

Course Goals

1. Help you get started writing your second year paper and job market paper.
2. Introduce you to macro literatures with a strong empirical component and the datasets used in these literatures.

Towards those goals:

- ▶ Problem sets
- ▶ Final Paper/Presentation

Notes on Heathcote et al. (2010):
"Unequal we stand: An empirical
analysis of economic inequality in
the United States, 1967-2006"

Research Questions

- ▶ How has cross-sectional inequality changed in the US over the last 4+ decades?
- ▶ How does our understanding of inequality depend on...
 - ▶ the income/consumption measure?
 - ▶ the measure of inequality (e.g. variance of log, gini coefficient)?
 - ▶ the data source?

Why are these questions important?

- ▶ Differences between income and consumption inequality are informative about interesting objects:
 - ▶ duration/persistence of random income shocks
 - ▶ effectiveness of insurance and public policy mechanisms available to households
- ▶ Many datasets, each with their own strengths and weaknesses.
 - ▶ Important to know whether the income measures line up.

Current Population Survey (CPS)

- ▶ Approx. 150K individuals per year.
- ▶ Monthly Sample
 - ▶ Individuals surveyed for 4 months, then 4 months a year later.
 - ▶ Employment, education, demographic and geographic variables.
 - ▶ 1976 to present.
- ▶ March Sample
 - ▶ Richer data on sources of income, work.
 - ▶ 1962 to present.
- ▶ Disadvantages: Weak panel dimension. Little info on consumption.

Panel Survey of Income Dynamics (PSID)

- ▶ Approx. 5-10K individuals, 1968 to the present.
 - ▶ Annual up to 1996; bi-annual beginning in 1999.
- ▶ Main advantages:
 - ▶ Can track individuals/families over time.
 - ▶ Income, asset holding, and demographic data.
- ▶ Disadvantages:
 - ▶ Not nationally representative (oversamples whites).
 - ▶ Little info on consumption, especially early on in the sample
 - ▶ Food and housing since '68
 - ▶ Education and health care since '99
 - ▶ Furnishing, clothing, recreation, transportation since '05

Consumption Expenditure Survey (CEX)

- ▶ Approx. 5K individuals.
- ▶ Two types: Weekly Diary Survey and Interview.
- ▶ Rich data on expenditures on different (approx. 700) categories of goods and services.
- ▶ Some data on sources of income, education, demographics.
- ▶ How to access:
 - ▶ 1980-present: ICPSR
 - ▶ 1996-present: BLS Website:
<https://www.bls.gov/cex/pumd.htm>
- ▶ Disadvantages: Much less geographic info. Missing a large, growing fraction of consumption expenditures.

Survey of Consumer Finances (SCF)

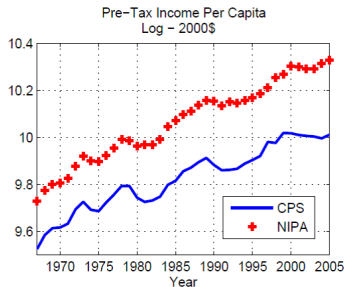
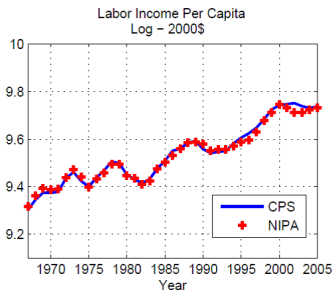
- ▶ Approx. 3-7K individuals; rich are oversampled
- ▶ 1980s to the present, every 3 years
- ▶ Rich data on labor income, loans, asset holdings, income from assets.
- ▶ Limited panel dimension (short panels in 1983-89 and 2007-09)

Basis of Comparison

How well do survey aggregates match up to those in the NIPA data?

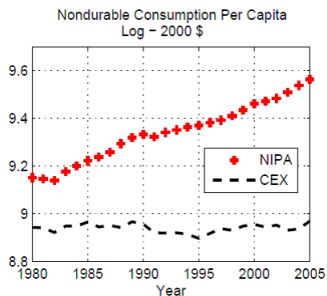
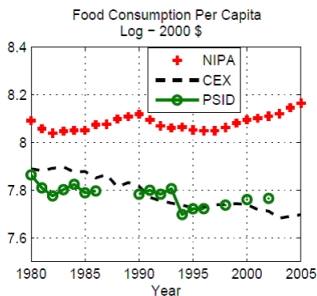
- ▶ National Income and Product Accounts (NIPA) are 7 sets of tables on
 - ▶ GDP and its components
 - ▶ personal income
 - ▶ government income and expenditures
 - ▶ foreign transactions
 - ▶ saving and investment
 - ▶ (labor and capital) income by industry.
 - ▶ etc...
- ▶ Many data sources: Census, BLS, IRS, Treasury Department, Dept. of Agriculture, Office of Management and Budget.
- ▶ Double entry; Adjustments seek consistency across tables.
- ▶ Only data on aggregates.

CPS and NIPA match up for labor income, not for pre-tax income



- ▶ CPS "misses" in-kind compensation (e.g., employer contributions to pension and health insurance funds).

Discrepancy between aggregate CEX consumption and NIPA consumption is big, increasing.



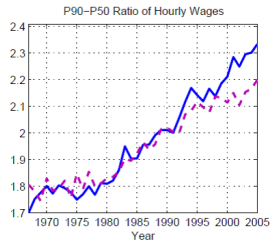
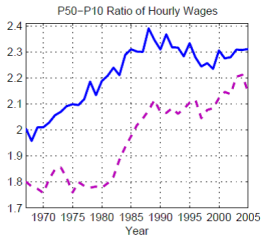
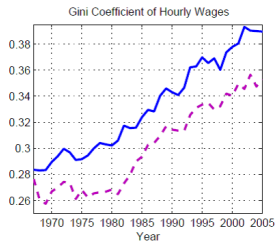
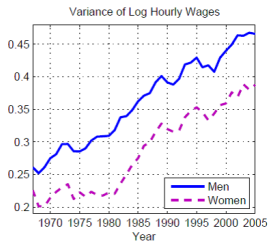
The household budget constraint

$$c + (a' - a) = w^m l^m + w^w l^w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$

- ▶ Several determinants of household consumption inequality:
 - ▶ individual labor supply
 - ▶ labor income pooling within the family
 - ▶ income from asset ownership
 - ▶ private transfers
 - ▶ government taxes and transfers
- ▶ The shares of income from these different income sources, and the correlations across income sources, shape consumption inequality.

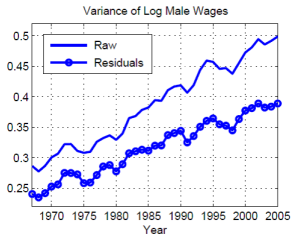
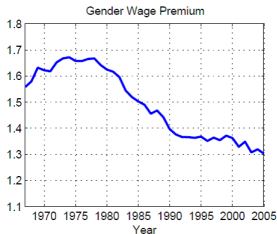
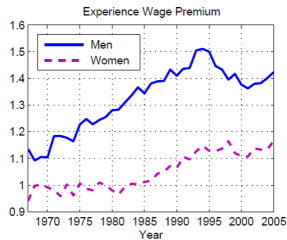
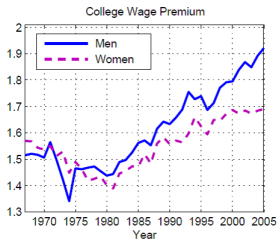
Inequality in hourly wages is increasing.

$$c + (a' - a) = w^m l^m + w^w l^w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$



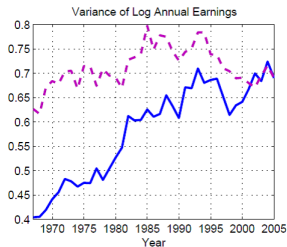
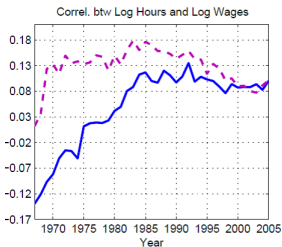
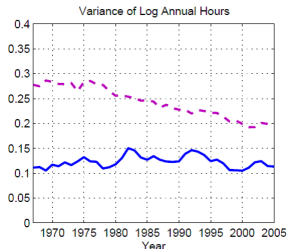
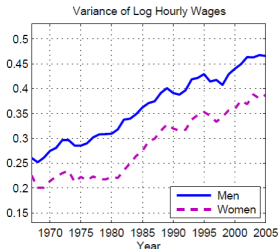
2/3 of the increase is from "residual" income inequality.

$$c + (a' - a) = w^m l^m + w^w l^w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$



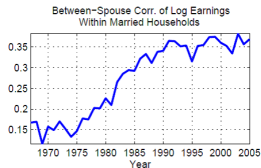
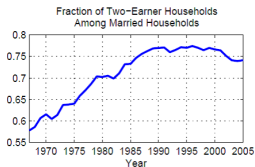
Inequality in labor earnings is increasing for men.

$$c + (a' - a) = w^m l^m + w^w l^w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$



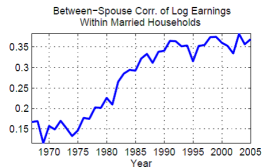
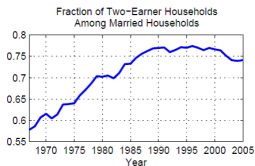
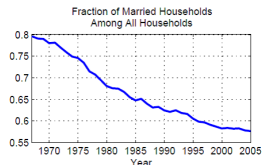
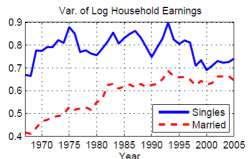
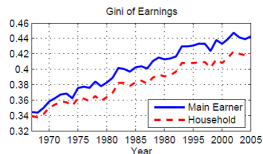
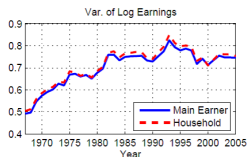
Inequality in household labor earnings is increasing.

$$c + (a' - a) = w^m / m + w^w / w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$



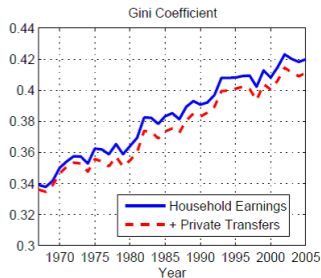
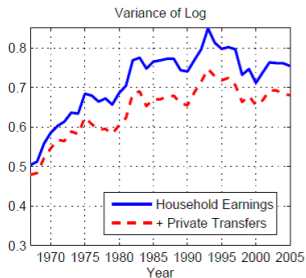
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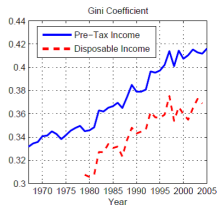
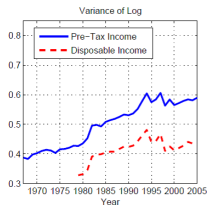
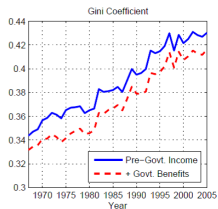
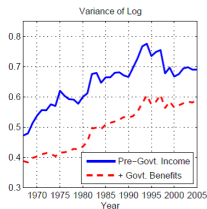
Inequality, when including asset income and private transfers, is lower

$$c + (a' - a) = w^m / m + w^w / w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$



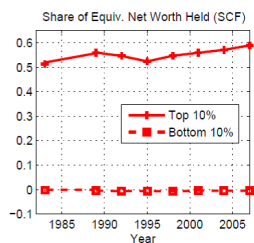
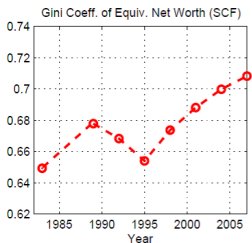
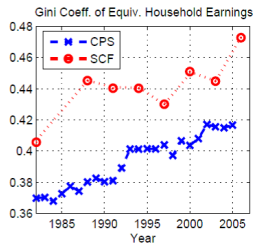
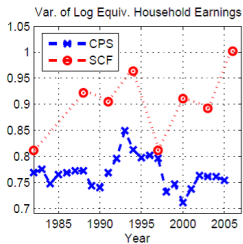
Inequality, when including taxes and government transfers, is even lower

$$c + (a' - a) = w^m / m + w^w / w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$



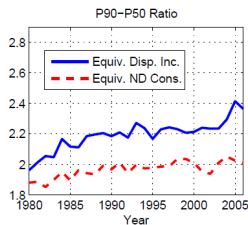
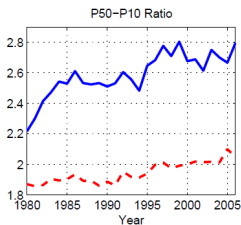
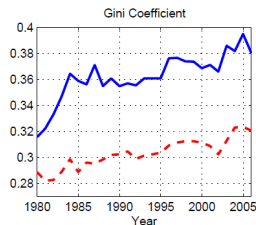
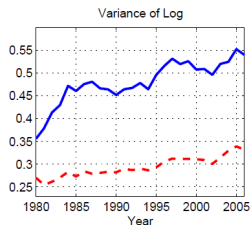
Inequality in wealth is increasing

$$c + (a' - a) = w^m / m + w^m / w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$



CEX: Inequality in expenditures is relatively flat.

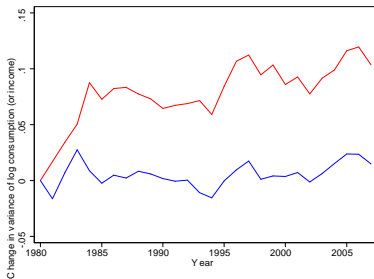
$$c + (a' - a) = w^m / m + w^w / w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$



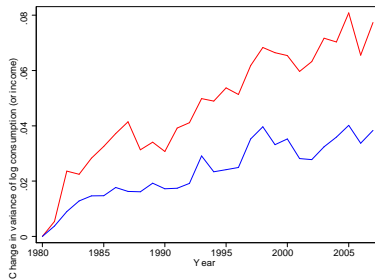
CEX: Between/within group changes in inequality

$$c + (a' - a) = w^m I^m + w^w I^w + y^{\text{Asset}} + t^{\text{Private}} + t^{\text{Govt.}}$$

Residual Variance



Between-Group Variance

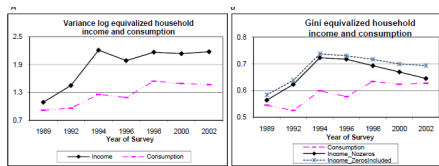
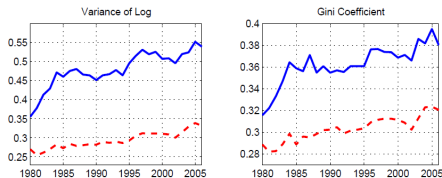
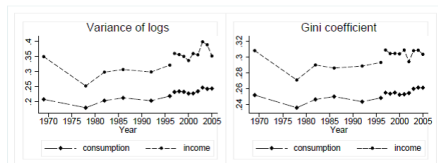


- ▶ Income inequality growth is largely *within* group.
- ▶ Consumption inequality growth is largely *between* group.
- ▶ Krueger and Perri (2006): These patterns are indicative of effective within-group insurance.

Summary

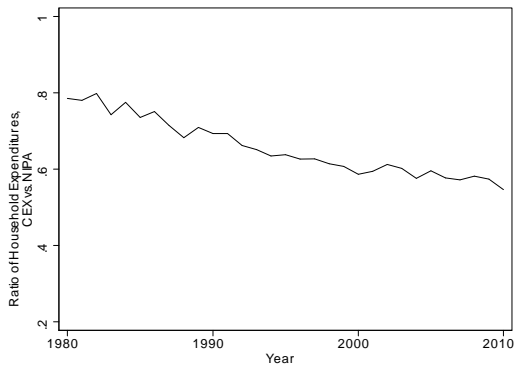
- ▶ Inequality is increasing
 - ▶ First half of the sample: both 50-10 inequality and 90-50 inequality
 - ▶ Second half of the sample: 90-50 inequality only
- ▶ According to the CEX, expenditure inequality increases only a little.
- ▶ Trends in earnings inequality are similar in the four datasets we looked at.
- ▶ Micro data aggregates (increasingly) miss some components of income and expenditures.
- ▶ Also part of the same issue of the *Review of Economic Dynamics*: Analysis of inequality in Canada, GB, Germany, Italy, Spain, Sweden, Russia, Mexico.

Mexican/Canadian consumption inequality is also increasing.



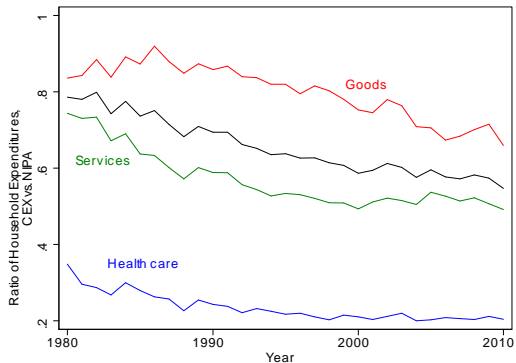
Aguiar and Bilts

Has Consumption Inequality Mirrored Income Inequality?



Aguiar and Bilal

Has Consumption Inequality Mirrored Income Inequality?

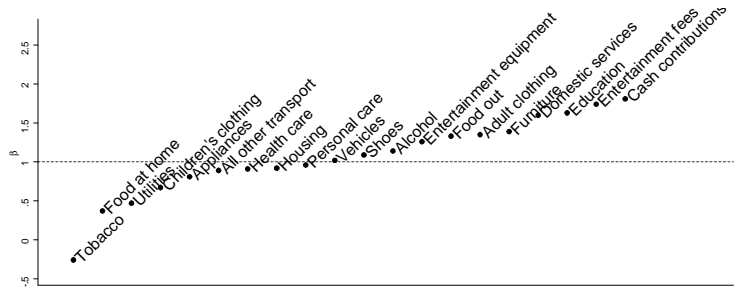


Aguiar and Bills

Has Consumption Inequality Mirrored Income Inequality?

- ▶ Hypothesis: Measurement error accounts for the "missing" increase in consumption inequality.
- ▶ Goal: Estimate "true" expenditures at time t for households with income i
 - ▶ Basic idea: Compare expenditures on income-elastic goods (entertainment, cash donations) to expenditures on inelastic goods (food at home, utilities) for groups of different income classes over time.
 - ▶ In the CEX, inequality in entertainment expenditures increases much faster than income on food at home expenditures.
- ▶ Main result: Consumption inequality tracks income inequality.

Income elasticities: β



Two main assumptions

1. Log-linear Engel curves:

$$\log x_{hjt}^* - \log \bar{x}_{jt}^* = \alpha_{jt}^* + \beta_j \log X_{ht}^* + \underbrace{\Gamma_j Z_h}_{\text{hh characteristics}} + \underbrace{\varphi_{hjt}}_{\text{taste shock}}$$

- ▶ Z_h = number of earners (<2, 2+); household size; age (25-37, 38-50, 51-64)

2. Household expenditures measurement error takes three components:

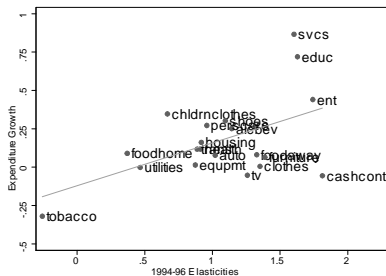
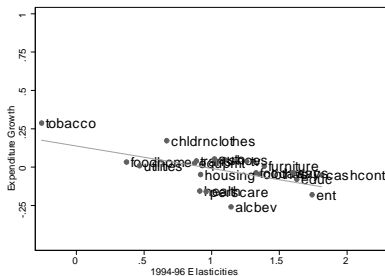
$$x_{hjt} = x_{hjt}^* e^{\zeta_{hjt}}, \text{ where}$$

$$\zeta_{hjt} = \psi_t^j + \phi_t^i + v_{hjt}$$

- ▶ ψ_t^j : good-specific measurement error
- ▶ ϕ_t^i : income-group-specific measurement error.
- ▶ Main assumption: v_{hjt} , φ_{hjt} are orthogonal to household characteristics or β_j .

Growth of expenditures for high and low income groups

$$\log x_{ijt} = \alpha_{jt} + \phi_t^i + \log X_{it}^* \beta_j + \epsilon_{ijt}$$



- ▶ Left: $\log \left(\frac{X_{\text{Poor},j,2007}}{X_{\text{Poor},j,1980}} \right) = \Delta \alpha_{j,2007-1980} + \log \left(\frac{X_{\text{Poor},2007}^*}{X_{\text{Poor},1980}^*} \right) \beta_j$
- ▶ Right: $\log \left(\frac{X_{\text{Rich},j,2007}}{X_{\text{Rich},j,1980}} \right) = \Delta \alpha_{j,2007-1980} + \log \left(\frac{X_{\text{Rich},2007}^*}{X_{\text{Rich},1980}^*} \right) \beta_j$
- ▶ Slopes = $-0.15, 0.28 \Rightarrow$ Expenditure inequality increases by 43 log points.

Notes on Aguiar and Hurst (2007):
"Measuring Trends in
Leisure: The Allocation of
Time over Five Decades"

The lecture so far

- ▶ Heathcote et al. (2010)
 - ▶ Household earnings inequality has been increasing since the 1970s.
 - ▶ Most of the increase is in residual ("within group") inequality.
 - ▶ Consumption inequality is basically flat. The small increase is mostly between-group inequality.
- ▶ Aguiar and Bilts (2013)
 - ▶ Consumption inequality actually increases at a rate similar to that of income inequality.

We care about utility from consumption expenditures...

...not consumption expenditures per se.

- ▶ We defined consumption $\equiv f(x_1, \dots, x_n)$ as a function of expenditures.

- ▶ Relevant budget constraint:

$$\sum_i \underbrace{p_i \cdot x_i}_{\text{expenditures on good } i} = \underbrace{W \cdot t_W}_{\text{labor income}} + \underbrace{V}_{\text{other income}}$$

- ▶ Becker (1965): Consumption consists of a bundle of commodities $c_1, \dots, c_i, \dots, c_n$
 - ▶ Commodities are a combination of market goods (x_i) and time inputs (t_i): $c_i = \phi^i(x_i, t_i)$
 - ▶ Extra budget constraint:

$$\sum_i \underbrace{t_i}_{\text{time spent on commodity } i} = T - t_W$$

Research question and method

- ▶ Data on the evolution of t_W have been readily available (in the PSID, CPS, NLSY, etc...) for awhile. Not so for the components of $T - t_W$.
- ▶ How have the components of $T - t_W$ (time spent not working in the market) changed over time
 - ▶ ... on average?
 - ▶ ... for men vs. women?
 - ▶ ... for individuals in different income groups?
- ▶ Method: Combine time-use surveys from 1965 to 2003 (some results extended to 2013).

Data Sources

- ▶ Use only retrospective diaries. Individuals badly estimate time use without time diaries.
 - ▶ Robinson and Godbey (1997): Someone with a diary showing 38 (55) hours/wk reports, in a retrospective interview, working 40 (70+) hours/wk
- ▶ Americans Use of Time (1965-1966), Time Use in Economic and Social Accounts (1975-1976), Americans' Use of Time (1985), National Human Activity Pattern Survey (1992-1994).
 - ▶ 2K-9K individuals per dataset.
- ▶ American Time Use Survey
 - ▶ Annual, beginning in 2003.
 - ▶ 20K in 2003, somewhat fewer in other years
 - ▶ Can be linked to the CPS.

Main results and their implications

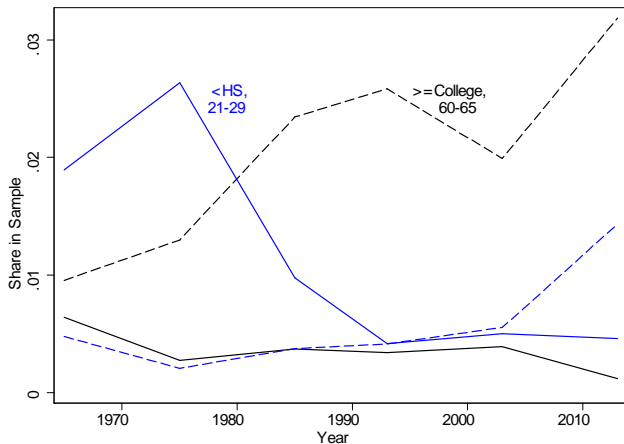
Two main findings:

1. Average time spent on leisure has gone up, by roughly 4 to 8 hours
2. Dispersion in leisure time also increasing
 - 2.1 90-10 difference in leisure time increases by 14 hours
 - 2.2 Less educated increase their leisure time more.

Implications:

- ▶ GDP growth may understate welfare growth
- ▶ Looking at consumption expenditures may overstate the growth of inequality in the past few decades.

Demographic Change



- ▶ Most calculations "fix" demographic weights when computing averages.

Time Categories

1. Market work

- ▶ "Core": Main and second jobs, telecommuting work
- ▶ "Total": Core + Commuting + Lunch Breaks at Work.

2. Non market work

- ▶ Meal preparation, house cleaning, laundry
- ▶ Shopping: obtaining goods and services
- ▶ Home and vehicle maintenance, pet care.

3. Time with children

4. Leisure

- ▶ Leisure 1: Entertainment, social and recreational activities, relaxing, gardening
- ▶ Leisure 2: "1" + Eating, sleeping, personal care
- ▶ Leisure 3: "2" + child care
- ▶ Leisure 4: "3" + civic activities, caring for other adults, education, medical care

What activities are leisure?

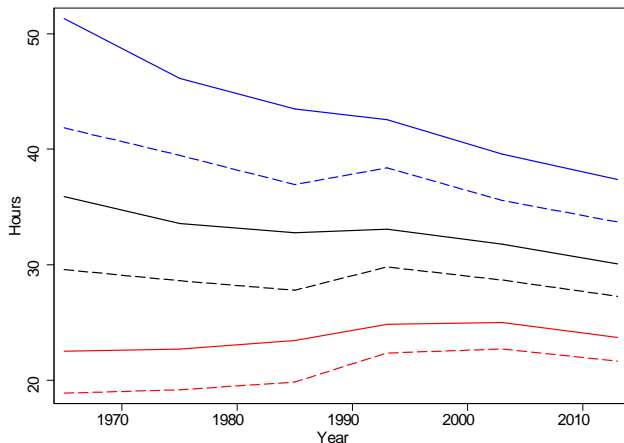
- ▶ Robinson and Godbey: activities that have high enjoyment

- ▶ 1985 Time Use Survey rate activities from 0 to 10

Activity	Index	Activity	Index
Sex	9.3	Market work	7.0
Play sports	9.2	Help adults	6.4
Play with kids	8.8	Child care	6.4
Talk/read to kids	8.6	Commute	6.3
Church	8.5	Pet care	6.0
Sleep	8.5	Homework	5.3
TV	7.8	Yardwork	5.0
Baby care	7.2	Child health	4.7
Gardening	7.1	Car repair shop	4.6

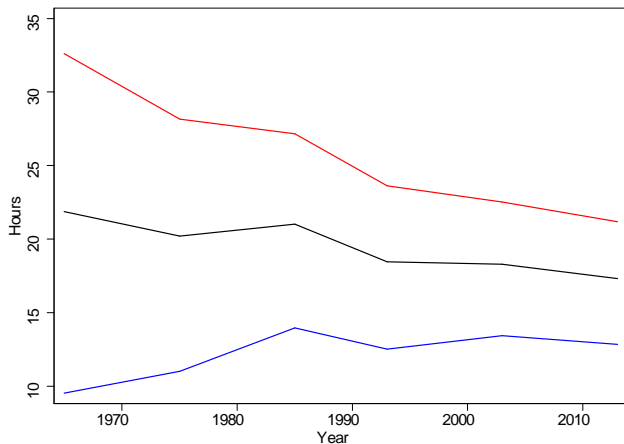
- ▶ Margaret Reid (1934): Home production is time spent in activities for which a market substitute could potentially exist.
 - ▶ gaden + pet care, child care, care of others

Time Spent in Market Work



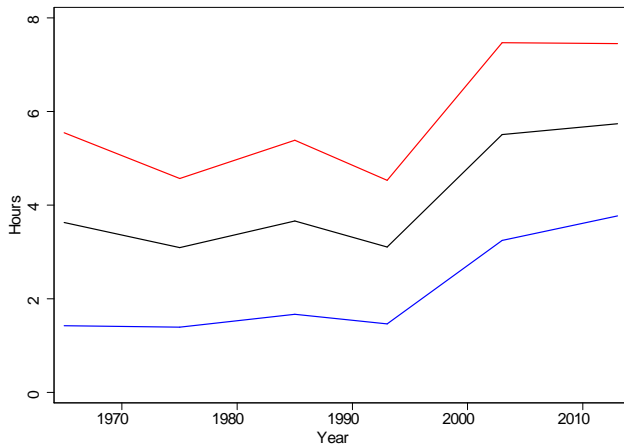
- ▶ Core work declines 8 hours for men, up 3 hours for women
- ▶ "Non-core" market work declines 6 hours for men, 2 for women.

Time Spent in Home Production



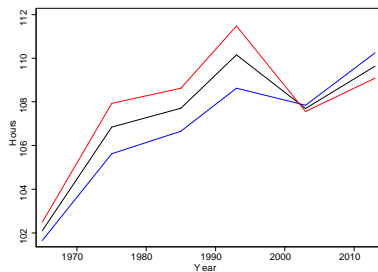
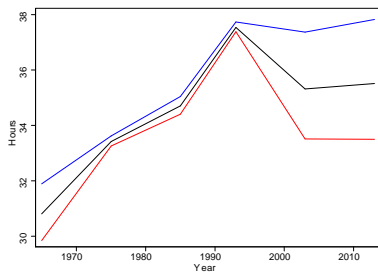
- ▶ Declines 11 hours for women, up 3 hours for men.

Time Spent with Children



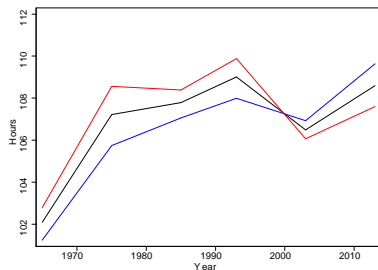
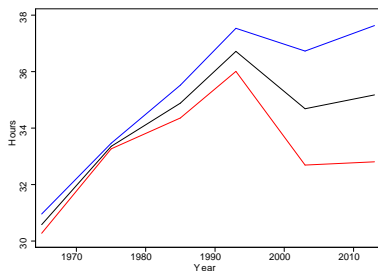
- ▶ Increases 2 hours for both men and women.

Leisure Time



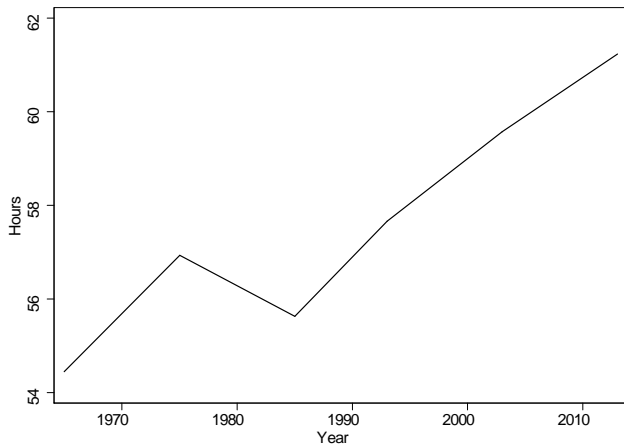
- ▶ "Leisure 2 measure" increases roughly by 6 hours for men, 5 for women.

Leisure Time: Changing Demographic Weights

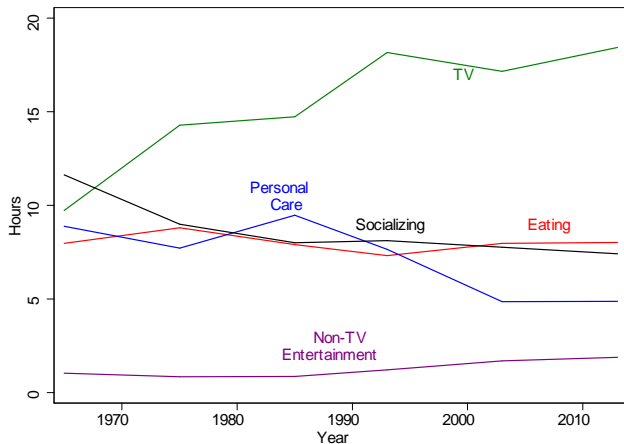


- ▶ Slightly larger increase in leisure-2 time, with changing demographic weights.

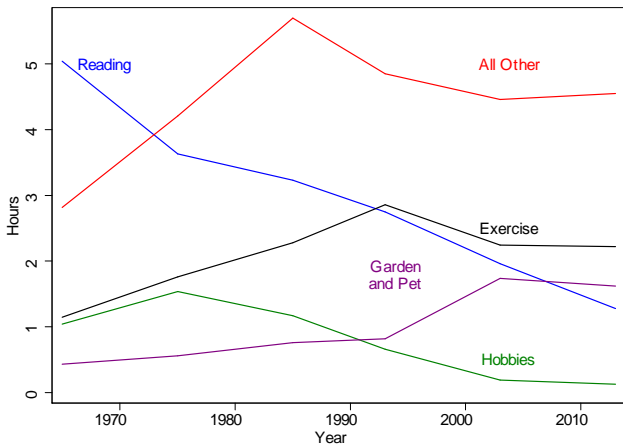
Leisure: Sleep has increased by 7 hours/wk



Leisure: TV has increased by 9 hours/wk



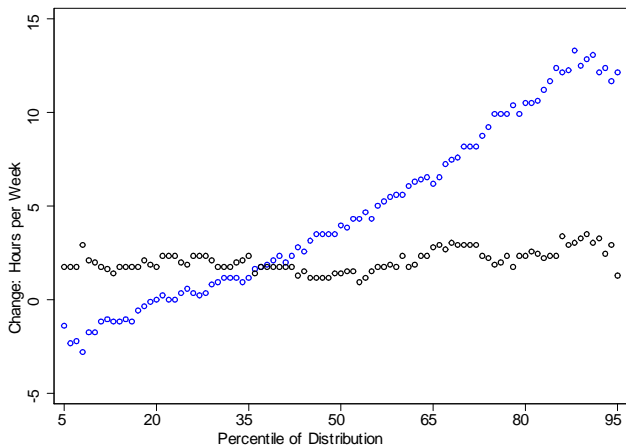
Leisure: Reading has decreased by 4 hours/wk



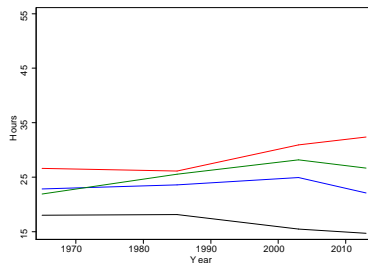
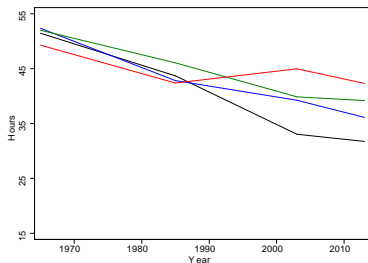
Distribution of leisure time

Percentile	1965	1975	1985	1993	2003	2013
10	74.7	77.4	77.0	75.5	72.9	74.1
25	85.2	88.1	88.4	87.5	85.8	86.3
50	98.1	102.1	102.7	103.3	102.1	101.5
75	117.3	126	127.2	130.4	127.2	125.4
90	136.5	146.1	147.5	154.0	149.3	148.8
Mean	102.0	107.0	107.5	110.8	110.2	109.2

Changes in the distribution of leisure time, 1965 to 2003 and 2003 to 2013

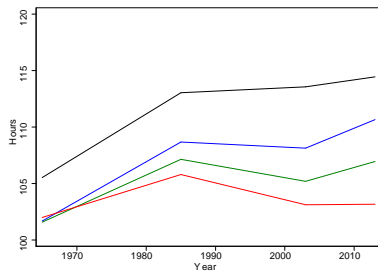
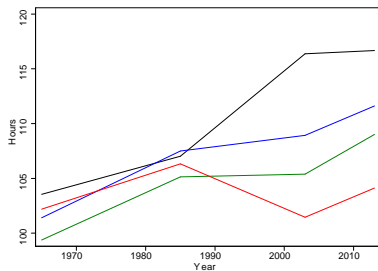


Changes in market time by education category



- ▶ Market time decreases most for less educated men.

Changes in leisure time by education category



- ▶ Leisure time increases most for less educated men.

Changes in leisure time by education category

Change: '65-'13	Whole Sample	< High School	High School	Some College	> College
Eating	-0.64	-1.43	-0.62	-0.85	0.18
Sleeping	6.78	8.17	7.98	6.84	3.57
Pers. Care	-4.10	-4.42	-4.40	3.52	-3.82
TV	8.70	9.66	9.74	8.35	6.46
Non-TV Ent.	0.84	0.98	0.95	0.82	0.57
Socializing	-4.96	-3.89	-4.95	-4.77	-6.06
Hobbies	-0.91	-0.89	-1.05	-0.77	-0.79
Reading	-3.75	-3.38	-3.75	-3.55	-4.23
Exercise	0.77	0.47	0.48	0.58	1.66
Garden	1.19	1.17	1.34	1.12	1.04
All Other	1.33	3.05	1.35	0.92	0.18

Conclusion

- ▶ Average leisure increases by approx. 5 hours.
- ▶ 90th percentile in leisure distribution increases from 137 to 149 hours per week; 10th percentile is flat at 74-75 hours.
- ▶ Leisure increases are concentrated in high school graduates, dropouts.
- ▶ Is it possible to estimate the functions, ϕ^i , f from the beginning of the presentation (where, again,

$$c = f(\phi^1(x_1, t_1), \dots, \phi^i(x_i, t_i), \dots, \phi^n(x_n, t_n))$$

How does inequality in $\sum x_i$ compare to inequality in c ?

Notes on Aguiar et al. (2013):
"Time Use During the
Great Recession"

Introduction

- ▶ Main Question: How does leisure and home production time vary over the business cycle?
- ▶ Because of data limitations, this question has been (up to now) difficult to answer.
 - ▶ ATUS begins in 2003. Now have dataset spanning only one recession.
 - ▶ Challenge to separate trend from cycle, draw inference from 1 recession.
 - ▶ Strategy: Use geographic (cross-state) variation on changes in market hours. Many more observations.

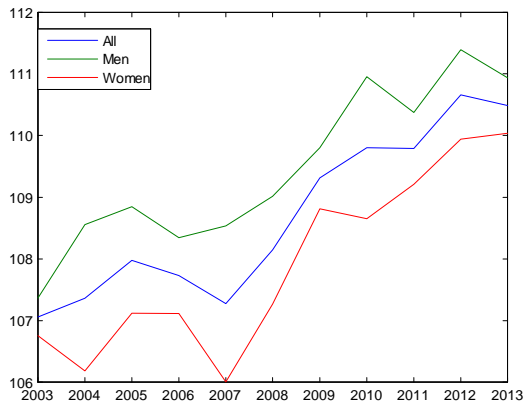
Outline

- ▶ Data.
- ▶ Aggregate results.
- ▶ Cross-state results.
- ▶ Implications for Benhabib et al (1991).

Data

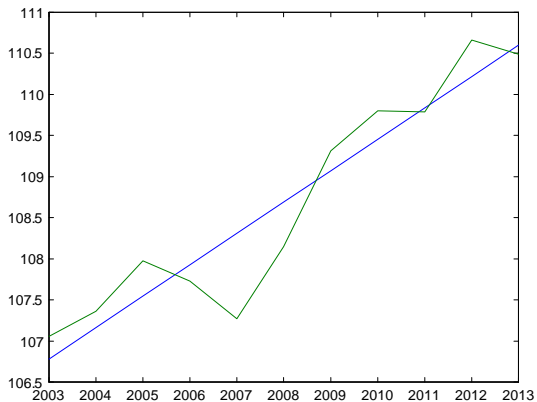
- ▶ American Time Use Survey: 2003 to 2013 (2010 in the paper).
- ▶ Similar categorization to Aguiar and Hurst (2007), with a few extra categories
 - ▶ Market work. Approx 32 hours
 - ▶ Other income generating activities. 10 minutes
 - ▶ Job search. 15 minutes;
 - ▶ Nonmarket work. 18 hours
 - ▶ Leisure: TV, Socializing, Sleeping, Eating & Personal Care. 108 hours.
 - ▶ Child care. 4.5 hours.
 - ▶ Other: Education, Religion activities, Own medical care. 5 hours.

Leisure has increased by roughly 3 hours

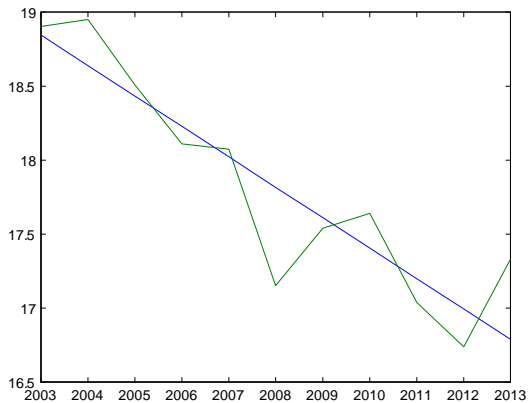


- ▶ About half of the increase from sleeping, the other half from TV watching.

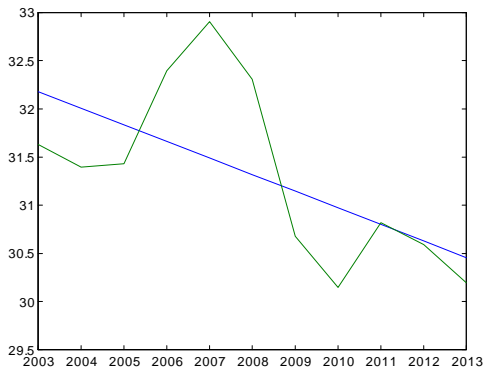
Leisure roughly 25 minutes above trend in the GR



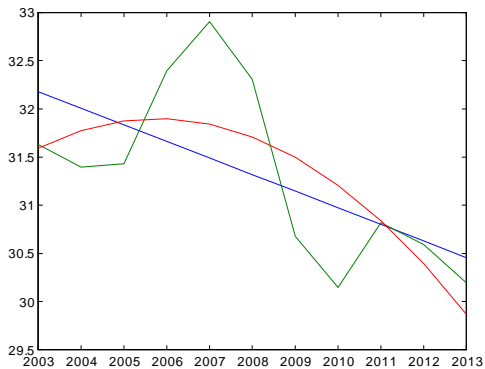
Homework 15 minutes above trend in the GR



Market time 40 minutes above trend in the GR

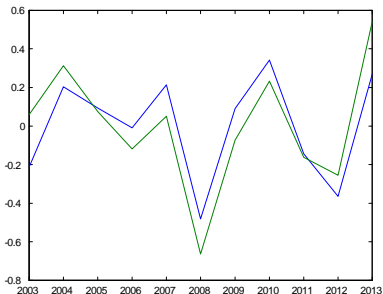


The method of de-trending matters

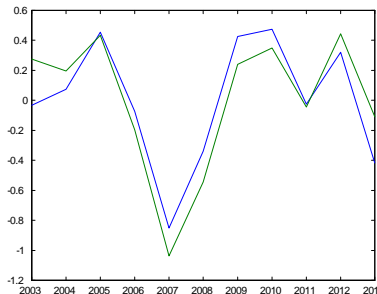


The method of de-trending matters

Homework-Dev. from trend



Leisure-Dev. from trend

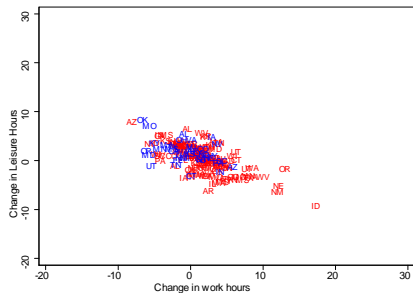
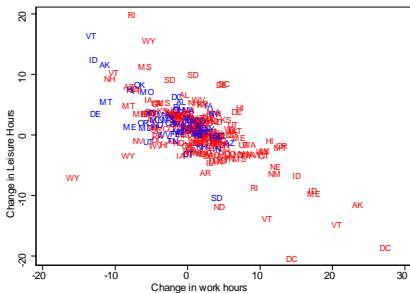


- ▶ Deviation roughly $3\times$ as large for homework, 40% higher for leisure, when using a quadratic trend.
- ▶ Not enough info from aggregate data \Rightarrow Use cross-state variation.

Compare states with different market hours

$$\Delta\tau_{st}^j = \alpha^j - \beta^j \Delta\tau_{st}^{market} + \varepsilon_{st}^j$$

s = state, t = period, j = activity

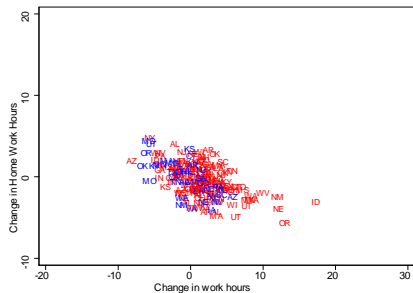
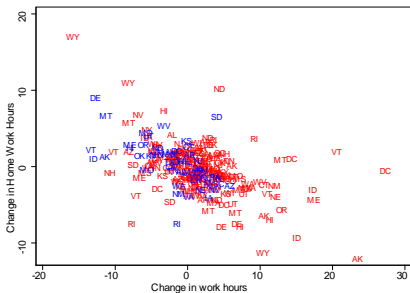


$$\beta^{\text{leisure}} \approx 0.55$$

Compare states with different market hours

$$\Delta\tau_{st}^j = \alpha^j - \beta^j \Delta\tau_{st}^{market} + \varepsilon_{st}^j$$

s = state, t = period, j = activity



$$\beta^{\text{home work}} \approx 0.30$$

More Comparisons

	Sample Mean	$\hat{\beta}$ unweighted	$\hat{\beta}$ weighted
Other income- generating activities	0.14	7.9	0.9
Job search	0.23	2.8	1.5
Child care	3.36	1.6	4.2
Nonmarket work	13.03	29.1	31.8
Core home production	6.91	13.2	13.3
Home ownership activities	1.57	4.4	5.8
Leisure	79.52	55.6	52.7
TV watching	13.07	12.4	13.2
Socializing	5.61	8.5	7.2
Sleeping	43.85	14.8	17.9
Eating and personal care	9.75	0.5	-0.1
Other leisure	7.23	19.5	14.4
Other	3.72	10.1	8.9

How to identify e from cross-state data?

- ▶ Simulate Benhabib, Rogerson, Wright model; 51 "states" and 58 years of data (discard first 50 years).
- ▶ From the simulated data, regress

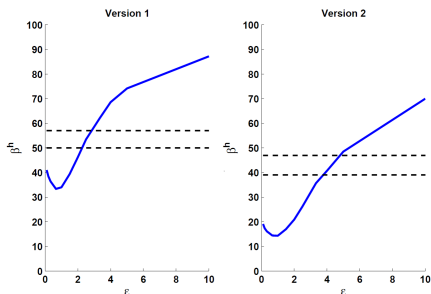
$$\Delta\tau_{st}^{\text{home}} = \alpha^j - \beta^j \Delta\tau_{st}^{\text{market}} + \epsilon_{st}^j$$

- ▶ Version 1 (2): Leisure includes (excludes) sleep.
- ▶ Now try different values of e

Version	Model $e = 0.8$	Model $e = 0.5$	Data Full Sample	Data Recession
1	0.74	0.46	0.50	0.57
2	0.48	0.20	0.39	0.47

How to identify "e" from cross-state data?

$$\Delta\tau_{st}^{\text{home}} = \alpha^j - \beta^j \Delta\tau_{st}^{\text{market}} + \epsilon_{st}^j$$



► $\sigma \in [2.5, 4] \iff e \in [0.6, 0.75]$

Connections to structural transformation?

- ▶ Different groups of individuals (women, college+ educated) had faster labor income growth. Is this related to
 - ▶ Increase in the prominence of services? (Problem Set 3)
 - ▶ Decline in the price of capital (particularly computer-related investment goods)?
- ▶ Time spent in home production declines (and women's labor force participation increases)
 - ▶ \Leftarrow declines in relative price of durable consumption goods?
- ▶ Capital share of income is increasing... Implications for inequality? (Problem Set 1)

Connections to other macro issues

- ▶ This paper: One example application of time use surveys: Reexamining changes in inequality
- ▶ One other example: Babcock and Marks (2010) examine time diaries of college students. Hours spent studying declines by a third between 1961 and 2003 \Rightarrow Declining production of human capital.
- ▶ Data from other countries are also readily available: Multinational Time Use Survey (MTUS) is a harmonized dataset of ~ 20 (mainly developed) countries.
- ▶ Survey of Unemployed Workers in New Jersey: Individual-level panel of time use.