▶ Approximate log-linear Engel curves by first order expansion
- ▶ Assume true spending given as

$$\ln x_{hjt}^* - \ln \overline{x}_{jt}^* = \alpha_{jt}^* + \beta_j \ln X_{ht}^* + \Gamma_j Z_h + \varphi_{hjt} \qquad (2)$$

with
  - ▶ $\overline{x}_{jt}^*$: average spending on j in t across households
  - ▶ α_{jt}^*: expansion point of av. total spending ('good-time intercept')
  - ▶ β_j: spending elasticities (assumed variant wrt to goods only)
  - ▶ Z_h: vector of demographic dummies (age, no of earners, hh size)
  - ▶ φ_{hjt}: idiosyncratic relative taste shocks and approximation error
- ▶ Note
  - ▶ α_{jt}^* captures demand changes due to relative prices movements
  - ▶ β_j rules out changes in elasticities due to relative prices changes

1. Estimation with CE observables

▶ Estimate (2) with 1994-1996 CE data (midpoint of AB sample)

$$\ln x_{hjt} - \ln \overline{x}_{jt} = \alpha_{jt} + \beta_j \ln X_{ht} + \Gamma_j Z_h + \phi_t^i + \nu_{hjt} + \varphi_{hjt}$$
$$= \alpha_{jt} + \beta_j \ln X_{ht} + \Gamma_j Z_h + u_{hjt} \qquad (3)$$

▶ (Note: ψ_t^j drops out bc of mean spending on lhs)

▶ What if ...
  ▶ spending on j is 0? $\rightarrow$ use % deviation from av. spending on lhs
  ▶ measurement error in residual and total spending correlated?
    (goods measurement error ν carries into total spending X_{ht})

    'Standard technique': instrument total spending
      ▶ Total spending correlated with current income:
        Use income groups and after tax income (I)
      ▶ Recall: total spending in CE = sum of four separate interviews
        Use total spending of Q1+Q2 and lhs spending from Q3+Q4 (II)

    IVs do not account for systematic measurement (group or hh) error!
    $\rightarrow \hat{\beta}_j$ depends on consumption inequality reported in 1994-1996

1. Elasticity estimates across good groups

TABLE 2—ENGEL CURVES FROM 1994–1996 EXPENDITURE SURVEY

Good category	CE share 1994–1996	(I) Elasticity	SE	(II) Elasticity	SE
Housing	27.3	0.92	(0.02)	0.93	(0.02)
Food at home	11.7	0.37	(0.02)	0.47	(0.02)
Vehicle purchasing, leasing, insurance	13.2	1.02	(0.08)	0.72	(0.1)
All other transportation	7.4	0.89	(0.03)	0.91	(0.04)
Utilities	5.2	0.47	(0.02)	0.55	(0.02)
Health expenditures including insurance	5.0	0.91	(0.06)	1.11	(0.08)
Appliances, phones, computers with associated services	4.9	0.87	(0.04)	0.94	(0.05)
Food away from home	4.6	1.33	(0.06)	1.32	(0.07)
Entertainment equipment and subscription television	4.1	1.26	(0.07)	1.22	(0.08)
Men's and women's clothing	2.6	1.35	(0.05)	1.38	(0.06)
Entertainment fees, admissions, reading	2.2	1.74	(0.06)	1.65	(0.07)
Cash contributions (not for alimony/support)	2.2	1.81	(0.18)	1.26	(0.12)
Furniture and fixtures	1.5	1.39	(0.1)	1.55	(0.15)
Education	1.3	1.63	(0.18)	1.88	(0.23)
Shoes and other apparel	1.5	1.09	(0.09)	1.19	(0.11)
Domestic services and childcare	1.5	1.60	(0.13)	1.80	(0.13)
Tobacco, other smoking	1.0	−0.26	(0.09)	−0.05	(0.08)
Alcoholic beverages	1.0	1.14	(0.09)	1.14	(0.08)
Children's clothing (up to age 15)	1.0	0.67	(0.07)	0.83	(0.09)
Personal care	1.0	0.96	(0.05)	0.96	(0.05)

$\rightarrow$ identifies two goods with different elasticities (necessity and luxury)

2. Estimating consumption inequality over time

- ▶ Aim: spending ratios for different income groups i over time
- ▶ AB invert (2) and use results from estimating (3)

$$\hat{x}_{ijt} = (\ln x_{hjt} - \ln \overline{x}_{jt}) - \hat{\Gamma}_j Z_h$$

$$\hat{x}_{ijt} = \alpha_{jt} + \phi_t^i + \beta_j \ln X_{ht}^* + \nu_{hjt} + \varphi_{hjt} \quad [+\beta_j(\ln X_{it}^* - \ln X_{it}^*)]$$

$$\hat{x}_{ijt} = \alpha_{jt} + \phi_t^i + \beta_j \ln X_{it}^* + \varepsilon_{hjt} \qquad (4)$$

- ▶ Estimate (4) by regressing $\hat{x}_{ijt}$ on
    - ▶ good-time dummies $D_{j,t}$ (coefficients correspond to α_{jt})
    - ▶ income-time dummies $D_{i,t}$ (coefficients correspond to ϕ_t^i)
    - ▶ interaction $D_{i,t} \times \hat{\beta}_j$ (coefficients are $\ln X_{it}^*$ for each i)
      $\rightarrow$ AB's estimate for true consumption spending for each i and t
- ▶ with
    - ▶ spending normalized relative to $i = 1$ ($\delta_{it} = \ln X_{it}^* - \ln X_{1t}^*$)
    - ▶ α_{jt} allowed to vary each year, ϕ_t^i and δ_{it} restricted for 3 year windows

2. More on identification

- "Identification comes from the fact that if the total expenditure of group i increases relative to that of group i', that increase will fall disproportionately on luxuries."

- Expressed as formal identification assumption:
    - Idiosyncratic measurement errors and preferences shocks are not related to spending elasticities across goods:
      $(\nu_{hjt}, \varphi_{hjt}) \perp \beta_j$ has to hold within each income group
    - This implies ε_{hjt} is independent of $D_{i,t} \times \hat{\beta}_j$
    - (Changing systematic errors ψ_t^j, ϕ_t^i captured by dummies $D_{j,t}, D_{i,t}$)

- Strengths and weaknesses:
    - $\varphi_{hjt} \perp \beta_j$: AB use different years to estimate $\hat{\beta}_j$ and equation (4)
    - $\nu_{hjt} \perp \beta_j$: More problematic under two scenarios
        1. Relative price changes cause shift in spending on good j
   2. Mis-reporting after increase in permanent income

2. Potential identification failures

1. Relative price changes cause shift in spending on good j
   - If independent of i: addressed by α_{jt} (picks up the average effect)
   - If dependent on i:
     - correlation of rel. price changes and $\hat{\beta}_j$ is small and not significant
     - including hh fixed effects with $D_{j,t}$ does not change results

2. Mis-reporting after increase in permanent income:
   - rich become richer and under-report spending towards luxuries
     $\rightarrow$ inequality will be understated (i.e. biased)
   - reverse is true when
     - rich under-report necessities relative to luxuries
     - poor over-report necessities relative to luxuries

   This potential failure cannot be addressed by AB... how serious is it?

Results: Evolution of spending ratios across income groups
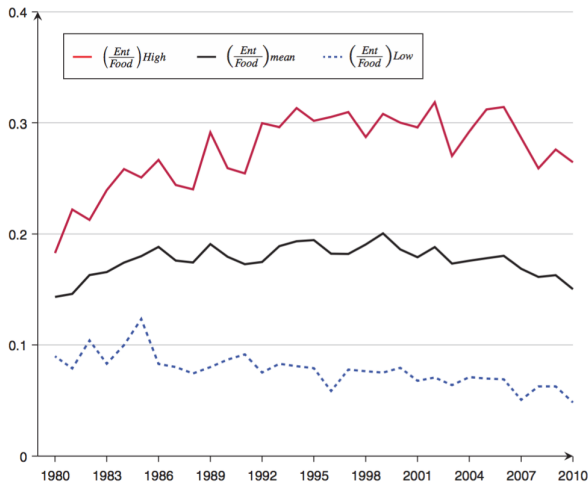
Change in ratios from 1980 to 2010

- ▶ +0.06 for high income hh
- ▶ -0.03 for low income hh

Results: Based on our two good example

Using food and entertainment

- ► For high income hh:
  - ► entertainment: + 48% relative to mean expenditure
  - ► food at home: + 4% relative to mean expenditure
    → + 32 ppts total expenditure of high hh relative to mean hh
- ► For low income hh:
  - ► entertainment: − 16 % relative to mean expenditure
  - ► food at home: + 4% relative to mean expenditure
    → − 15 ppts total expenditure of low hh relative to mean hh

- ► Contains noise from idiosyncratic shocks at the income-good level
  → need to use all goods

Results: Using all goods and different configurations

The results of estimating (4)

	(1)	(2)	(3)	(4)	(5)
log inequality, 1980–1982	0.85	0.90	0.82	0.71	0.91
	(0.07)	(0.06)	(0.08)	(0.05)	(0.06)
log change, 1980–1982/1991–1993	0.27	0.17	0.20	0.27	0.15
	(0.08)	(0.06)	(0.07)	(0.06)	(0.07)
log change, 1980–1982/2005–2007	0.48	0.35	0.43	0.46	0.30
	(0.08)	(0.07)	(0.08)	(0.06)	(0.07)
log change, 2005–2007/2008–2010	−0.06	−0.04	−0.05	−0.05	−0.04
	(0.08)	(0.06)	(0.08)	(0.06)	(0.06)
Categories included	All	All	All	Without durables	Without tobacco
Specification	OLS	WLS	WLS	WLS	WLS
First-stage instrument	Income	Income	Lagged expenditure	Income	Income

Results: Using all goods and different configurations

The results of estimating (4)

	(1)
log inequality, 1980–1982	0.85
	(0.07)
log change, 1980–1982/1991–1993	0.27
	(0.08)
log change, 1980–1982/2005–2007	0.48
	(0.08)
log change, 2005–2007/2008–2010	−0.06
	(0.08)
Categories included	All
Specification	OLS
First-stage instrument	Income

Rise in consumption inequality btw low and high income hhs from 1980
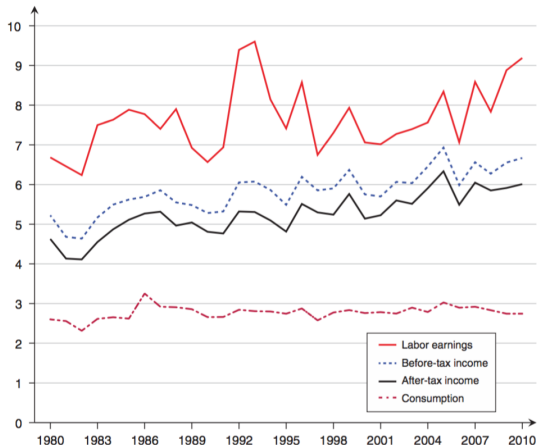
- to 1993: + 27%
- to 2010: + 42.5%

These findings are contrasting the 'naive' results shown earlier

Robustness

- Log linear Engel Curves? ✓
- Time-invariant elasticities? ✓
- Different periods to estimate the elasticities? ✓
- Different weights to different goods? ✓
- Use elasticities estimated with different instruments? ✓

Thanks

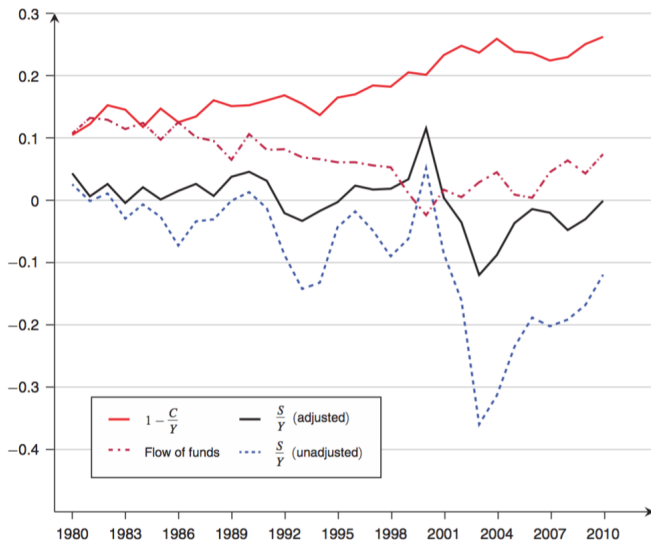# The CE data: ratio of mean of top/bottom income groups

- From 1980 to 2007
  - +21% Labor earnings
  - +30% Before-tax income (includes transfers)
  - +33% After-tax income
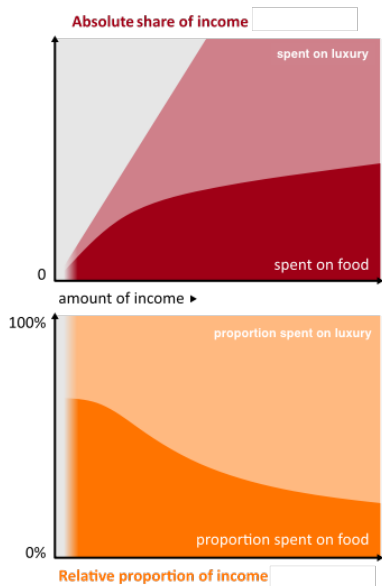 - +17% Consumption spending
    → supports the Krueger and Perri view

The CE data: something does not fit...

('Adjusted' corrects for potential mis-reporting of new mortgages)

AB's method: The idea and procedure in a nutshell

Absolute share of income

spent on luxury

spent on food

0   amount of income ▶

100%

proportion spent on luxury

proportion spent on food

0%   Relative proportion of income

Idea

▶ If consumption inequality rises over time, high income hh shift consumption much more towards luxury than low income hh

▶ Since food and luxury have different spending elasticities, their spending ratio identifies hh total consumption spending

▶ This ratio measures consumption inequality across income groups robust to measurement error in total hh consumption spending as well as hh and good specific multiplicative errors

Procedure

1. Identify goods with different elasticities
2. Use the evolution of their spending ratio to estimate consumption spending inequality across different income groups