The Inequality of Lifetime Pension

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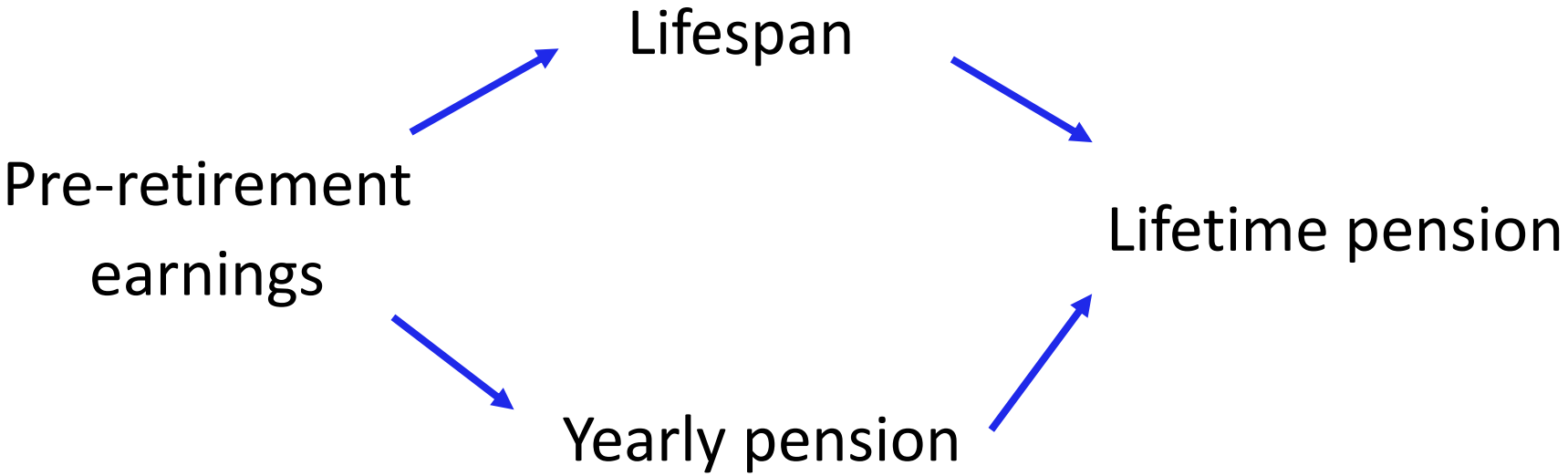
Inequality & population aging

- Inequality research focuses on the working ages
- Older people are not homogeneous
- Less know about inequality in pension income, the major source of income in later life
- Prior work
  - Yearly old-age income
  - Net pension wealth
    - Based on pension plans
    - Strong assumptions on mortality

The present study

- Most prior studies use a cross-sectional approach
  - Living standards & consumption ability
- We take a cohort approach: Lifetime pension
  - From retirement onset to death
  - Individual experience over the life course
  - How pension systems distribute incomes across members of the same generation?



Individual-level lifetime pensions are determined by lifespan and pre-retirement earnings.

Population-level lifetime pension inequality is determined by the inequalities in lifespan and pre-retirement earnings.

Between- vs. within-group inequalities

Between-group inequality compares the averages of groups.

- One average, men in the top 20% earn 4 million SEK more than men in the bottom 20% (Shi & Kolk 2021).

Within-group inequality measures the variation across individuals.

- The majority of variation is within-group.

We focus on individual-level inequality in lifetime pension.

Data

Swedish registrations covering the entire population

1918–1939 cohorts, born in Sweden, never migrated after age 50

Lifetime pension: accumulated annual pension incomes from age 65 to death. Inflation adjusted. All kinds of pension payments. Bottom coded as 3,000 SEK.

Earnings: average yearly earnings over ages 50–59, inflation adjusted. Bottom coded as 3,000 SEK.

Lifespan: Observed age at death + simulated age at death

Control variables: occupation, education, civil status, urban residence

Simulating of age at death

Gompertz relationship: $log(m(a)) = \alpha + \beta a$

Step 1: Estimation

Predictors: age, earnings (quintile), cohort, age * earnings, age * cohort

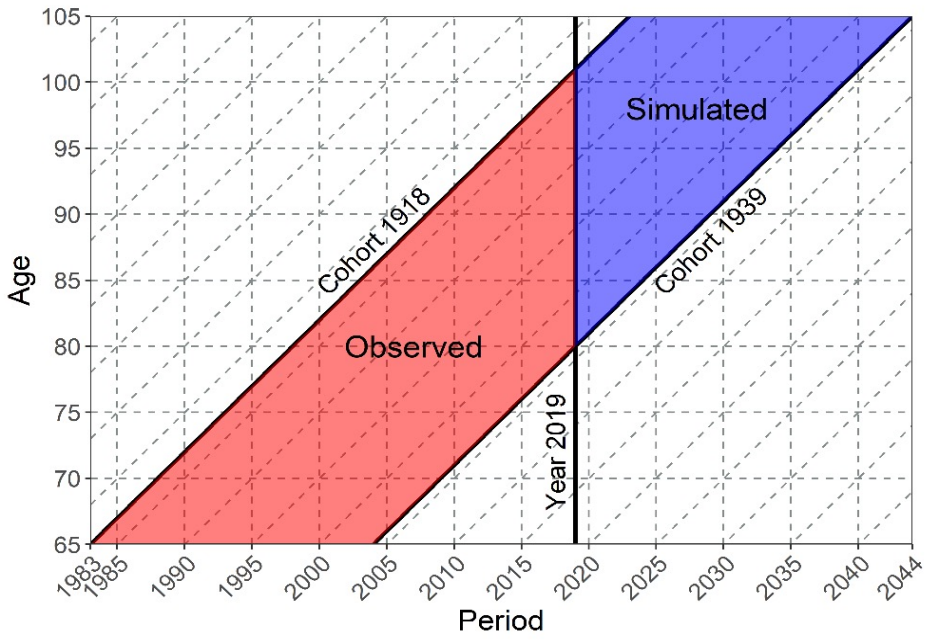
Step 2: Prediction

Step 3: Adjustment

Mortality forecasts (Statistics Sweden)

Step 4: Simulation

For individuals who survived to 2019



How large is lifetime pension inequality?

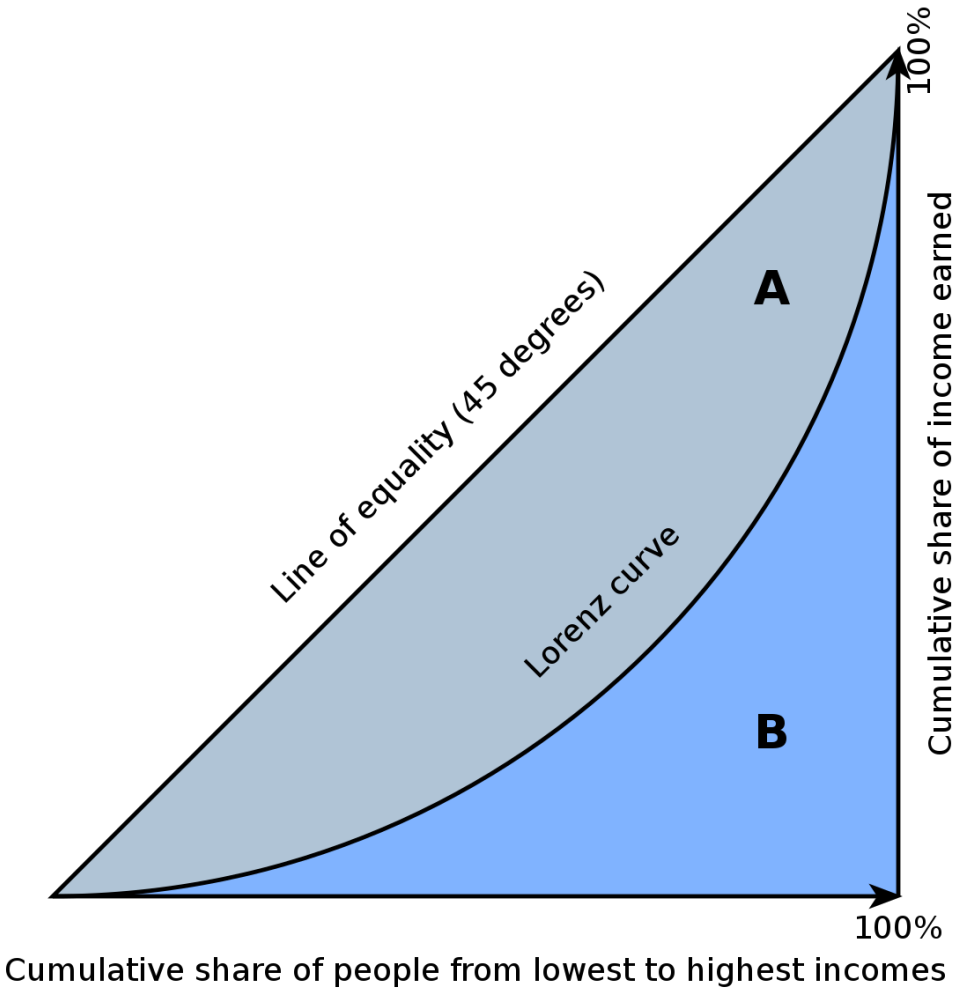
The Lorenz curve and the Gini coefficient

$$G = \frac{A}{A + B} = 2A$$

$(A + B = \frac{1}{2})$

Individual-level interpretation

Average difference between any two random individuals with respect to the mean



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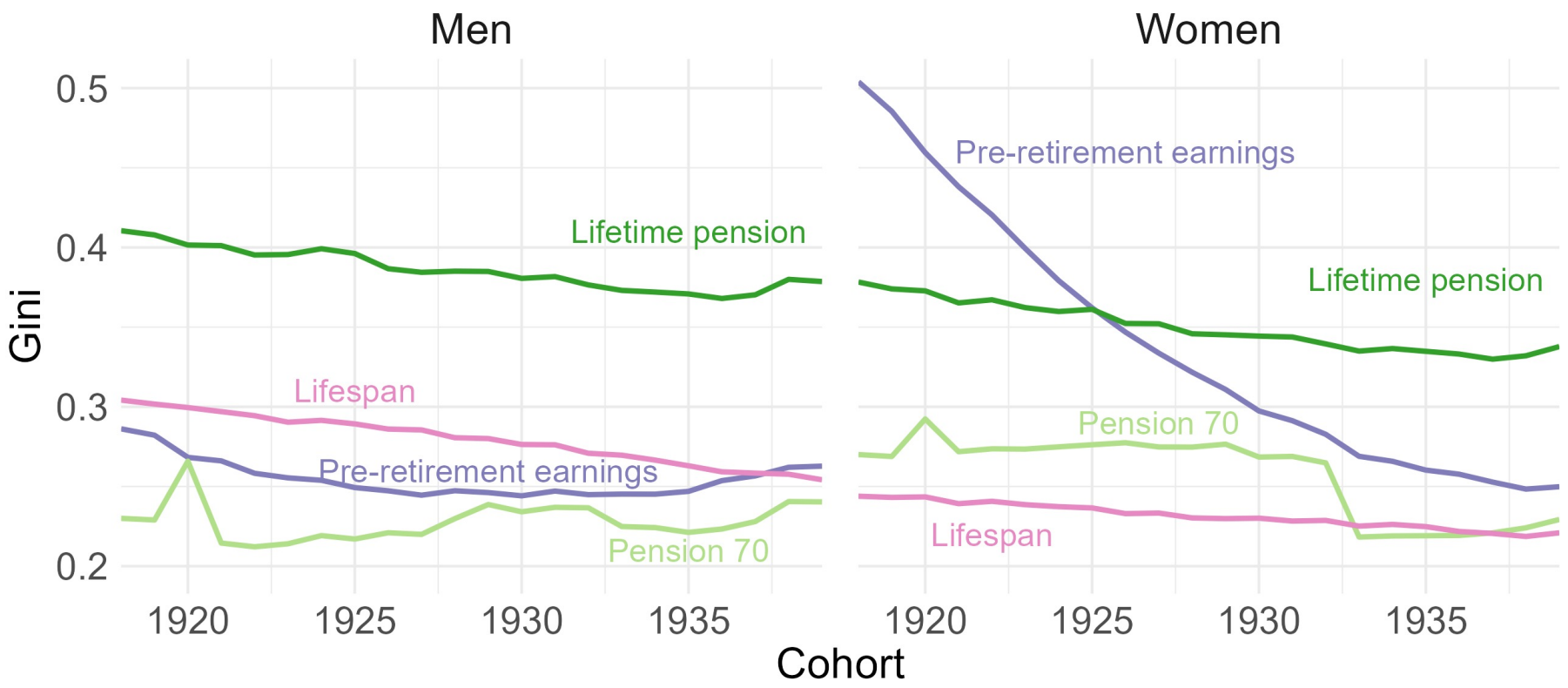
Individual-level interpretation
Average difference between any two random individuals with respect to the mean

How has lifetime pension inequality changed across cohorts?



What contributed more to cohort changes in lifetime pension inequality?

Standardization (Reweighting)

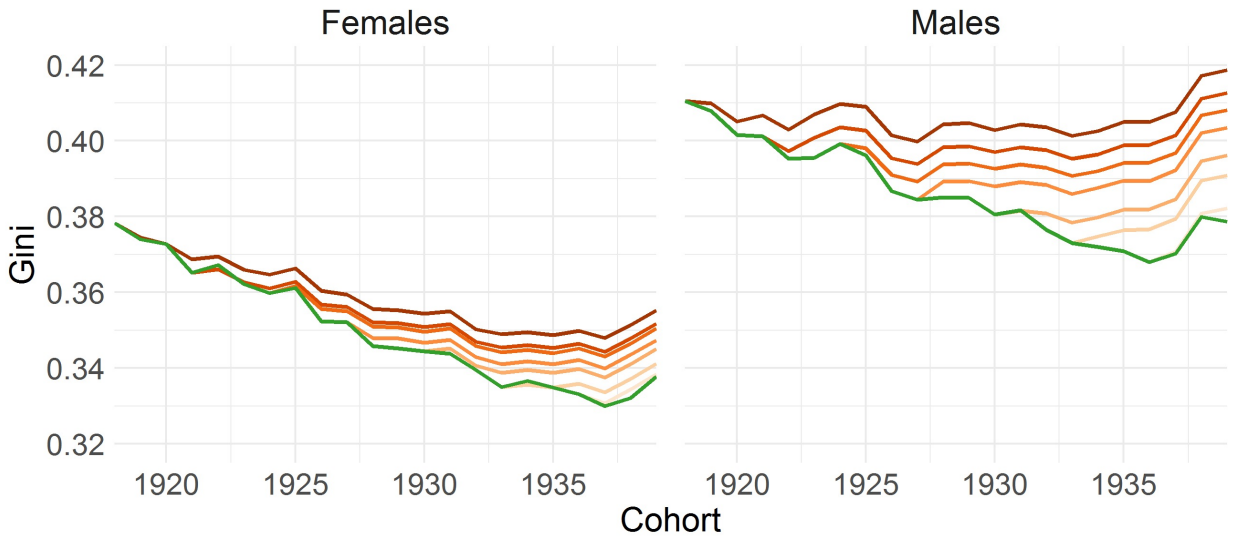
E.g., what if lifespan/earnings distribution has remained constant since 1918?

1. Apply weights to individuals in population B (later cohort) so that the density of earnings of population B becomes the same as that of population A (earlier cohort).

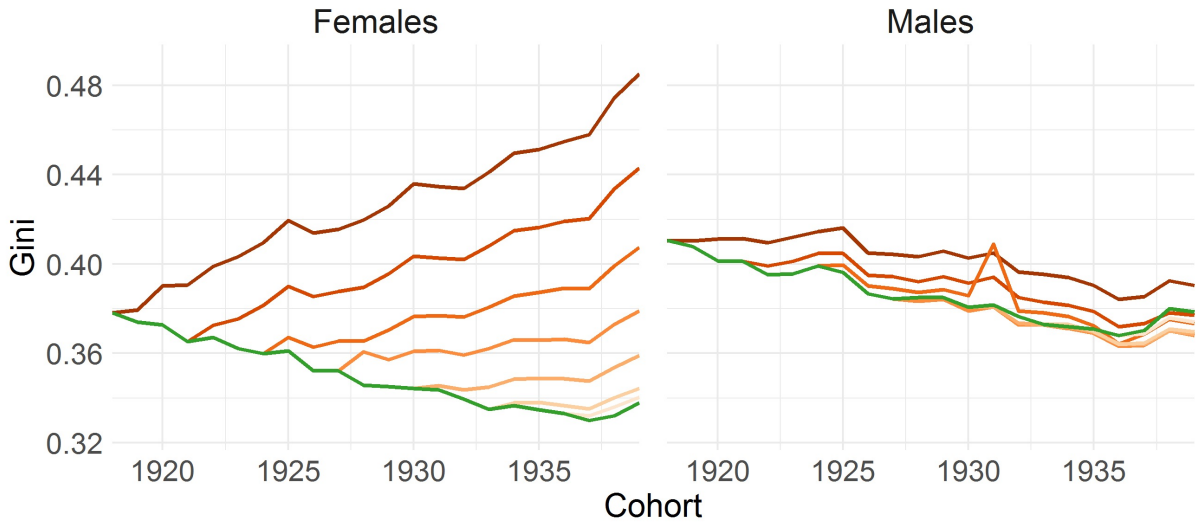
$$Weight = \frac{density\ in\ A}{density\ in\ B}$$

2. Recalculate inequality

Standardization based on lifespan distributions



Standardization based on earnings distributions



Shortcomings:

(1) Only considers compositional changes in the independent variable
(2) Not controlling for other covariates

What explains more inequality for a given cohort?

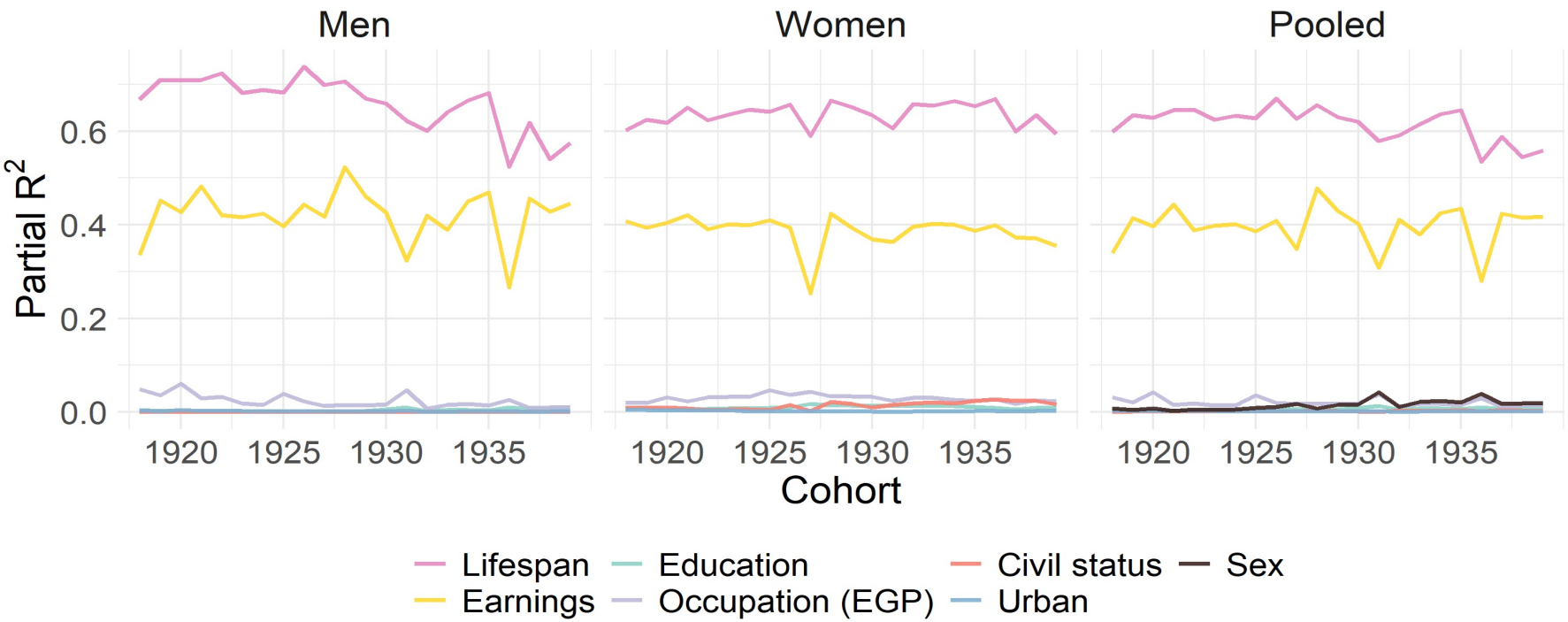
The partial R^2 to detect relative importance of predictors

The proportion of the variance not explained by other control variables but explained by the main predicting variable K

$$\text{Partial } R^2 = \frac{R^2 - R^2_{-K}}{1 - R^2_{-K}}$$

- R^2: variance explained by all covariates in the full model
- R^2_{-K}: variance explained by all covariates in the model where variable K is removed.

Partial R^2



Shortcomings

(1) Not a usual inequality index for income

(2) Only tells the relative importance, but not actual contributions, which are more relevant to public policy

(3) Partial R^2 may drift in either direction on occasions when the covariate actually leads to an increase in total inequality (Zhou 2014)

Decomposing the Gini coefficient

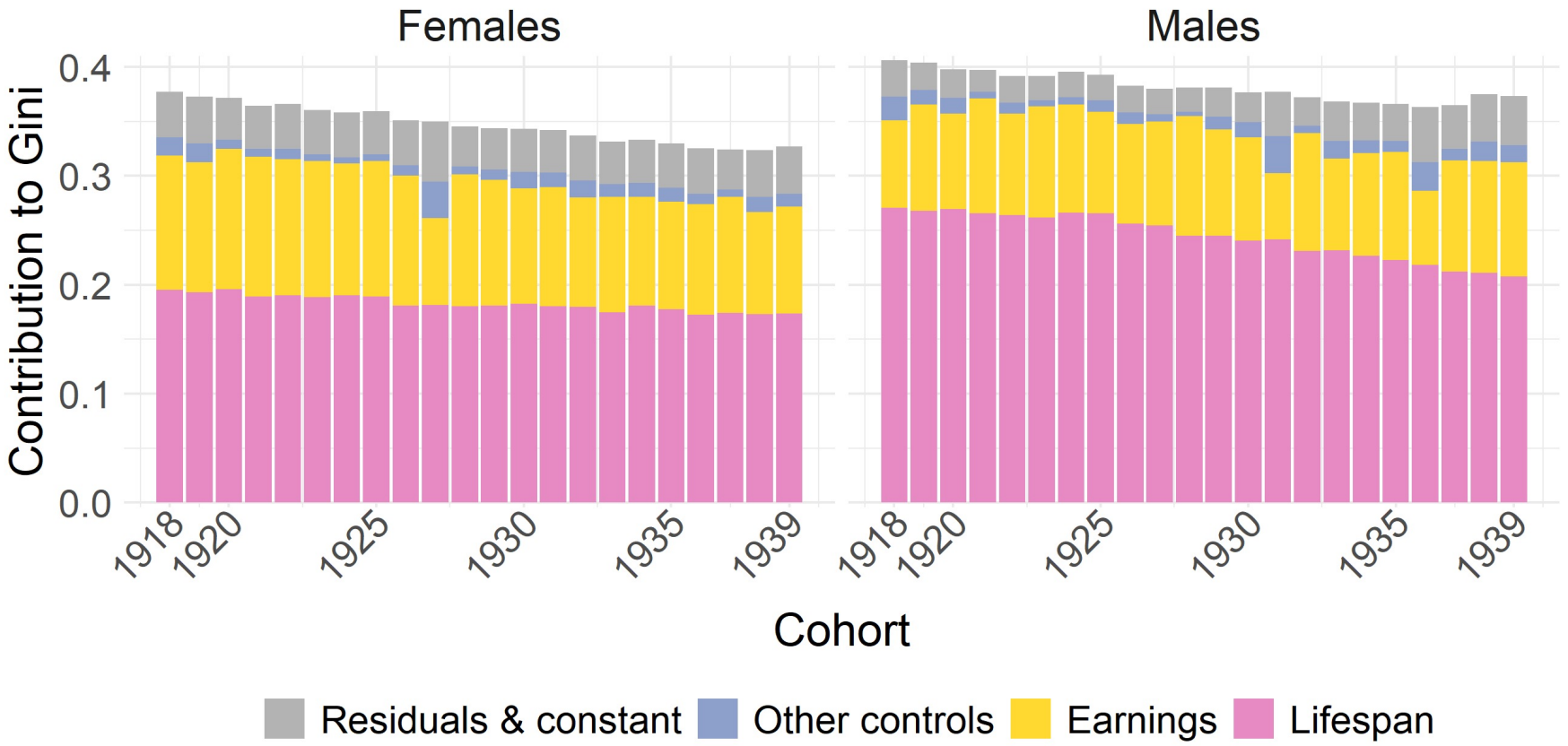
(Wagstaff, van Doorslaer, and Watanabe, 2003)

An alternative way of calculating Gini: $$G = \frac{2}{n\mu}\sum_{i=1}^{n} y_i R_i - 1 \qquad (1)$$

Regressing Y on predicting variables: $$y_i = \alpha + \sum_k \beta_k x_{ki} + \epsilon_i \qquad (2)$$

Substituting Eq. (2) into Eq (1): $$G = \sum_k \underbrace{\left(\frac{\beta_k \bar{x}_k}{\mu}\right) C_k}_{\text{Contribution of variable } k} + \underbrace{\frac{GC\epsilon}{\mu}}_{\text{Contribution of residuals}} \qquad (3)$$

Decomposition



What is more important for changes across cohorts?

Changes between 1918 and 1939

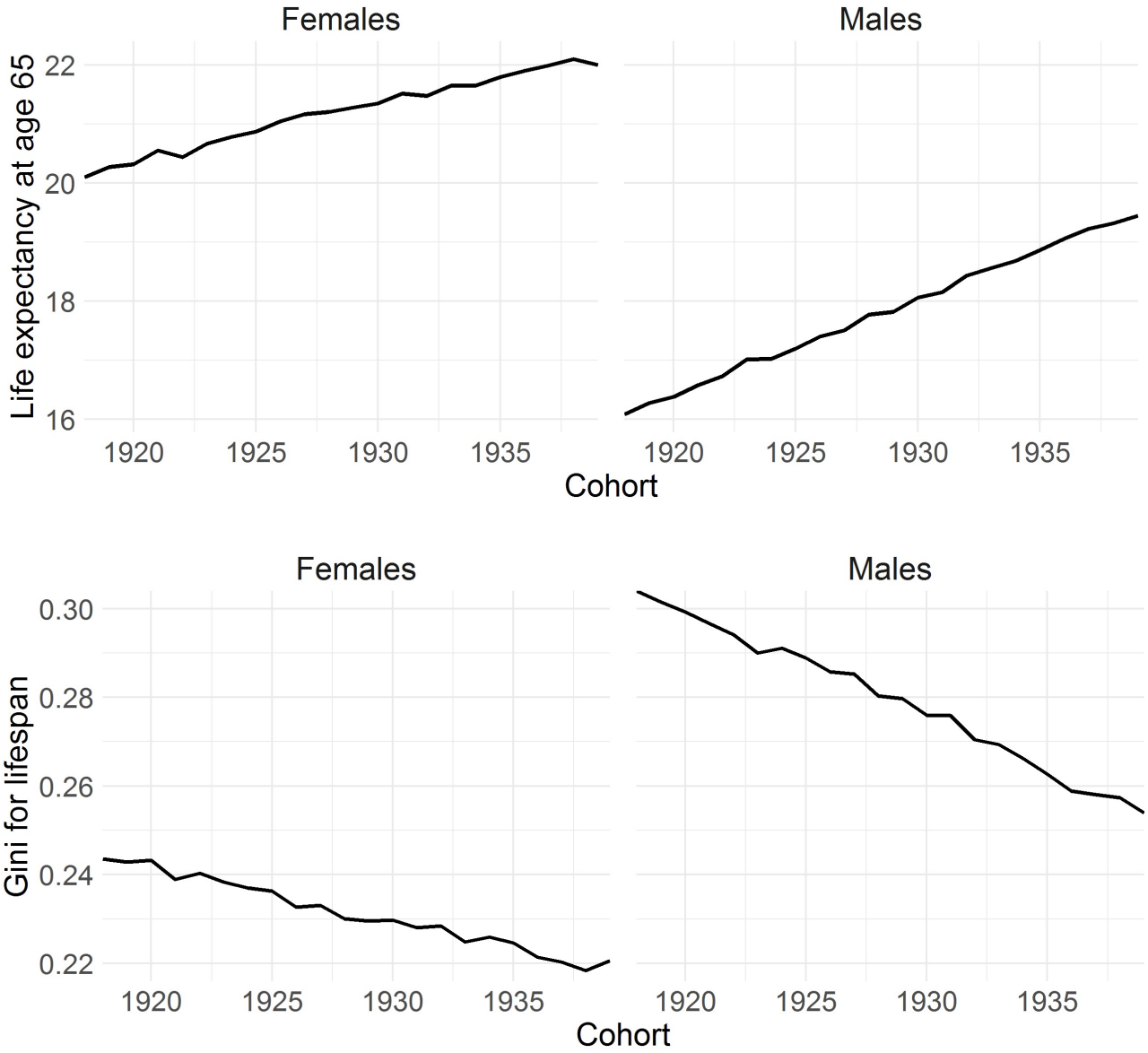
	Females		Males	
	Contribution	Percentage	Contribution	Percentage
Lifespan	-0.022	44.2%	-0.063	191.9%
Earnings	-0.025	49.5%	0.025	-76.1%
Education	0.002	-3.3%	0.003	-9.7%
Occupation	-0.008	15.1%	-0.009	27.3%
Civil status	0.002	-4.7%	0.000	0.8%
Urban residence	-0.001	2.6%	0.000	1.4%
Residual	0.002	-3.5%	0.012	-35.5%
Total	-0.050	100.0%	-0.033	100.0%

Summary

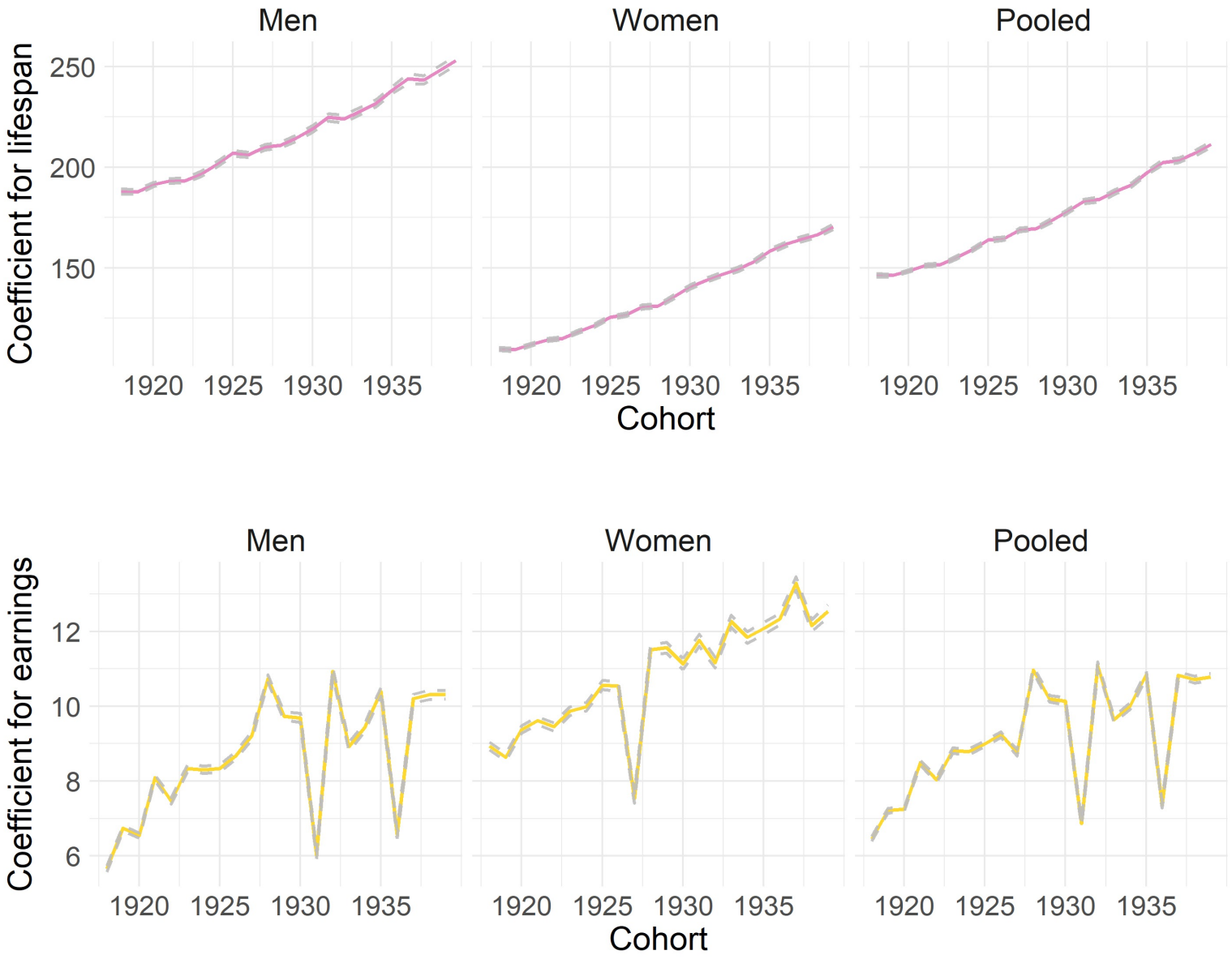
- Lifetime pension is more unequal than yearly labor earnings and yearly pension income.
- Within cohorts, variation in lifetime pension is mainly explained by variation in lifespan, and the share is relatively stable across cohorts.
- Across cohorts, lifespan inequality declined over time.
  - For women, this was driven by changes in both lifespan and earnings.
  - For men, lifespan offset the opposite effects of earnings, and is the most important factor
  - Changes in occupational structure also played an important role

	Mean pension at age 80 (1000 SEK)		average % change in income for an individual					
			1 year later		5 year later		10 year later	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Men								
Bottom 20%	125.49	25.13	-0.84	10.67	0.60	6.58	1.52	6.28
Second 20%	170.52	6.99	0.40	1.74	0.49	5.12	0.35	5.93
Third 20%	195.05	7.55	0.33	1.75	0.28	3.99	0.10	5.50
Fourth 20%	228.69	12.31	0.06	2.26	-0.24	5.00	-0.46	6.74
Top 20%	338.06	145.77	-0.57	4.50	-1.25	7.65	-1.56	9.46
Total	211.67	97.87	-0.12	5.40	-0.06	5.88	-0.15	7.18
Women								
Bottom 20%	73.35	10.63	-0.56	68.85	-0.90	12.20	0.72	20.90
Second 20%	93.80	4.18	-0.55	6.68	-1.97	27.09	-1.99	33.98
Third 20%	112.12	6.98	-0.06	8.95	-0.26	16.92	0.04	14.86
Fourth 20%	142.55	10.83	0.06	4.64	0.13	11.20	0.99	16.93
Top 20%	209.30	61.53	-0.31	4.26	-0.73	19.35	-0.46	11.20
Total	126.55	55.11	-0.28	30.11	-0.76	18.56	-0.20	21.23

Life expectancy and lifespan inequality




Lifespan at age 65, men
Years
Cohort
Pre-retirement earnings, men
1000 SEK
Cohort
Lifetime pension, men
1000 SEK
Cohort
Q90
Q75
Mean
Q50
Q25
Q10
Lifespan at age 65, women
Years
Cohort
Pre-retirement earnings, women
1000 SEK
Cohort
Lifetime pension, women
1000 SEK
Cohort


Men
Women
Pooled
Coefficient for lifespan
250
200
150
1920
1925
1930
1935
Cohort
Men
Women
Pooled
Coefficient for earnings
12
10
8
6
1920
1925
1930
1935
Cohort