Health, Longevity, and Welfare Inequality of the Elderly

Ray Miller [1] Neha Bairoliya [2]

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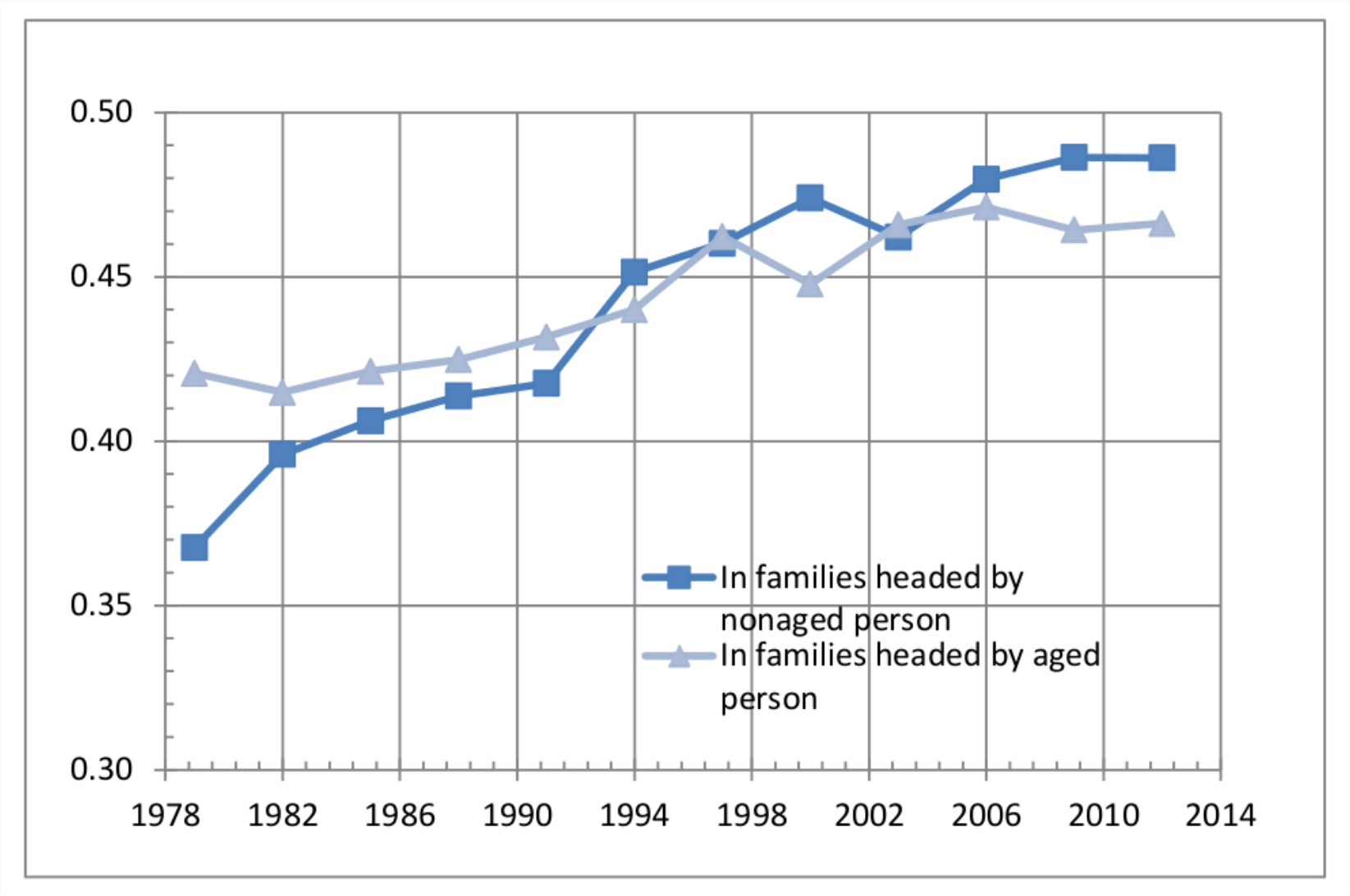
[1]Colorado State University

[2]University of Southern California

Introduction

Income Gini coefficient by age of family head, 1979-2012

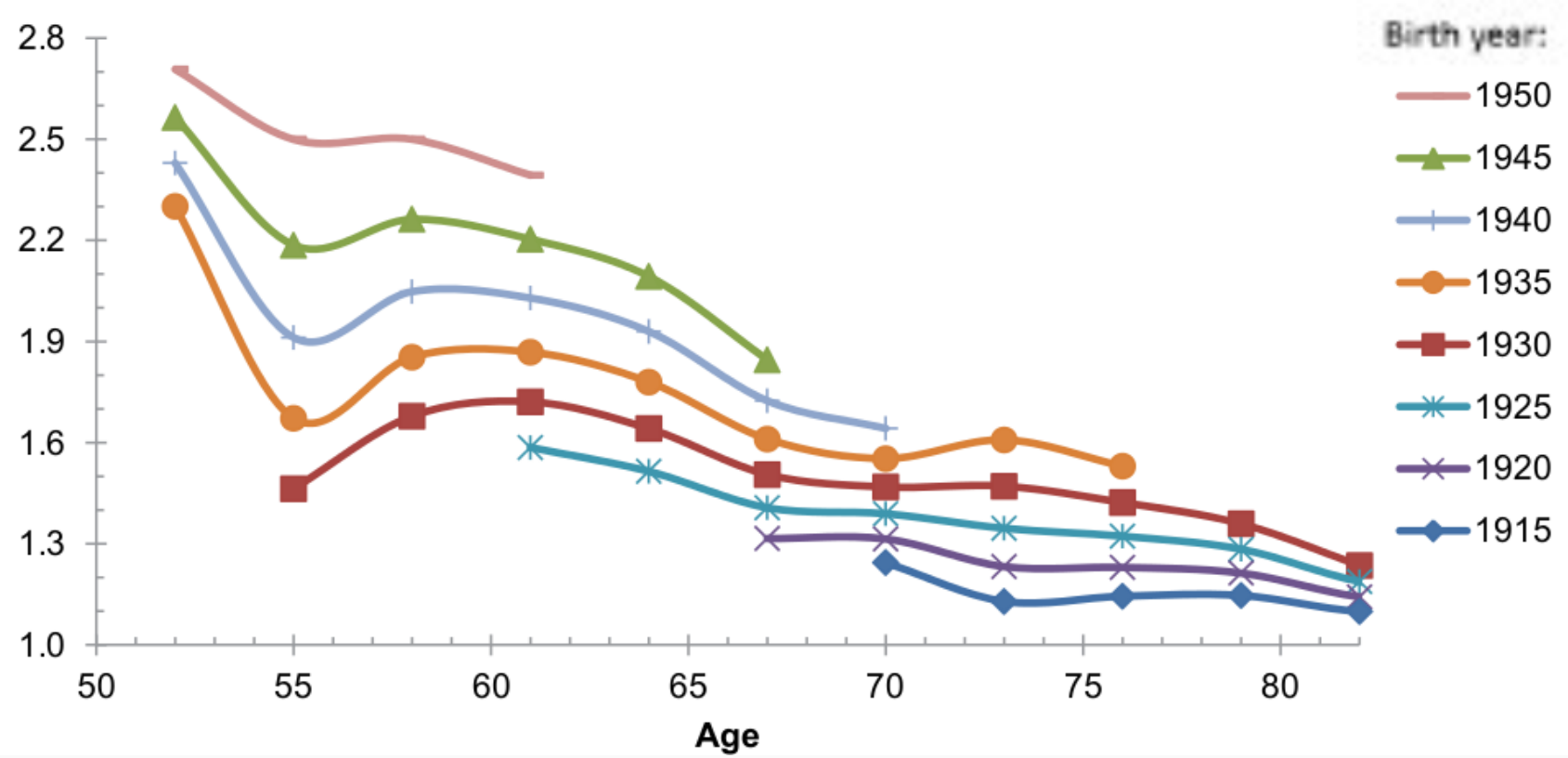


Source: Bosworth, B., Burtless, G., and Zhang, K. (2016). Data from Census Bureau's Annual Social and Economic Supplement files from the CPS. An "aged head" is 62 years old or older.

Disparities in well-being

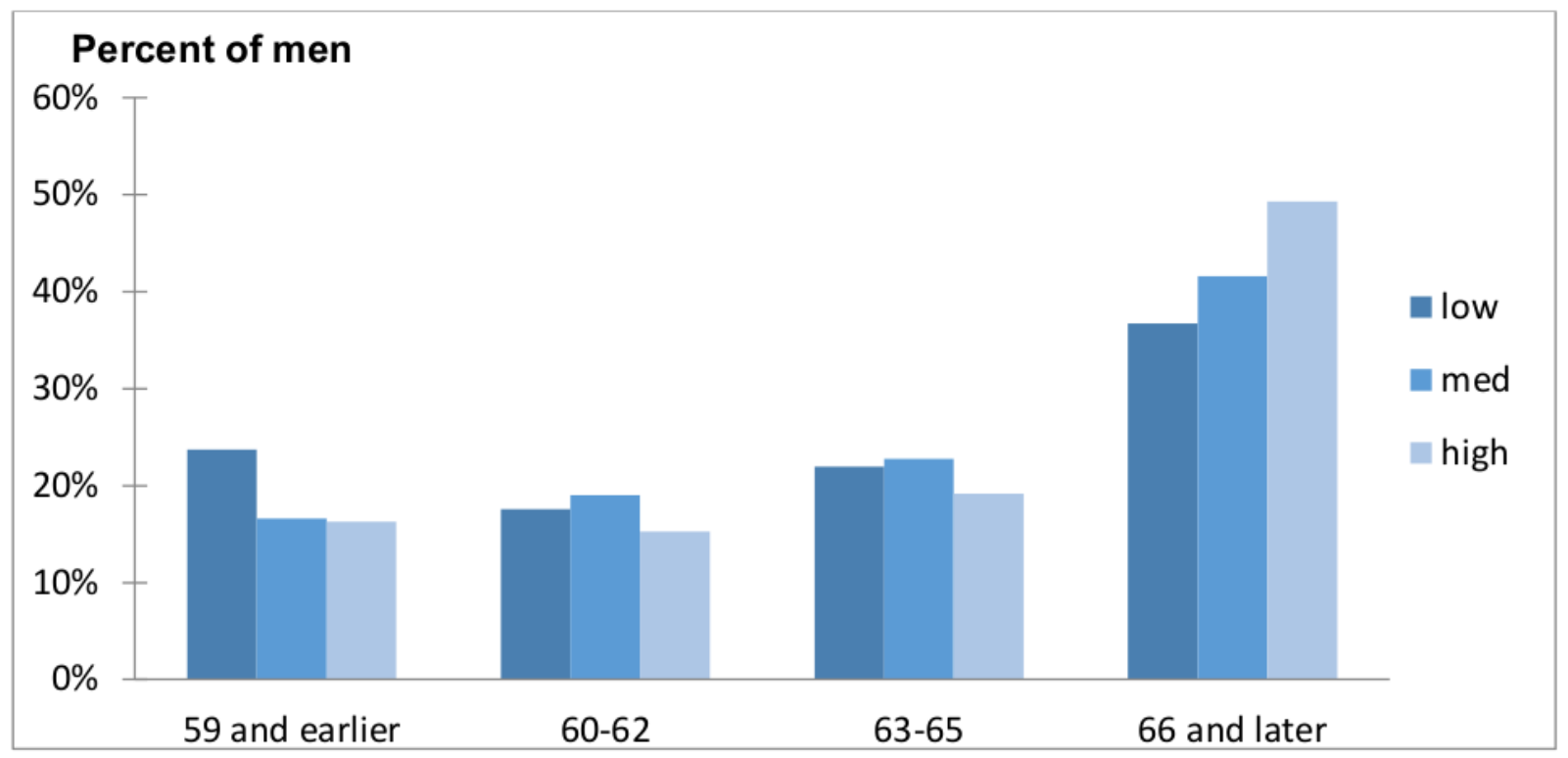
- Consumption and income inequality are incomplete metrics of well-being
  - Leisure, social interactions, political/natural environments, etc. (e.g. Stiglitz, Sen, and Fitoussi, 2008)
  - Health disparities of particular importance among elderly (e.g. Deaton and Paxson, 1998)

Mortality rate ratios of low-earning to high-earning men



Source: Bosworth, B., Burtless, G., and Zhang, K. (2016). "Low-earnings" male is one with at least one-half of years of nonzero earnings between ages 41 and 50 in which earnings are below the 31 percentile of male earnings. Data from Survey of Income and Program Participation (SIPP).

Last age with earnings by thirds of career earnings



Source: Bosworth, B., Burtless, G., and Zhang, K. (2016). Data from Social Security earnings records. Career earnings are computed as the average of non-zero earnings for the ages of 41-50. 1943-45 birth cohorts.

A measure of elderly welfare

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  - Include consumption, leisure, mortality, and health

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  - Map health to utility $\Longrightarrow$ quality-adjusted life year (QALY)

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1. How much better do we expect remaining life to be for the median sixty year old in the U.S., compared to the sixty year old who is the worst off?

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4. How well do other measures (e.g. age 60 income, health) compare to a (more) complete metric of well-being? What measures best identify well-being gaps?

Analysis outline

- Welfare model $\Longrightarrow$ expected utility framework

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  1. Forecasting outcomes $\Longrightarrow$ system of dynamic equations describing the joint evolution of outcomes (panel VAR)
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  3. Age 60 data as initial conditions $\Longrightarrow$ repeatedly simulate outcome paths for each individual
  4. Derive distribution of ex-ante welfare at age 60
     - Four birth cohorts $\Longrightarrow$ EHRS, LHRS, War Babies, Baby Boomers

Welfare Model

Welfare model

- Expected lifetime utility:

$$E\left[\sum_{a=j}^{J}\psi_{ia}\beta^{a-j}u\left(c_{ia},l_{ia},h_{ia}\right)\right]$$

- Flow utility: $u\left(c,l,h\right)=\phi\left(h\right)\left[\bar{u}+log\left(c\right)+\nu\left(l\right)\right]$

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- Consumption equivalent welfare λ :

$$U_{ij}\left(\lambda\right)=E\left[\sum_{a=j}^{J}\psi_{ia}\beta^{a-j}u\left(\lambda c_{ia},l_{ia},h_{ia}\right)\right]$$

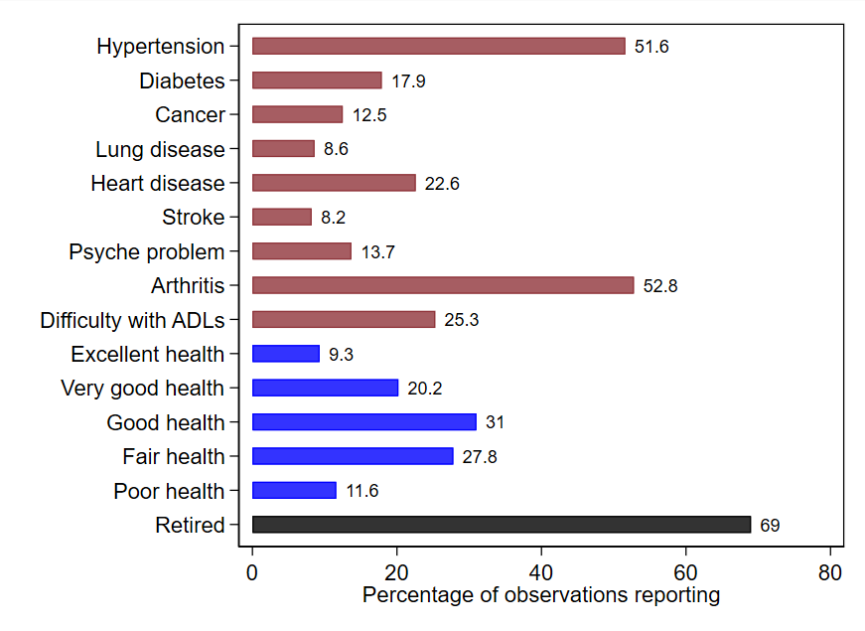
  welfare defined by:

$$U_{mj}\left(\lambda_{ij}\right)=U_{ij}\left(1\right)$$

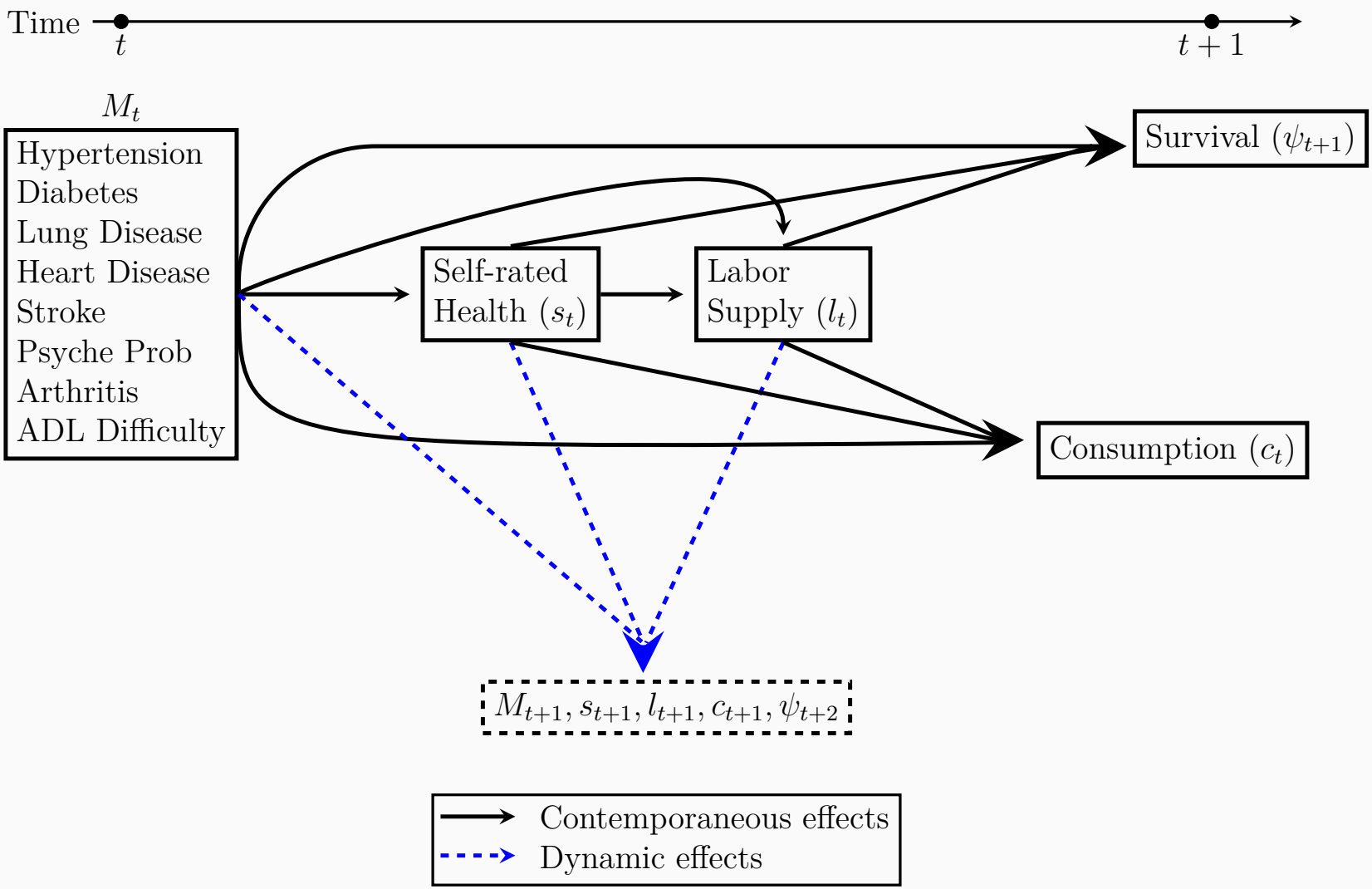
Data, Estimation, and Simulation

Data

- Health and Retirement Study (HRS)
  - Biennial longitudinal survey of individuals aged 50+ (1992-2014)
  - Consumption data (CAMS) on off years (2001-2013)
- Estimation sample
  - 35,889 individuals
  - 216,626 person-year observations
- Simulation sample (age 60)
  - 3,091 EHRS cohort (1931-36)
  - 3,607 LHRS cohort (1937-41)
  - 2,572 War Babies (1942-47)
  - 2,735 Baby Boomers (1948-53)
  - Descriptives



Forecasting model



Forecasting model

- Structural panel VAR representation:

$$AY_{it} = BY_{it-1} + CX_{it} + \epsilon_{it}$$

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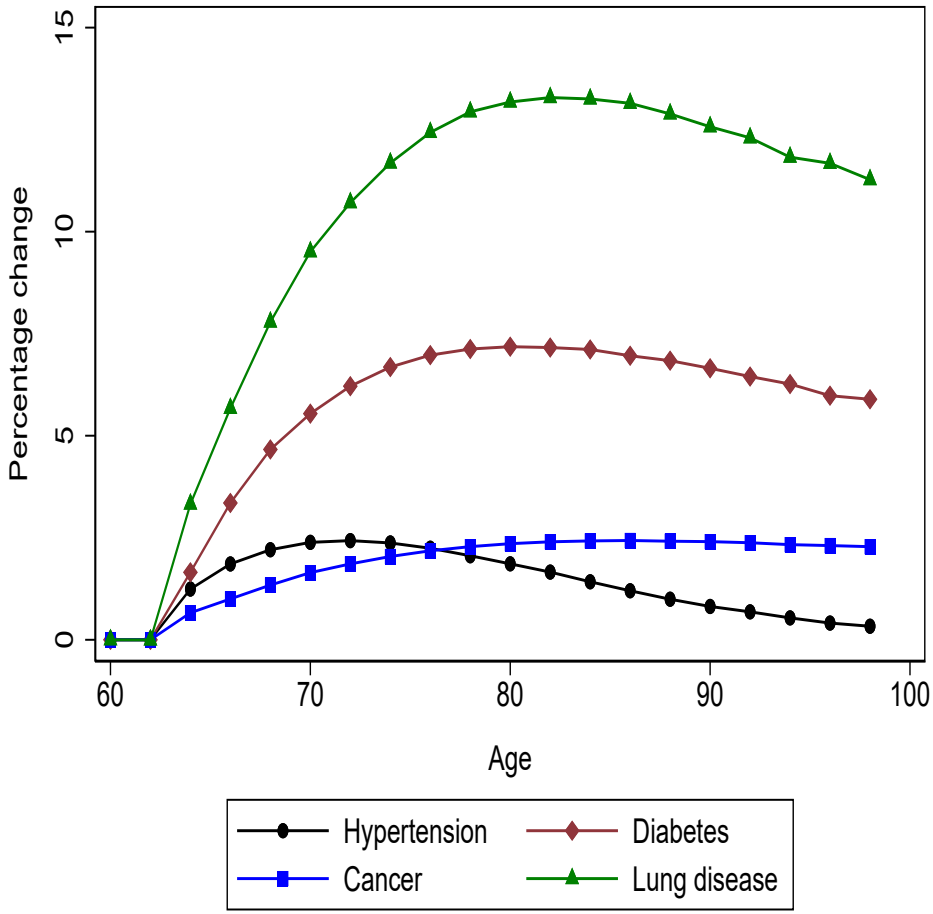
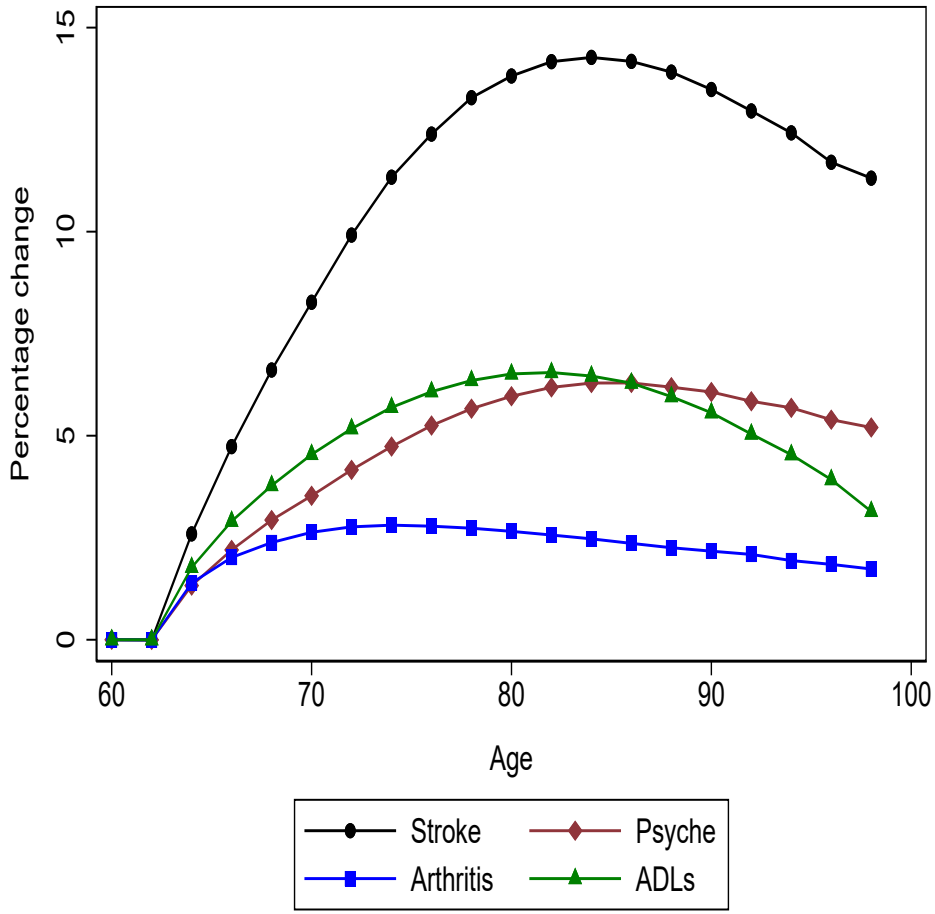
- Key assumptions:
  - Block triangulation of the system
  - Consumption fixed effect
  - Differences across cohorts:
    - linear time trend
    - cohort specific intercept
    - initial (age 60) conditions

Impulse response to onset of heart disease at age 62





Notes: Results plot percentage difference in expected outcomes with the exogenous onset of heart disease at age sixty-two relative to remaining without heart disease at sixty-two. Sample includes all individuals in the simulation sample without heart disease at age sixty. Expected outcomes are conditional on survival.

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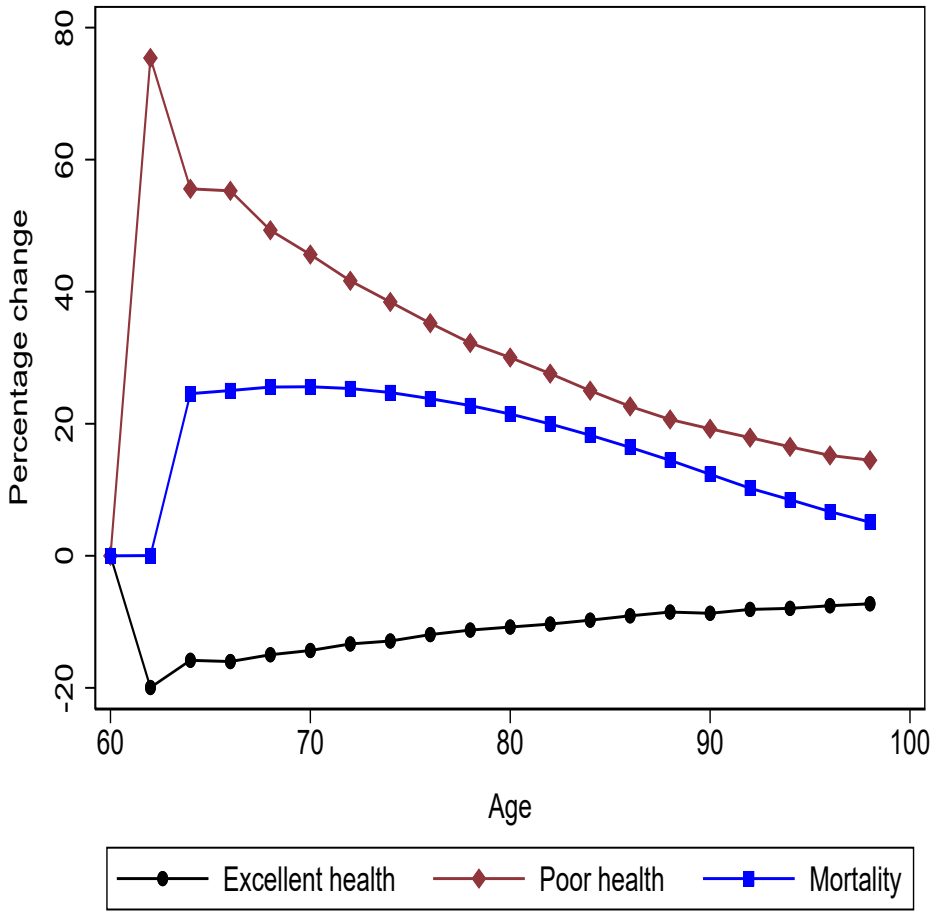

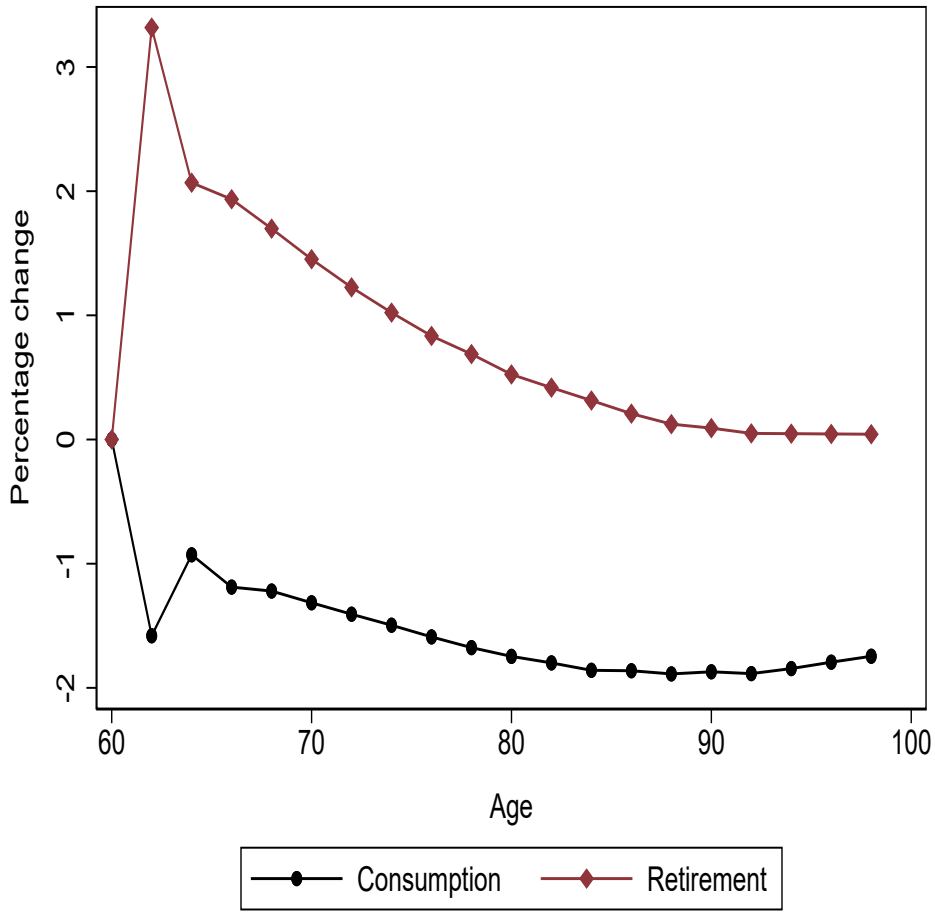

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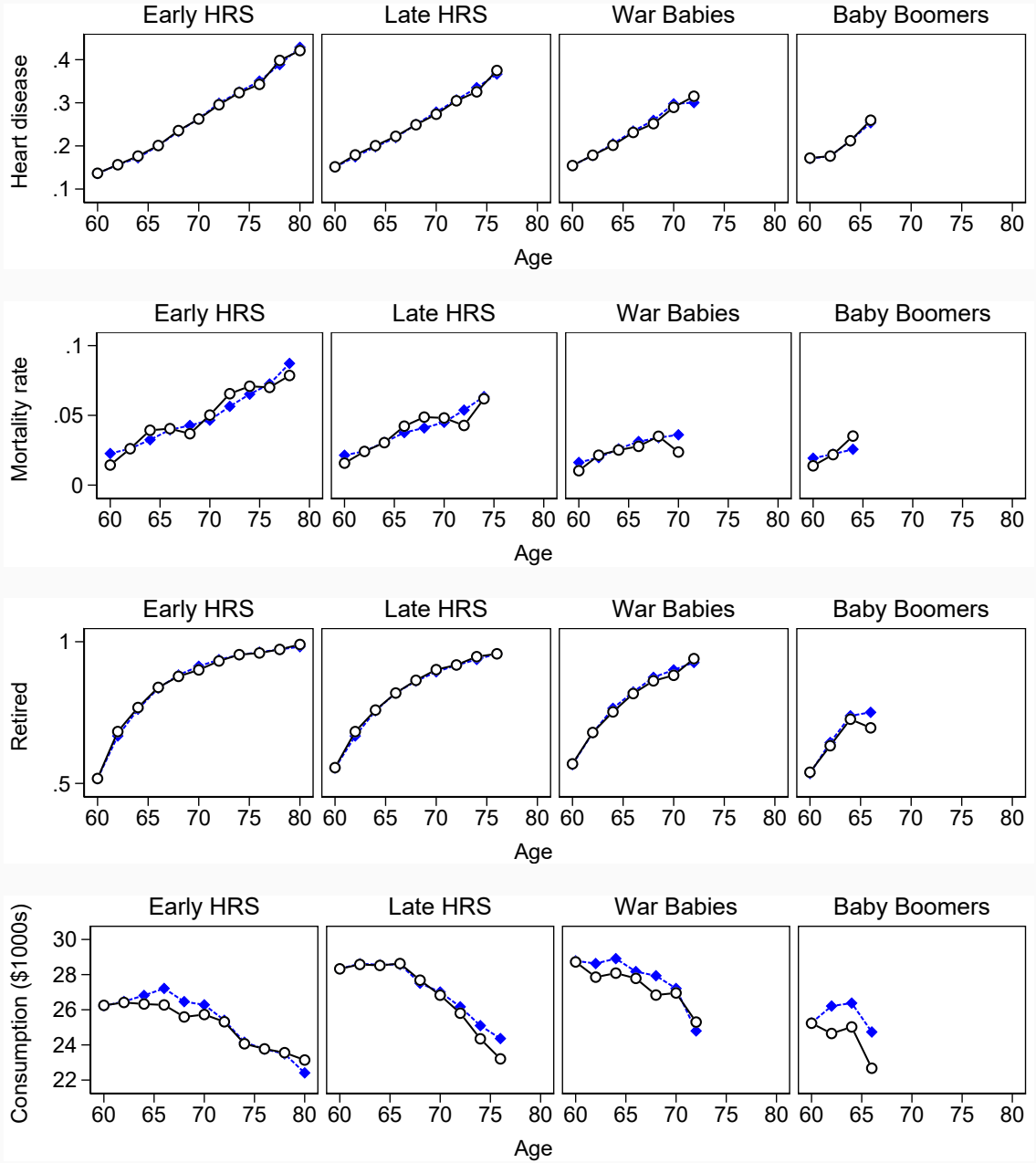
Point Estimates

Life-cycle model fit



Calibration of welfare model

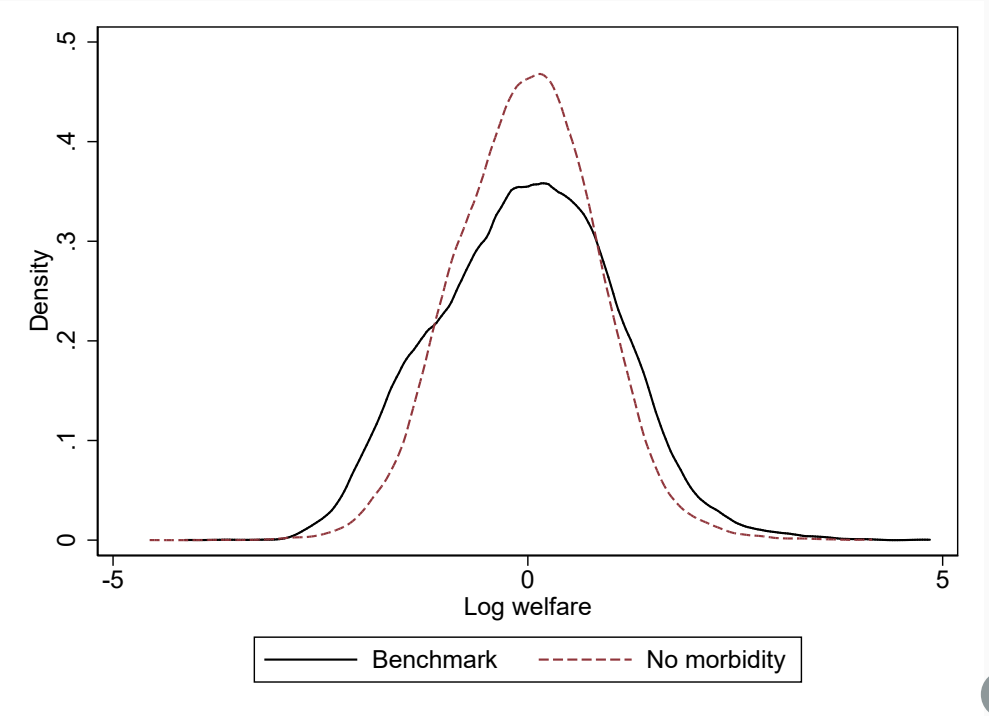
- Median 60 year-old in EHRS cohort as reference person
- Health utility function: $\phi(h) = \gamma h \Longrightarrow$ Health Utilities Mark 3 (HUI3) Results
- Leisure utility function: $\nu(l) = -\frac{\theta\epsilon}{1+\epsilon}(1-l)^{\frac{1+\epsilon}{\epsilon}} \Longrightarrow$ constant Frisch elasticity of labor supply
  - $\epsilon = 1$, $\theta = 8.37 \Longrightarrow$ FOC of labor supply holds at median
  - Working $\Longrightarrow l = 0.66$
- Discount factor $\beta = 0.98$
- Flow utility intercept $\bar{u} = -0.34 \Longrightarrow$ median value of remaining life equal to \$50,000 per QALY

Welfare Results

Elderly welfare inequality

Welfare	Gini	10/50 ratio	90/50 ratio	ρ
Benchmark	0.544	0.234	3.774	-
No morbidity	0.453	0.335	2.831	0.972

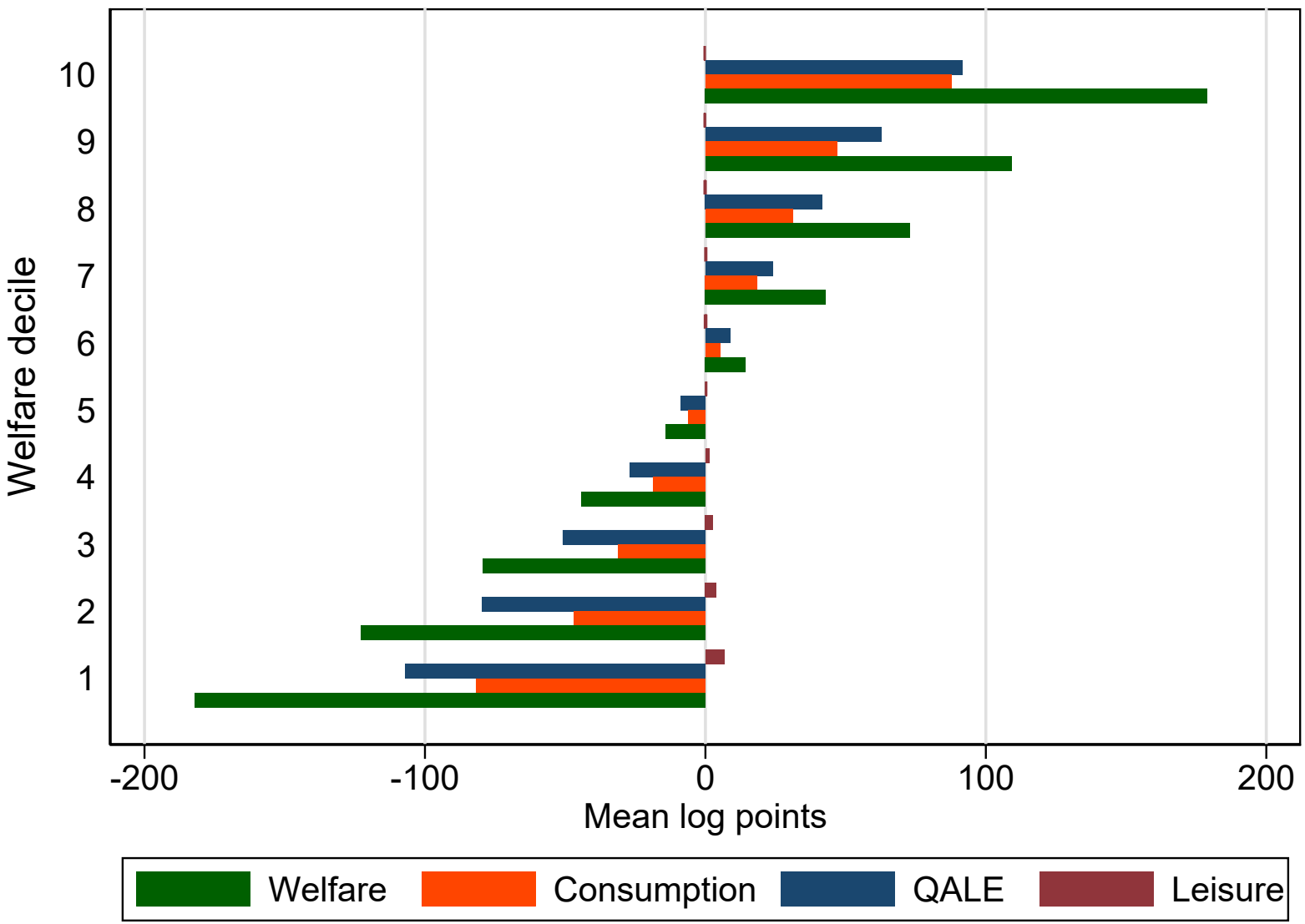
Notes: Estimates use base year sampling weights. No morbidity measure removes health from flow utility. Spearman's rank correlation between the two welfare measures denoted by ρ.



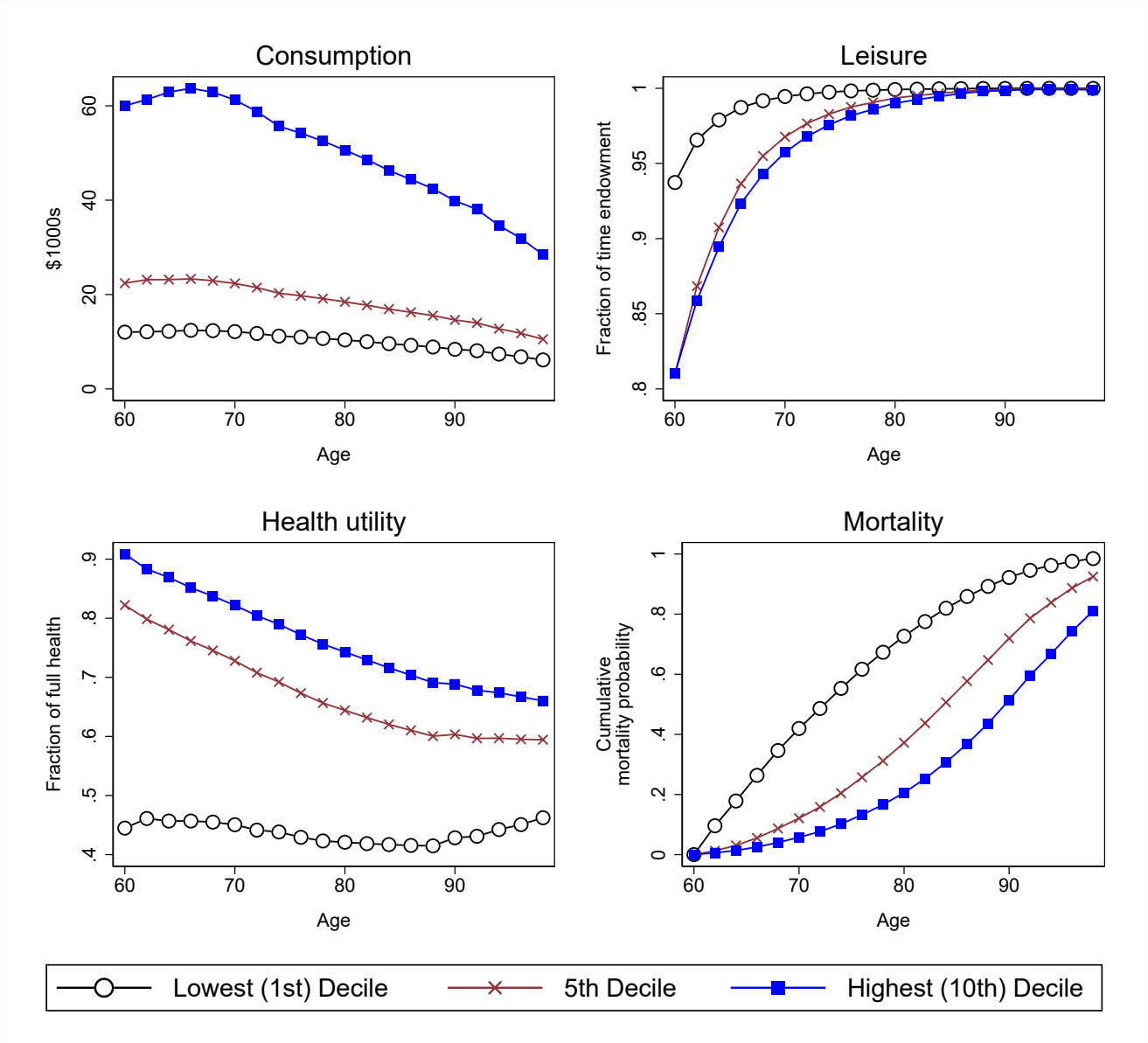
Dollar Value QALE

Elderly welfare and decomposition by decile

More



Life-cycle profiles by welfare decile



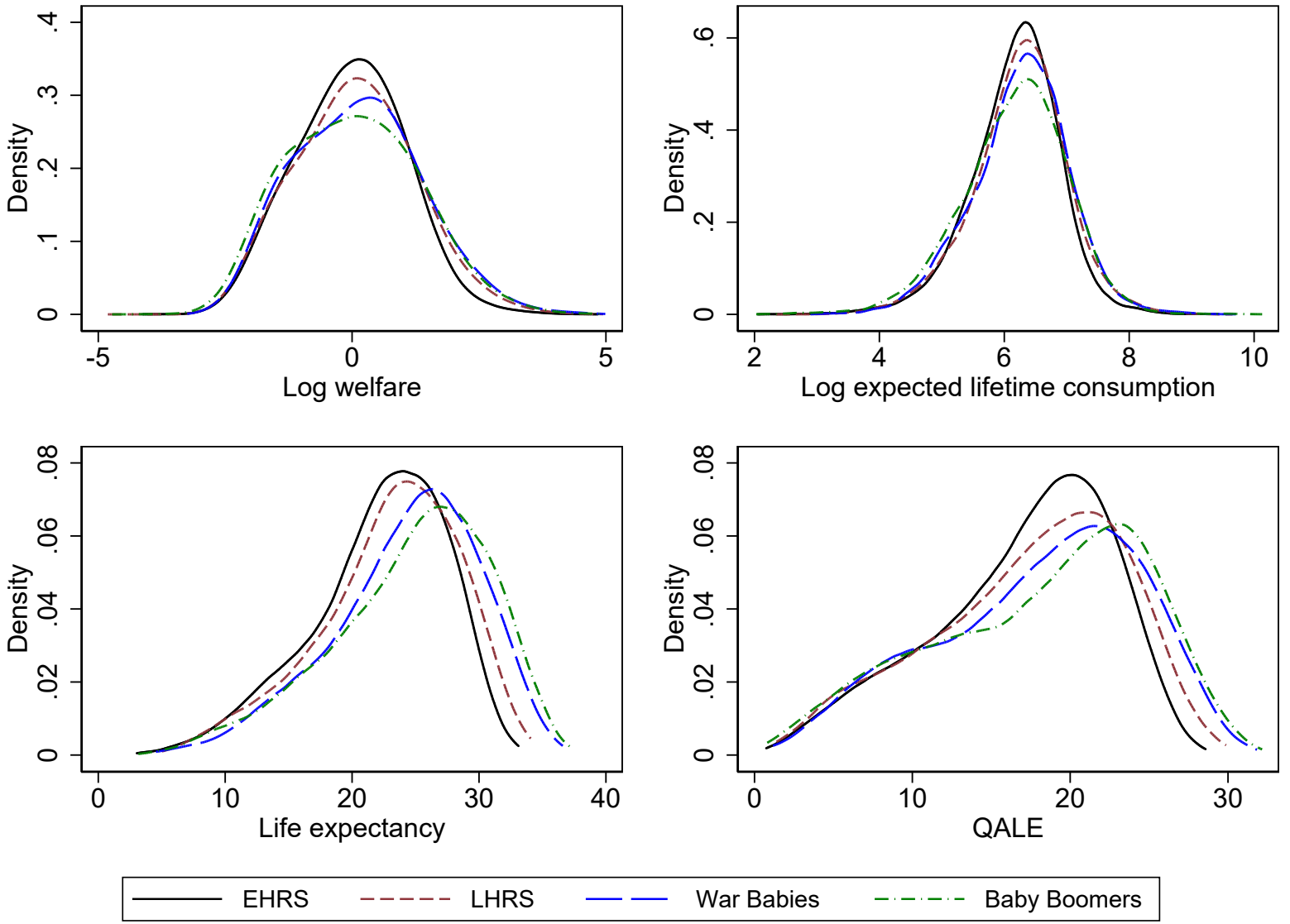
Welfare over cohorts

Cohort	Gini	10/50 ratio	90/50 ratio
EHRS	0.544	0.234	3.774
LHRS	0.606	0.210	4.667
War Babies	0.643	0.196	5.159
Baby Boomers	0.674	0.196	5.727

Notes: Estimates use base year respondent analysis weights.

Robustness

Welfare over cohorts



Comparison with other measures of well-being

Measure	Gini	ρ
Welfare (λ)	0.544	
Income	0.492	0.508
Consumption	0.424	0.573
Health utility	0.109	0.745
Flow utility	0.235	0.767
Life expectancy	0.132	0.818
QALE	0.176	0.872
Expected lifetime consumption	0.364	0.921

Notes: Estimates for initial HRS cohort using base year respondent analysis weights. Income, consumption, and health utility are cross-sectional measures at age sixty. Flow utility is calculated using cross-sectional consumption, leisure, and health along with our benchmark preferences. Spearman's rank correlation between λ and each measure denoted by ρ.

Graphs

Comparison with other measures of over cohorts

Cohort	Welfare (λ)	Cons.	QALE	ELC
EHRS	0.544	0.424	0.184	0.364
LHRS	0.606	0.442	0.198	0.390
War Babies	0.643	0.443	0.203	0.403
Baby Boomers	0.674	0.449	0.215	0.427

Notes: Estimates use base year respondent analysis weights. Income, consumption, and health utility are cross-sectional measures at age sixty. QALE is quality-adjusted life expectancy at age sixty. ELC is expected lifetime consumption at age sixty.

Conclusions

1. Elderly welfare inequality is substantial
    - Driven foremost by health and mortality gaps, followed by gaps in consumption
    - Ignoring well-being cost of health significantly underestimates inequality

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3. Cross-sectional income and consumption at age 60
    - Underestimate the *level* and *growth* of aggregate inequality
    - Are worse predictors of individual welfare rank than cross-sectional health

Limitations and future work

- Limitations
  - Abstract from potentially important inputs $\Longrightarrow$ caregiver time, social interactions, end-of-life care, bequests, etc.
  - Single set of preferences
  - Forecasting model falls short of fully specified structural model

- Opportunities for future work
  - Sub-sample analysis (e.g. education, race, gender, age) Maps
  - Policy experiments / outcome in natural experiments
  - Cross-country comparison of elderly welfare inequality

Thank You!

Welfare decomposition

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$$log\left(\lambda_{ij}\right) =$$

$$\tilde{\psi}\sum_{a=j}^{J}\beta^{a-j}\left[\left(E\left[\psi_{ia}\phi\left(h_{ia}\right)\right]-E\left[\psi_{ma}\phi\left(h_{ma}\right)\right]\right)E\left[u_{ia}\right]+\Phi\right] \qquad QALE$$

$$+\tilde{\psi}\sum_{a=j}^{J}\beta^{a-j}E\left[\psi_{ma}\phi\left(h_{ma}\right)\right]\left(E\left[log\left(c_{ia}\right)\right]-E\left[log\left(c_{ma}\right)\right]\right) \qquad Cons.$$

$$+\tilde{\psi}\sum_{a=j}^{J}\beta^{a-j}E\left[\psi_{ma}\phi\left(h_{ma}\right)\right]\left(E\left[\nu\left(l_{ia}\right)\right]-E\left[\nu\left(l_{ma}\right)\right]\right) \qquad Leisure$$

where

$$\Phi = \left(E\left[\psi_{ia}\phi\left(h_{ia}\right)u_{ia}\right]-E\left[\psi_{ia}\phi\left(h_{ia}\right)\right]E\left[u_{ia}\right]\right)$$
$$-\left(E\left[\psi_{ma}\phi\left(h_{ma}\right)u_{ma}\right]-E\left[\psi_{ma}\phi\left(h_{ma}\right)\right]E\left[u_{ma}\right]\right)$$

Simulation sample initial conditions by cohort

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	EHRS	LHRS	WB	BB
Age (mean)	60	60	60	60
Hypertension (%)	38.10	41.93	47.60	51.23
Diabetes (%)	11.81	12.77	16.45	20.13
Cancer (%)	6.84	8.25	10.82	9.48
Lung disease (%)	7.11	6.78	7.37	8.15
Heart disease (%)	13.85	14.75	16.11	16.25
Stroke (%)	2.90	3.88	5.22	4.66
Psyche problem (%)	7.44	11.85	17.32	21.85
Arthritis (%)	44.79	48.12	51.62	52.53
Difficulty with ADLs (%)	11.75	19.35	22.40	22.42
Self-rated health (%)				
Poor	7.31	6.68	6.61	7.26
Fair	15.20	16.71	16.60	17.15
Good	28.32	30.12	31.08	29.34
Very good	31.66	30.80	31.72	34.19
Excellent	17.51	15.70	13.98	12.06
Retired (%)	48.66	50.46	48.07	47.47
Annual consumption ($1000s, mean)	27.59	30.29	29.43	26.41

Notes: Mean and percentage estimates use base year sampling weights. Consumption is reported in real 2010 dollars.

Select estimation results

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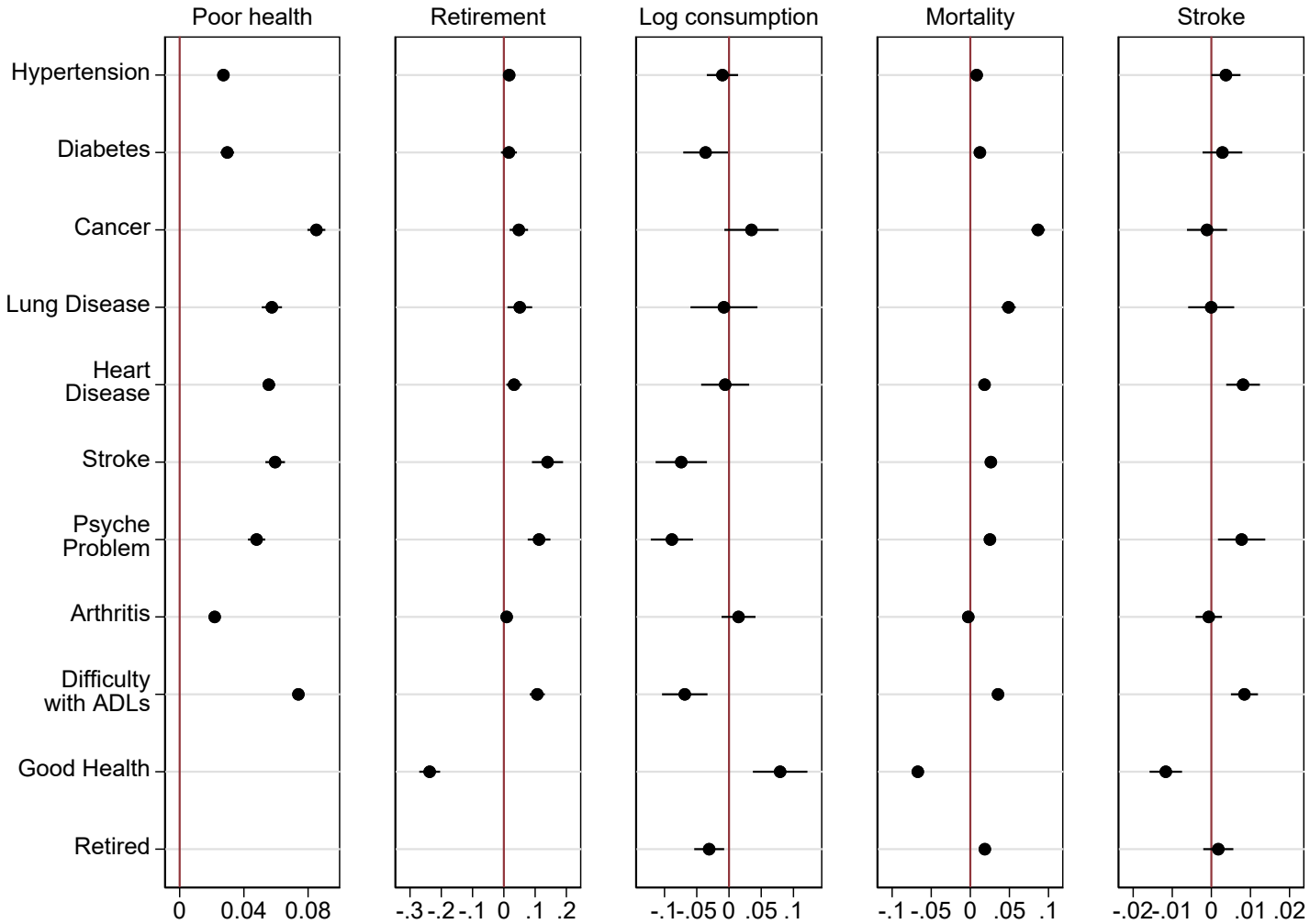

Notes: Dependent variables across columns. Average marginal effects on the probability of an outcome reported for probit results—poor health, retirement, mortality, and stroke. Contemporaneous associations reported for poor health, retirement, and consumption as dependent variables. Lagged associations reported for mortality and stroke. Good health coefficients use poor health state as reference group. Spikes indicate 95% confidence intervals.

Estimated health utility weights

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Measure	Weight	SE
Self-rated health		
Fair	0.226	0.026
Good	0.313	0.026
Very good	0.403	0.027
Excellent	0.421	0.031
Hypertension	0.003	0.012
Diabetes	-0.001	0.018
Cancer	0.010	0.017
Lung disease	-0.020	0.022
Heart disease	-0.032	0.015
Stroke	-0.076	0.022
Psych problem	-0.073	0.020
Arthritis	-0.062	0.012
Diff with ADL	-0.161	0.016
Constant	0.517	0.028

Notes: Results from regression of HUI3 score on self-rated health and morbidities. SE denotes standard error. $R^2 = 0.48$. N = 1,089.

Quality adjusted life expectancy

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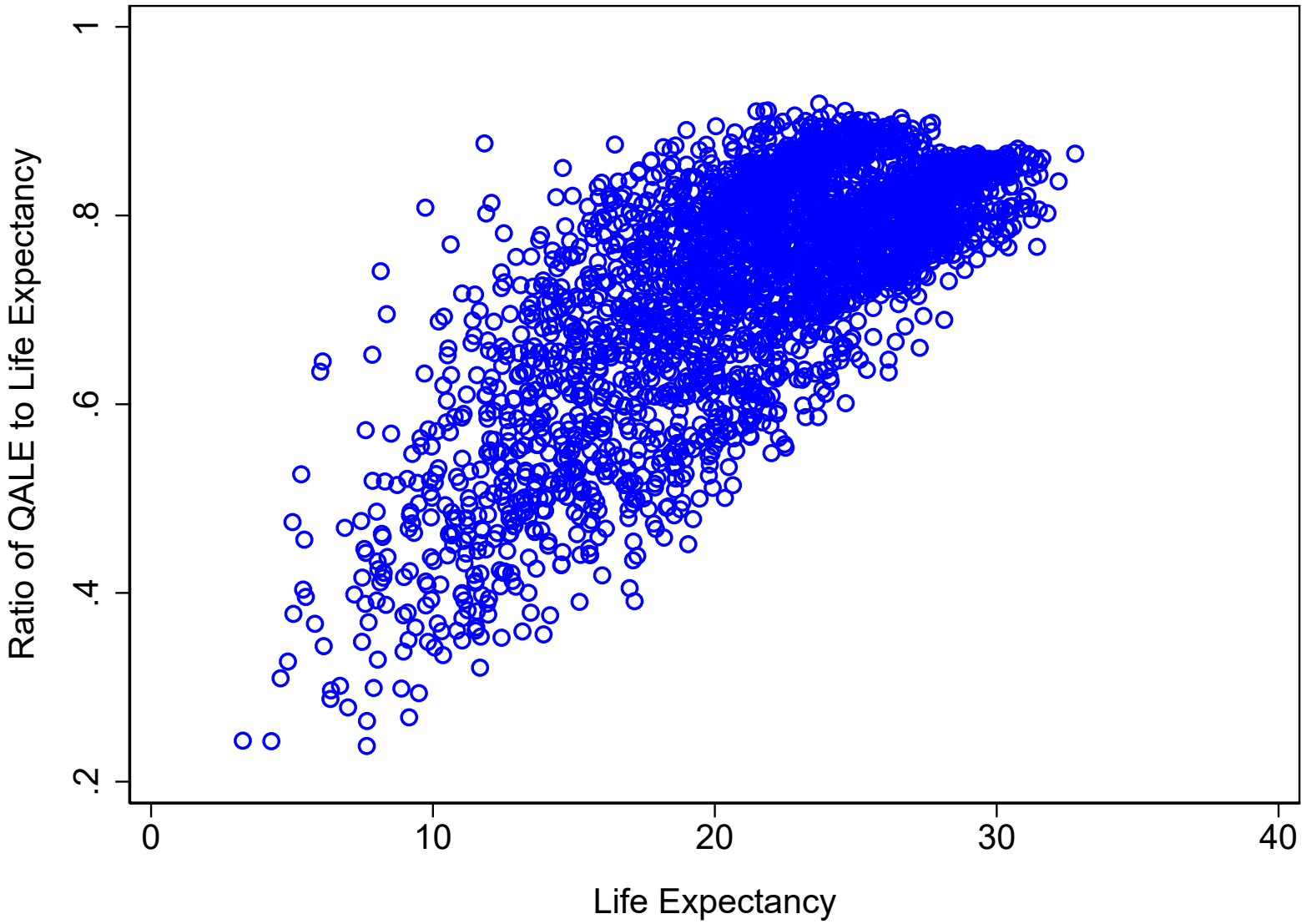

Age 60 Consumption and QALE by welfare decile

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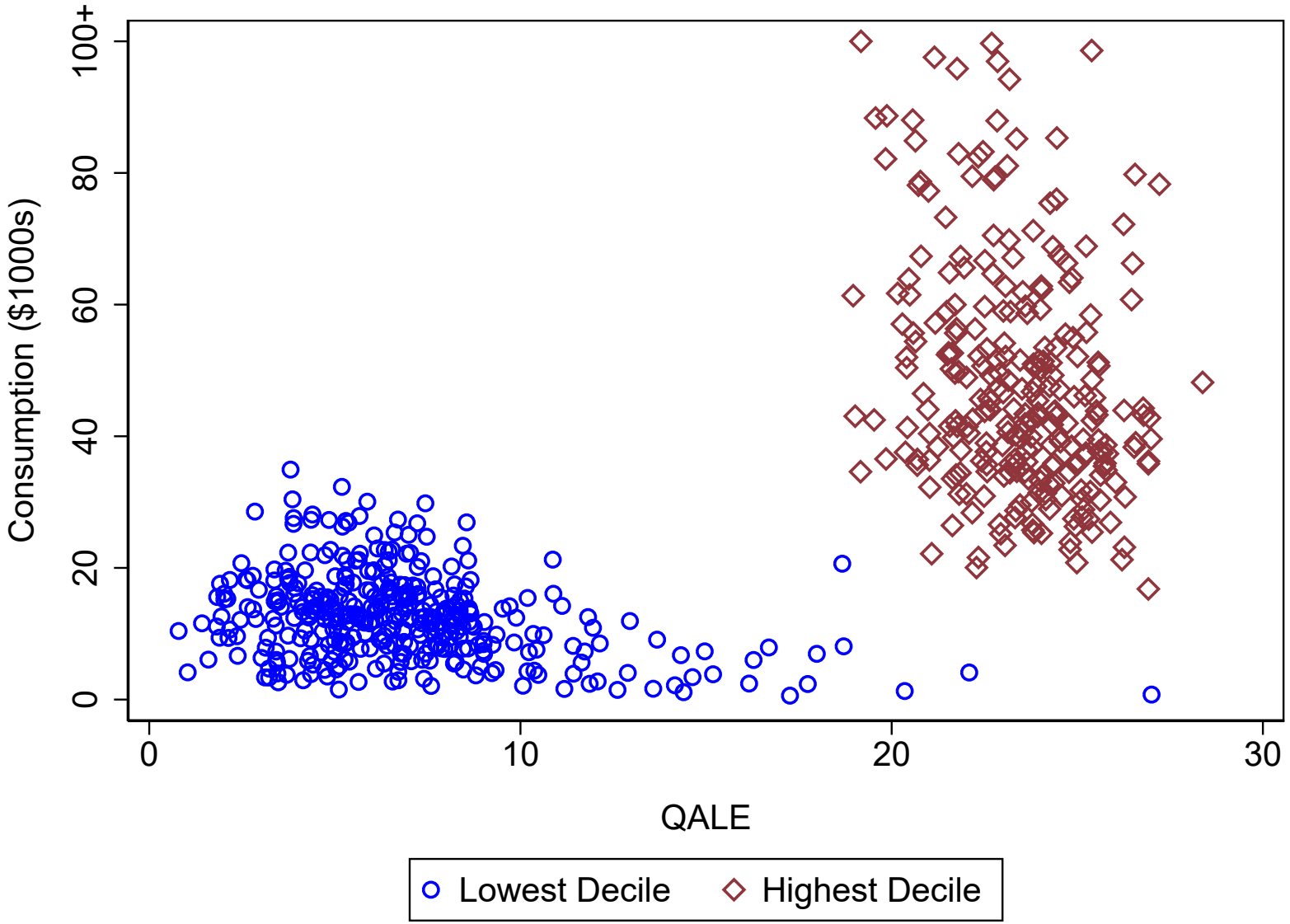

Robustness

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Measure	λ 10/50	λ 90/50	Gini by cohort EHRS	LHRS	WB	BB	ρ
Benchmark	0.234	3.774	0.544	0.606	0.643	0.674	0.573
Compensating variation	0.059	2.856	0.505	0.533	0.546	0.566	0.556
Reference 90th %tile	0.314	2.842	0.446	0.500	0.533	0.555	0.573
\$100k per QALY	0.076	6.465	0.670	0.731	0.763	0.784	0.502
$\beta = 0.90$	0.256	3.130	0.491	0.539	0.567	0.590	0.616
$\epsilon = 0.5$	0.231	3.726	0.539	0.600	0.637	0.665	0.572
$\epsilon = 2$	0.239	4.074	0.560	0.620	0.658	0.692	0.570
$\theta = 15.9$	0.258	3.539	0.525	0.584	0.621	0.652	0.571
Survival adjusted	0.177	4.015	0.568	0.618	0.648	0.674	0.573
Non-imputed data	0.242	3.543	0.522	0.568	0.591	0.627	0.603

Notes: Estimates use base year respondent analysis weights. War Babies denoted by WB and Baby Boomers by BB. Spearman's rank correlation between welfare and cross-sectional consumption at age sixty denoted by ρ.

Robustness

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- More general preferences:

$$u(c,l,h) = \phi(h)\left[\bar{u} + \frac{c^{1-\gamma}}{1-\gamma}\left(1-(1-\gamma)\frac{\theta\epsilon}{1+\epsilon}(1-l)^{\frac{1+\epsilon}{\epsilon}}\right)^{\gamma} - \frac{1}{1-\gamma}\right]$$

	EV 10/50 ratio by cohort				CV 90/50 ratio by cohort				
	EHRS	LHRS	WB	BB	EHRS	LHRS	WB	BB	ρ
$\gamma = 1$	0.234	0.210	0.196	0.196	2.856	3.161	3.211	3.563	0.573
$\gamma = 1.5$	0.207	0.180	0.163	0.165	3.567	3.915	3.829	4.158	0.520
$\gamma = 2$	0.231	0.197	0.163	0.167	4.237	4.500	4.183	4.502	0.471

Notes: Estimates use base year respondent analysis weights. War Babies denoted by WB and Baby Boomers by BB. Spearman's rank correlation between EV measure of welfare and cross-sectional consumption at age sixty denoted by ρ.

Welfare and age 60 income/health

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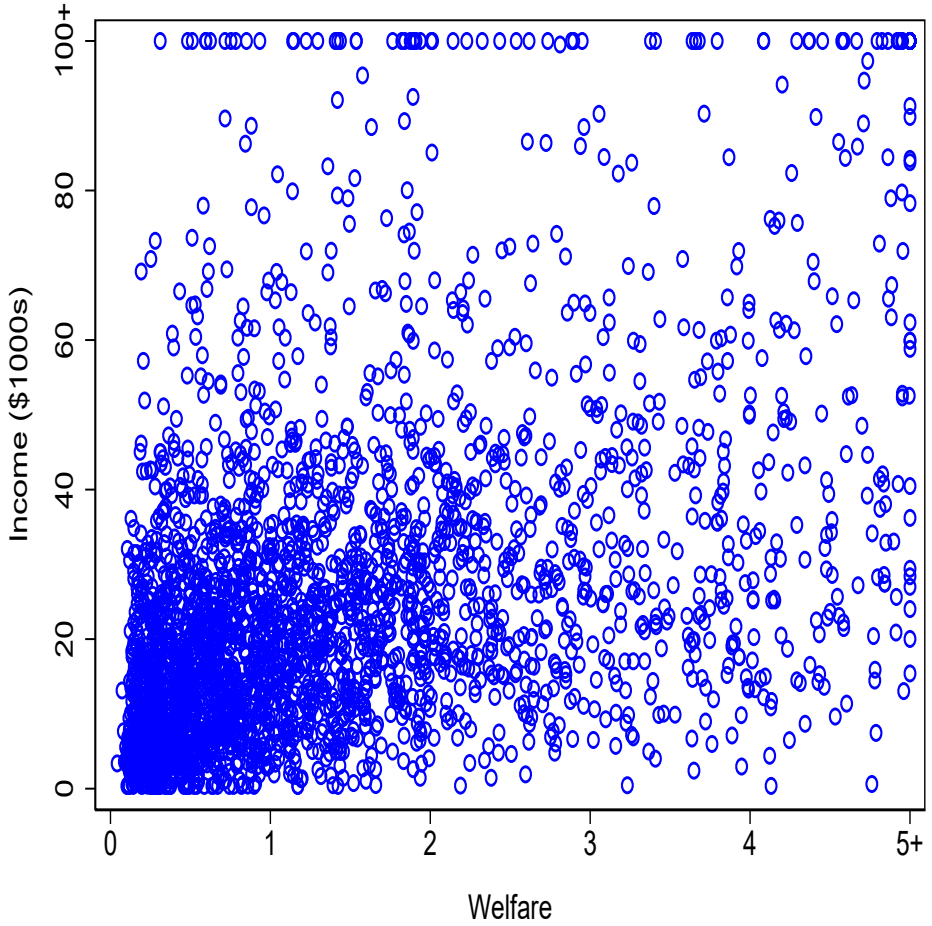

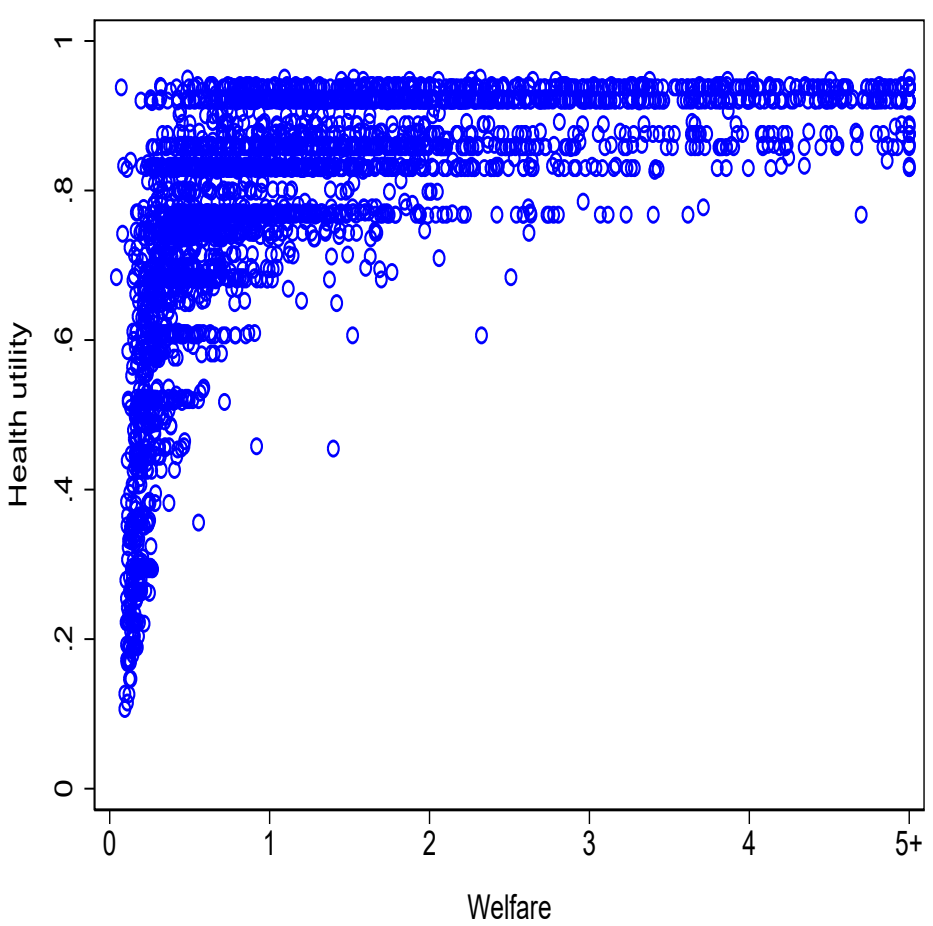

Welfare by census division for HRS cohort

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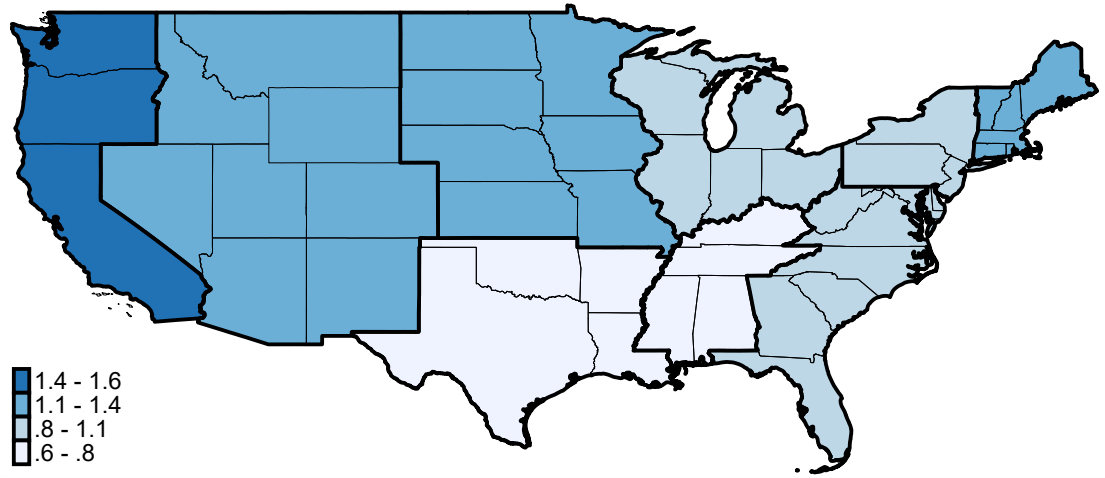
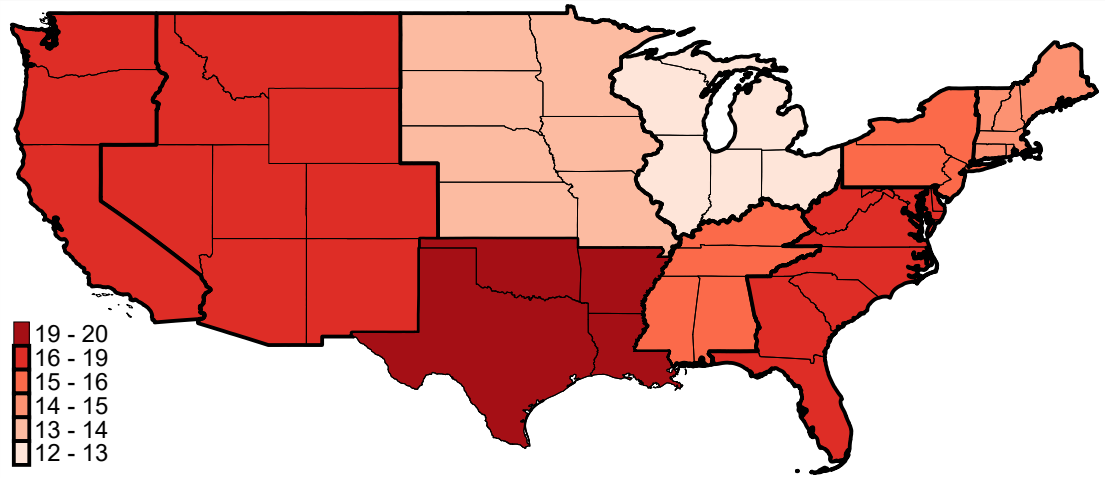
Median Welfare



Welfare 90/10 Ratio



Welfare decomposition in EHRS cohort

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	Median λ	Mean log λ	Decomposition		
			Cons.	Leisure	QALY
Education					
<HS	0.444	-0.802	-0.393	0.031	-0.440
HS grad	1.058	-0.020	-0.015	0.019	-0.025
Some college	1.402	0.271	0.196	0.006	0.069
College grad	2.536	0.893	0.476	-0.012	0.429
Gender					
Male	0.862	-0.150	0.045	-0.005	-0.190
Female	1.182	0.083	-0.030	0.031	0.081
Race					
White	1.112	0.070	0.063	0.013	-0.005
Black	0.457	-0.742	-0.404	0.028	-0.366
Other	0.771	-0.304	-0.245	0.011	-0.070

Welfare Dollar Value

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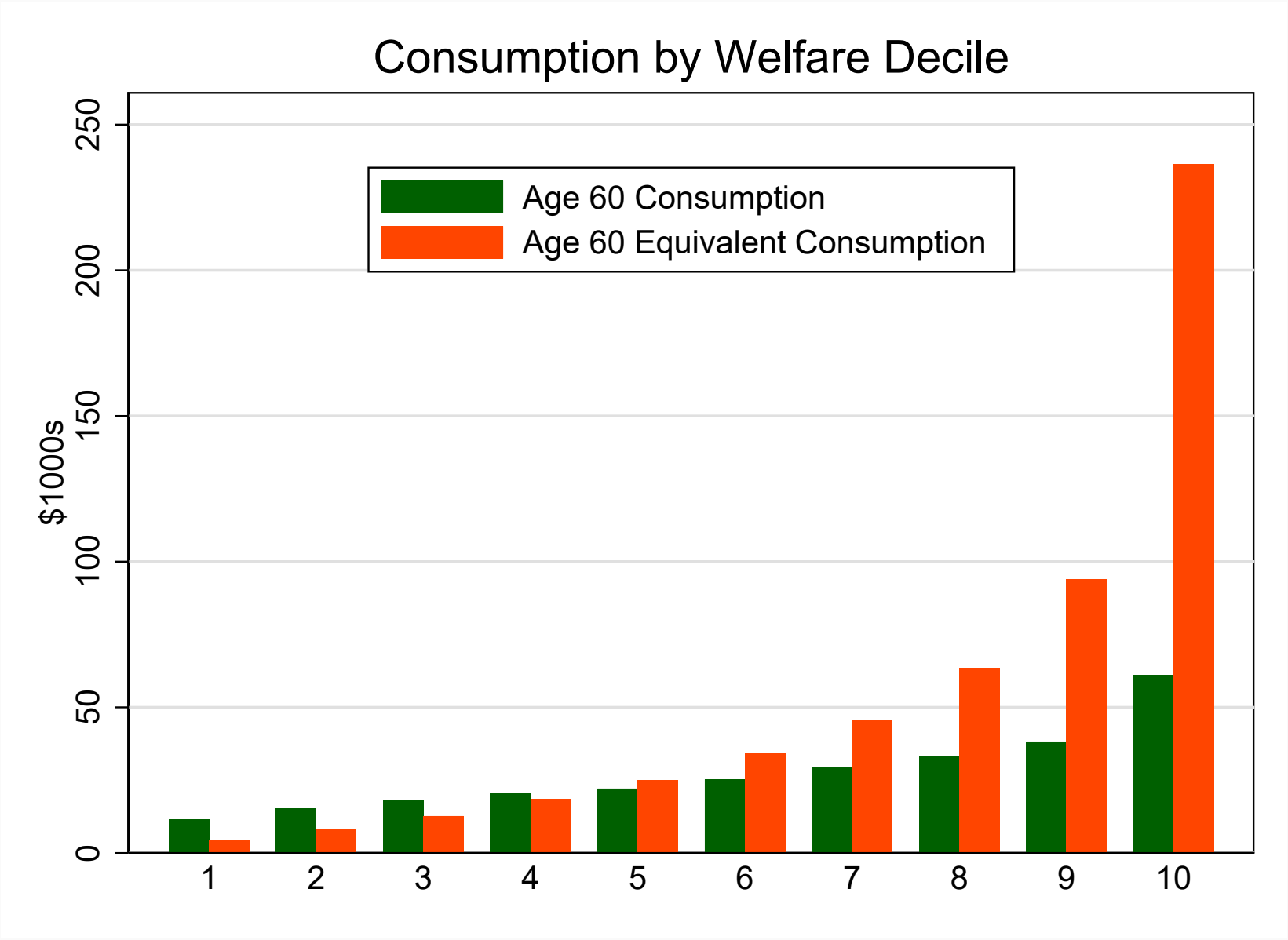

Welfare Dollar Value

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