The Evolution of Social Mobility

Norway over the 20th Century

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Motivation

- Patterns in social mobility (intergenerational mobility)
  - Nordic countries more mobile than other rich countries
  - less known about changes over time within countries

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Questions

- We know that intergenerational mobility is high today in the Norway and the other Nordic countries, but we do not understand well the process leading up
- Did the importance of family background decrease between children born in the 1930s and 1970s and how?
- What are the transission channels, focus on education and skills
- In a broader project I examine the extent to which the patterns documented here can be attributed to policy vs. other factors
  - Economic growth,structural change
  - Building of the welfare state:
  - Education reforms
  - Poverty relief programs
  - Redistribution
  - Large health investment programs, for instance
    - Mother/child centers

What do we do?

- Analyze the patterns of intergenerational mobility in a period when the welfare state was developed
- Descriptive, aim simply to present details of changing patterns
- Use different standard measures uses in the literature for cohorts 1930-1970
  - Log intergenerational elasticity of mobility of income
  - Brother correlations
  - Also:
  - rank korrelations
  - non-linear rank korrelations and transition matrices
  - Use newly digizalized data, military records and censuses $\rightarrow$ can start from fathers born in the early 20th century

Outline

- Income and family background
  - brother correlations
  - intergenerational income elasticity
  - father-son rank correlation
- Skills and family background
  - Education, IQ test scores
- Nonlinearities
  - transition matrices
  - local rank correlations

Data

Individual-level data

- Decential censuses/population register
  - full population from 1960 onwards
- Improvement of cenusus 1960 data to include
  - parent-child links from children born in 1920s onwards
  - link when and where (municipality) born
- Military records
  - birth cohorts 1932–33 with personal id and can be matched
  - information on occupation and education of their fathers
- Pension register
  - annual income from 1967 onwards
  - incl. some transfers, excl. capital income

Imputation of father income

- Challenge
  - only occupation and municipality observed for fathers born in the turn of the 20th century

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- Solution
  - 1948 tax statistics report average income at occupation–municipality level $\rightarrow$ impute income for all fathers
  - 20 occupations for 735 municipalities; occupations made consistent also up to 1980
  - to-do: alternative imputation approaches to check robustness

Income elasticities and correlations

Elasticities and correlations

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- Measure 1: Brother correlations
  - measure brothers annual income at ages 35–44
- Measure 2: Father-son income elasticities and rank correlations
  - son income: total income over ages 35–44
  - father income: imputed income around the time son is 19

Elasticities and correlations

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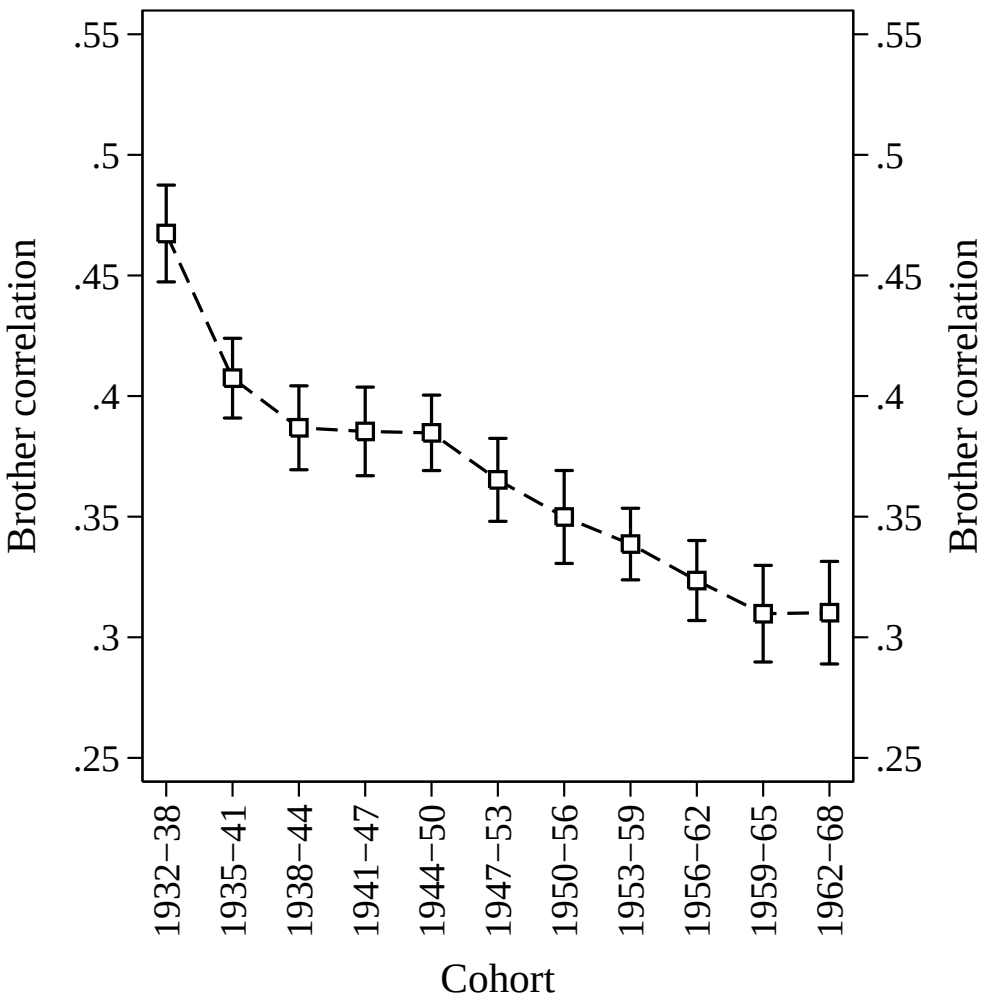
- Measure 2: Father-son income elasticities and rank correlations
  - son income: total income over ages 35–44
  - father income: imputed income around the time son is 19
- Robustness
  - comparison between brother correlations and father-son associations (no imputation for brother correlations)
  - to-do: alternative imputation approaches and real income of the fathers (available for later cohorts)

Brother correlations

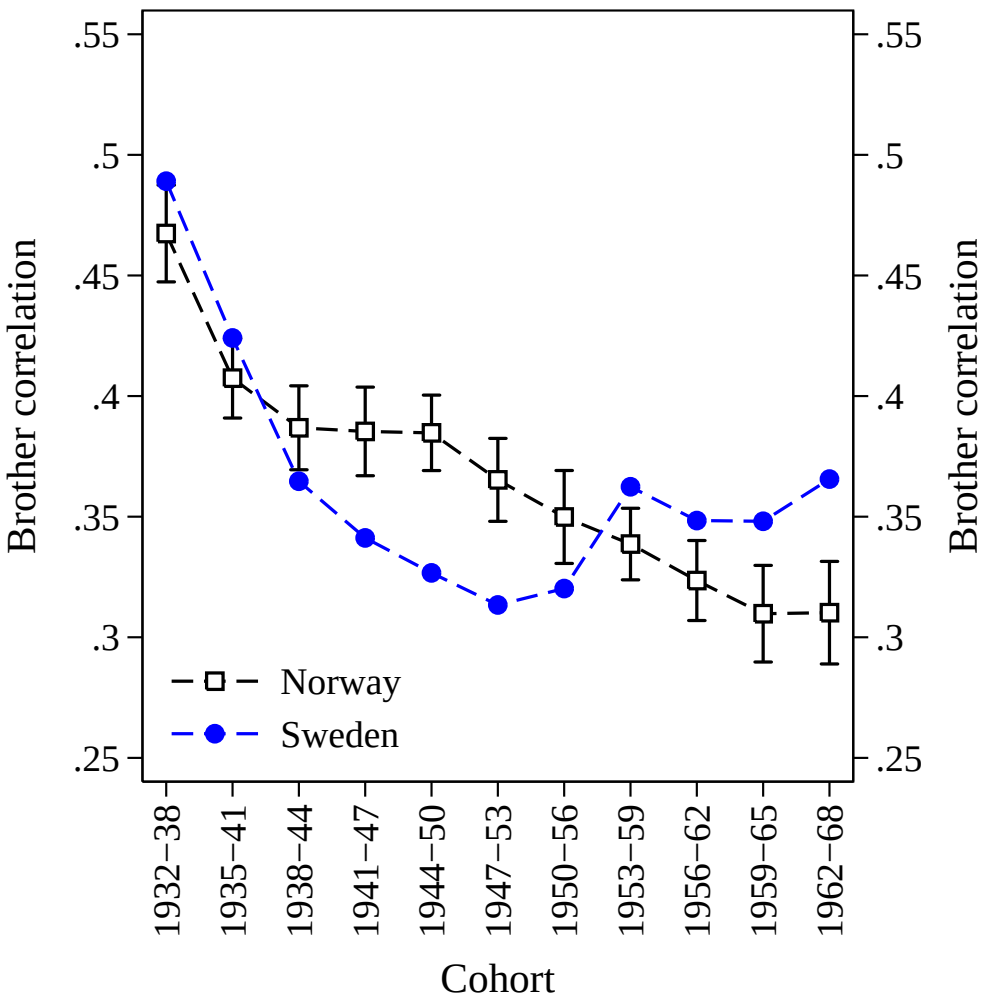


Result 1: Brother income correlations decrease by a third between the 1930s and 1960s (son) birth cohorts

This figure plots brother correlations in log income at ages 35–44 estimated using the approach by Björklund, Jäntti and Lindquist (2009)

Typically interpretted as an omnibus measure of family and community effects

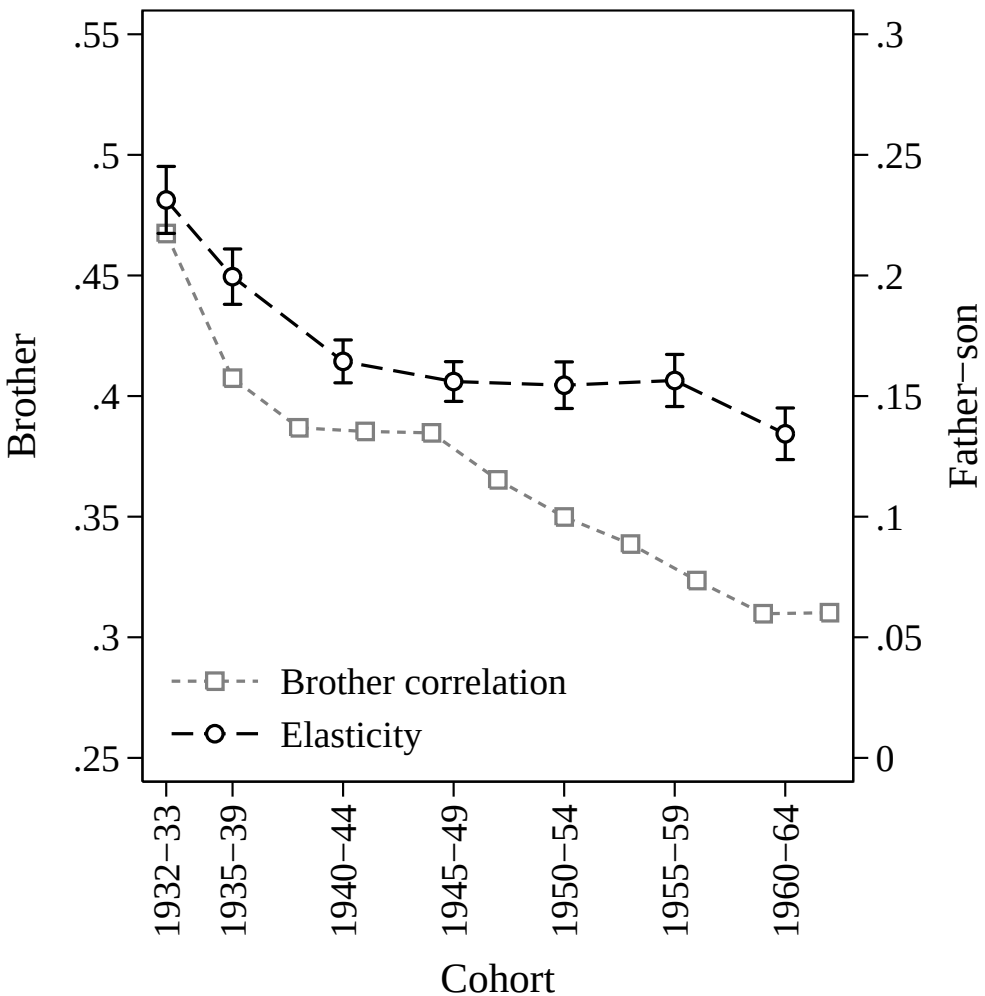
Brother correlations: Norway vs Sweden



The early drop is very similar to what BJL find for Sweden, but the patterns differ from 1940s birth cohorts onwards

Note that the two series are fully comparable (same methods, very similar data)

Intergenerational income elasticity



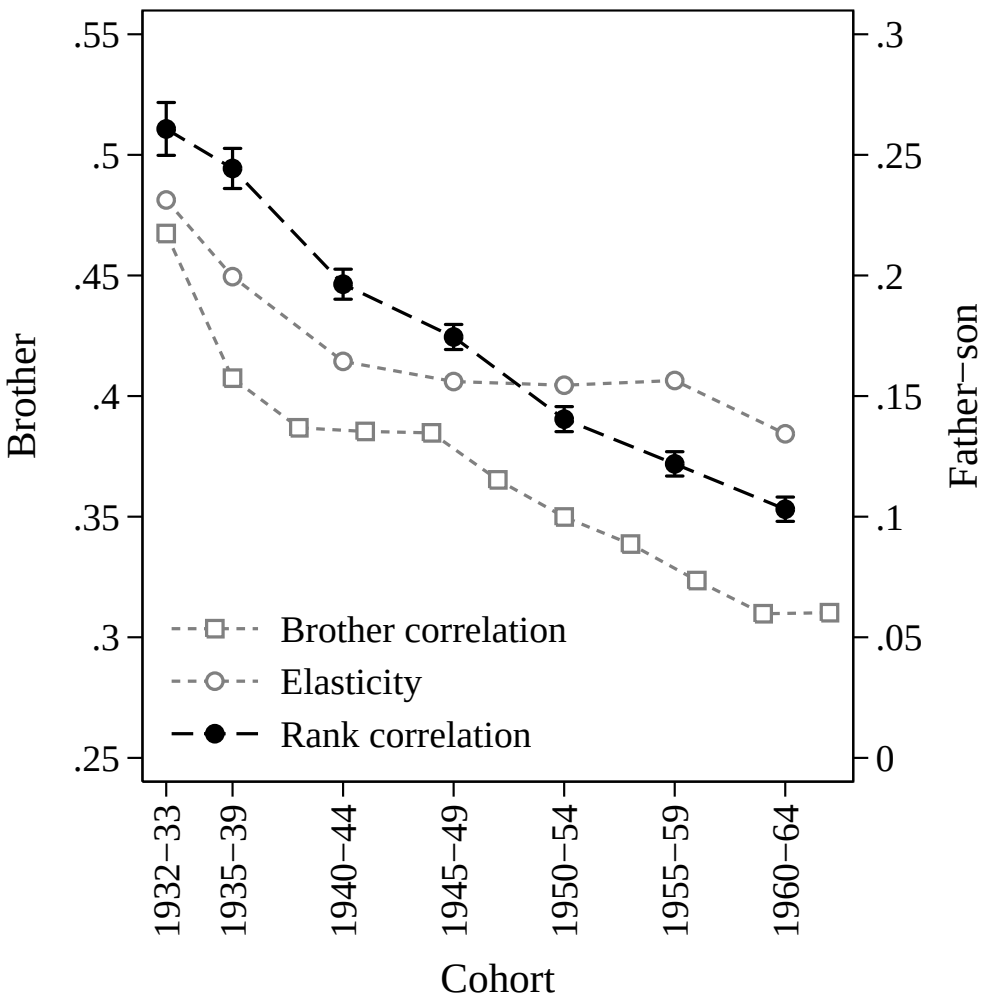
Result 2: Father-son income elasticity almost halves between the 1930s and 1960s (son) birth cohorts

This figure plots $\hat{\beta}$s from

$$y_s = \alpha + \beta y_f + \epsilon$$

where y_s is the log of son's total income between ages 35–44 and y_f is his father's log imputed income

Intergenerational income rank correlation



Result 2b: The rank-rank correlation decreases even more

This figure plots $\hat{\beta}$s from

$$y_s = \alpha + \beta y_f + \epsilon$$

where y_s is son's within birth cohort rank (total income between ages 35–44) and y_f is the rank of his father's imputed income

- Thus far: association between family background and income decreased between the 1930s and 1960s birth cohorts

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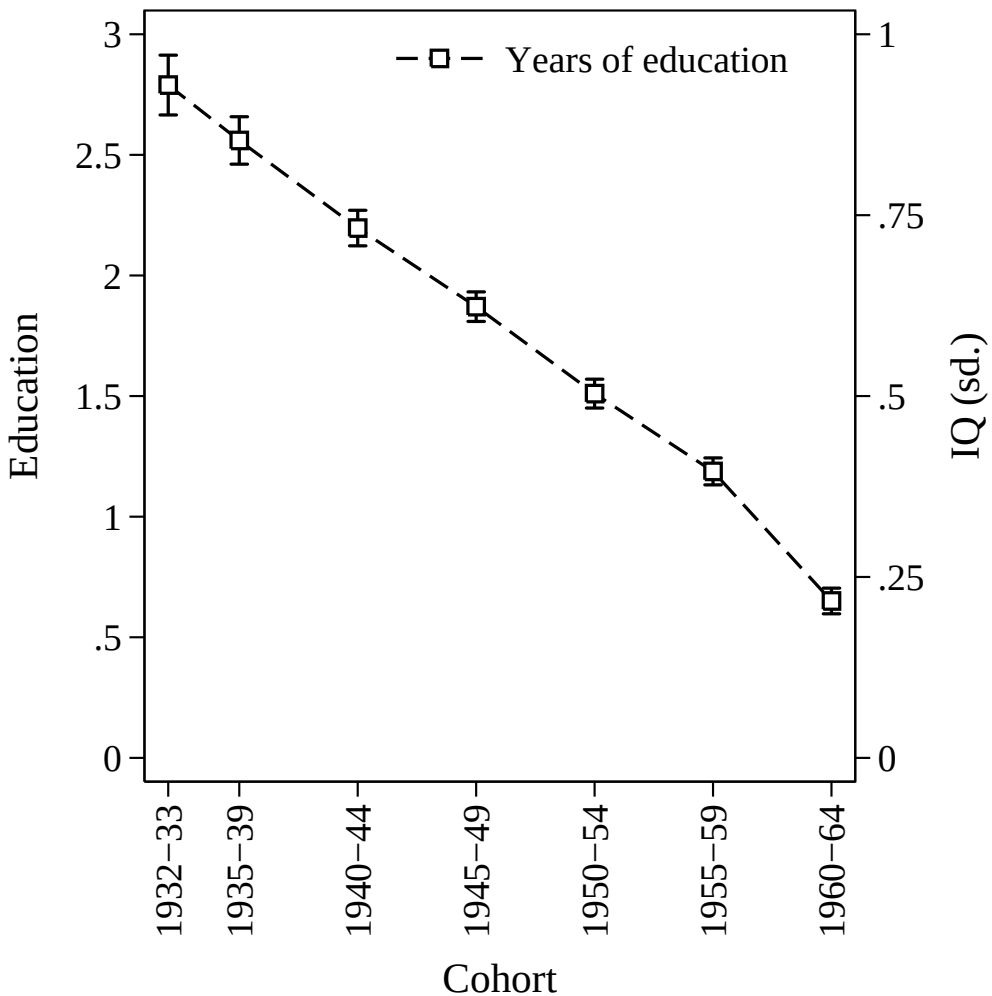
- These changes may be driven by many factors that affect
- Next: two measures of skills and retruns to skills in this period
  - years of education
  - Skils or IQ (test taken at age 19 at the mandatory military service)

Years of education and fathers income rank



Result 3: The assocation between son's years of education and father's income rank drops dramatically

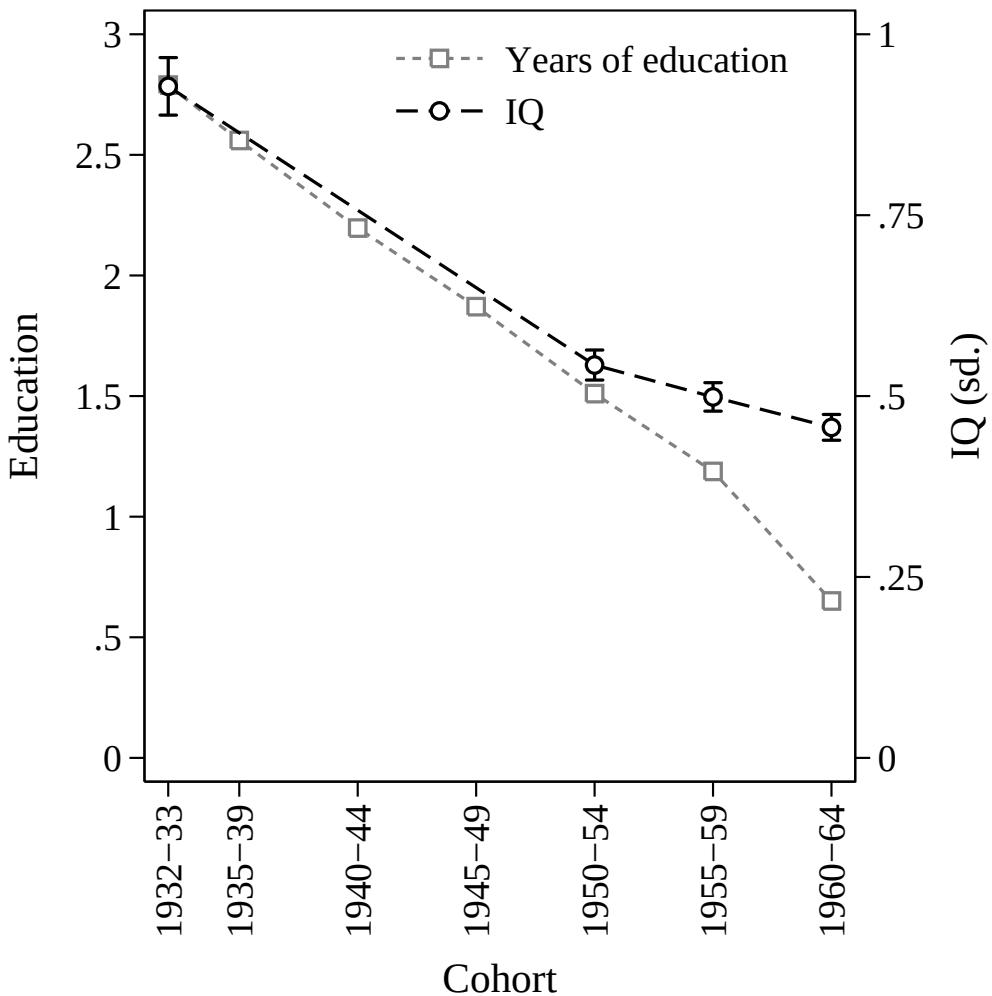
This figure plots $\hat{\beta}$s from

$$E_s = \alpha + \beta y_f + \epsilon$$

where E_s is son's years of education and y_f is the rank of his father's imputed income

Interpretation: average years of education between families at the top and bottom of the income distribution decreased from 2.79 to 0.65

IQ test scores and fathers income rank



Result 3b: ... and so does the assocation between son's IQ test scores and father's income rank

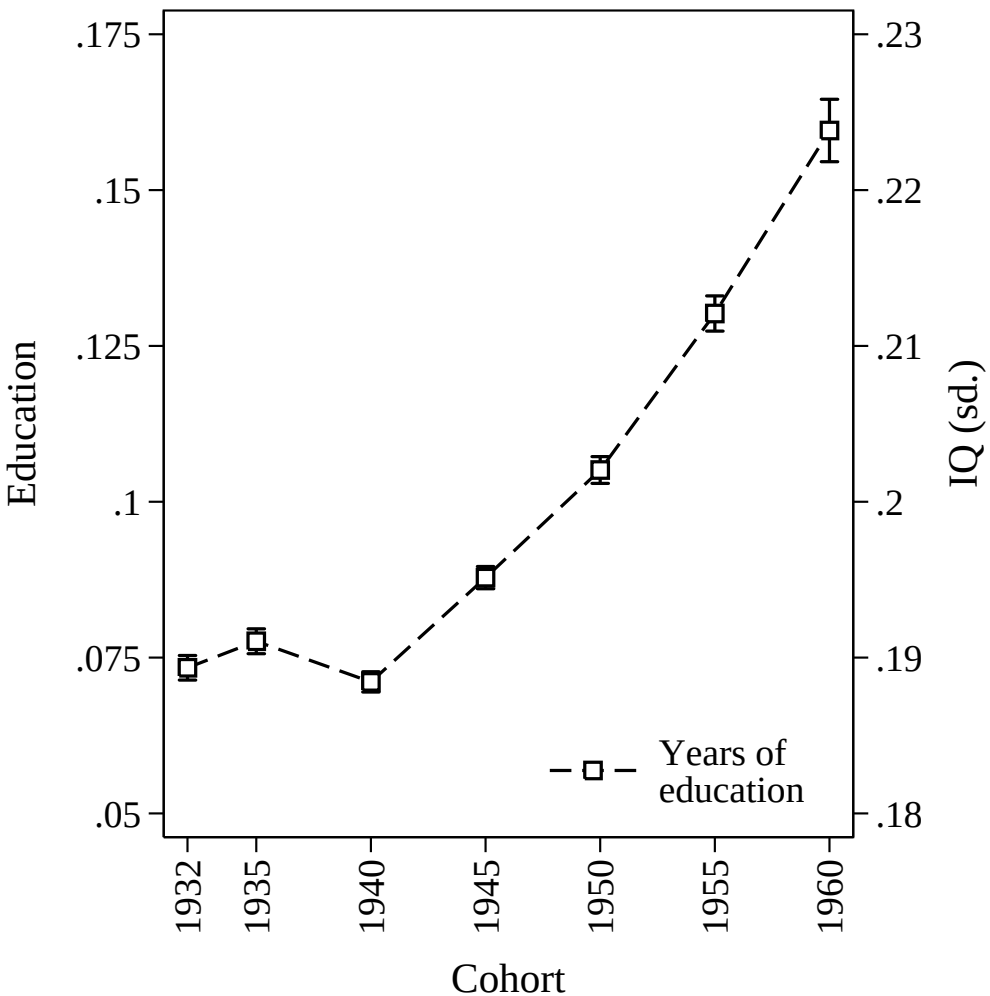
This figure plots $\hat{\beta}$s from

$$IQ_s = \alpha + \beta y_f + \epsilon$$

where IQ_s is son's IQ test score (standard deviations) and y_f is the rank of his father's imputed income

Interpretation: average years of education between families at the top and bottom of the income distribution decreased from 0.93 to 0.46 standard deviations

Years of education and income



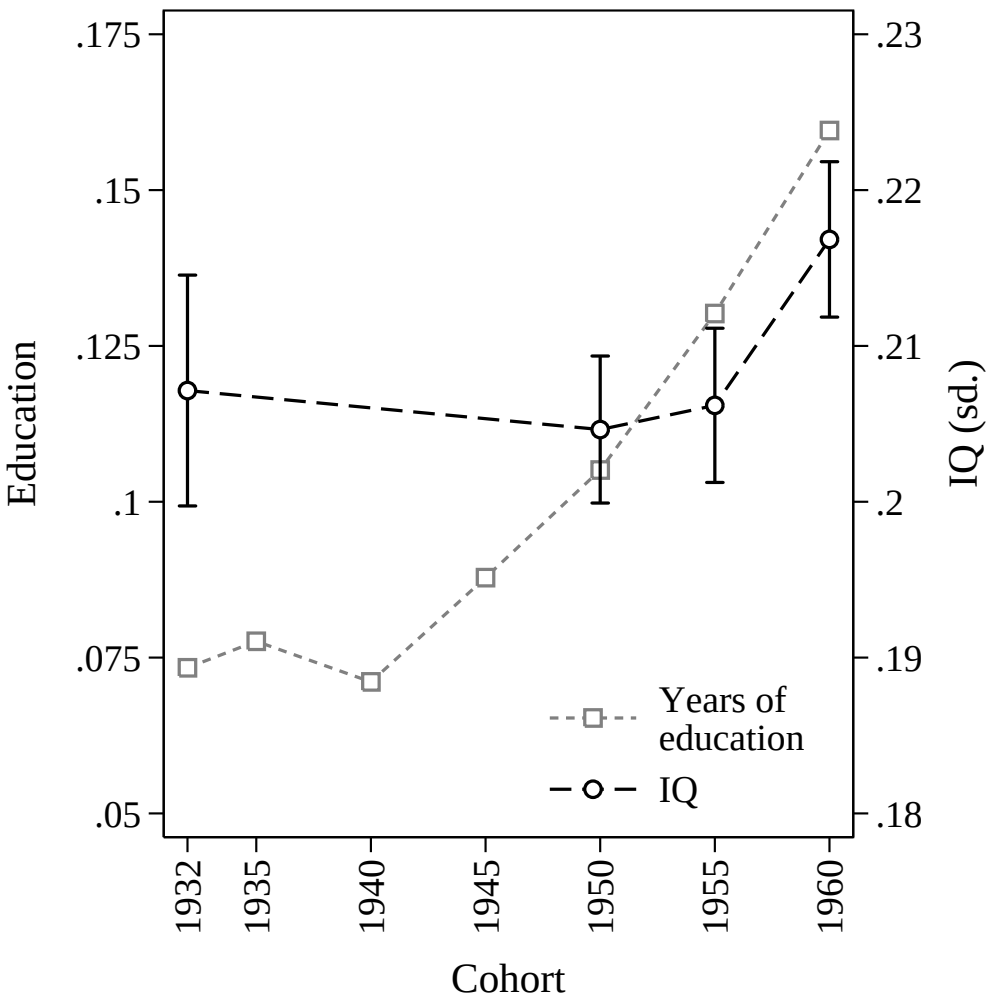
Result 4: The assocation between years of education and income doubled

This figure plots $\hat{\beta}$s from

$$y_s = \alpha + \beta E_s + \epsilon$$

where y_s is the log of son's total income between ages 35–44 and E_S is his years of education

IQ test scores and income



Result 4b: The assocation between IQ test scores and income has increased slightly

This figure plots $\hat{\beta}$s from

$$y_s = \alpha + \beta IQ_s + \epsilon$$

where y_s is the log of son's total income between ages 35–44 and IQ_s is his IQ test score at age 19

Nonlinearities

Nonlinearities

- Single numbers characterizing intergenerational mobility may miss important parts of the story
  - mobility among elite, middle-class, poor might differ
  - ... and change differently
- We use two complementary approaches to summarize the data
  - transition matrices
  - local associations over the fathers' income distribution

Transition matrices

Cohort: 1932–33

Father quantile	Son quintile 1	2	3	4	5	
1	0.26	0.25	0.22	0.16	0.11	1
2	0.22	0.25	0.21	0.18	0.13	1
3	0.17	0.23	0.22	0.21	0.18	1
4	0.13	0.18	0.23	0.23	0.24	1
5	0.11	0.13	0.17	0.23	0.36	1

Cohort: 1960–64

Transition matrices

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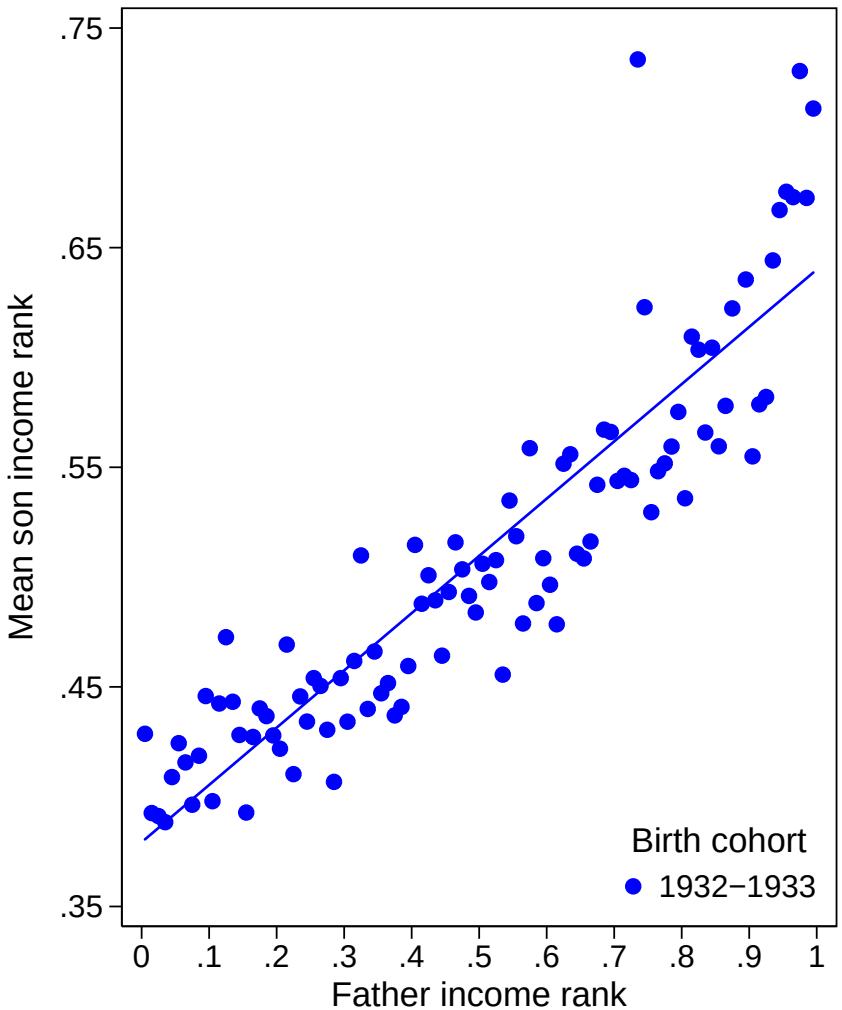
Cohort: 1960–64

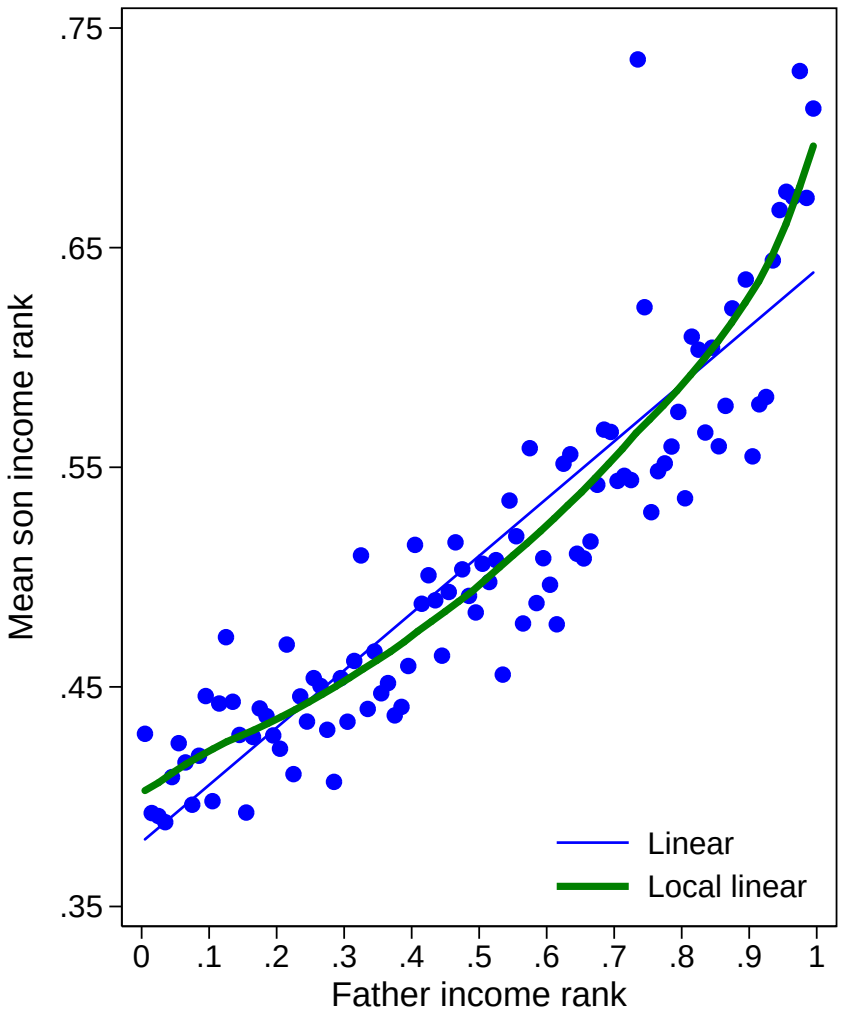
Father quantile	Son quintile 1	2	3	4	5	
1	0.23	0.24	0.21	0.18	0.14	1
2	0.18	0.21	0.22	0.21	0.18	1
3	0.19	0.20	0.21	0.21	0.20	1
4	0.20	0.18	0.20	0.20	0.22	1
5	0.19	0.16	0.17	0.21	0.27	1

Local linear estimates



This figure plots the association between son's average income rank as a function of his father's income rank for the 1932–33 (son) birth cohort

Local linear estimates



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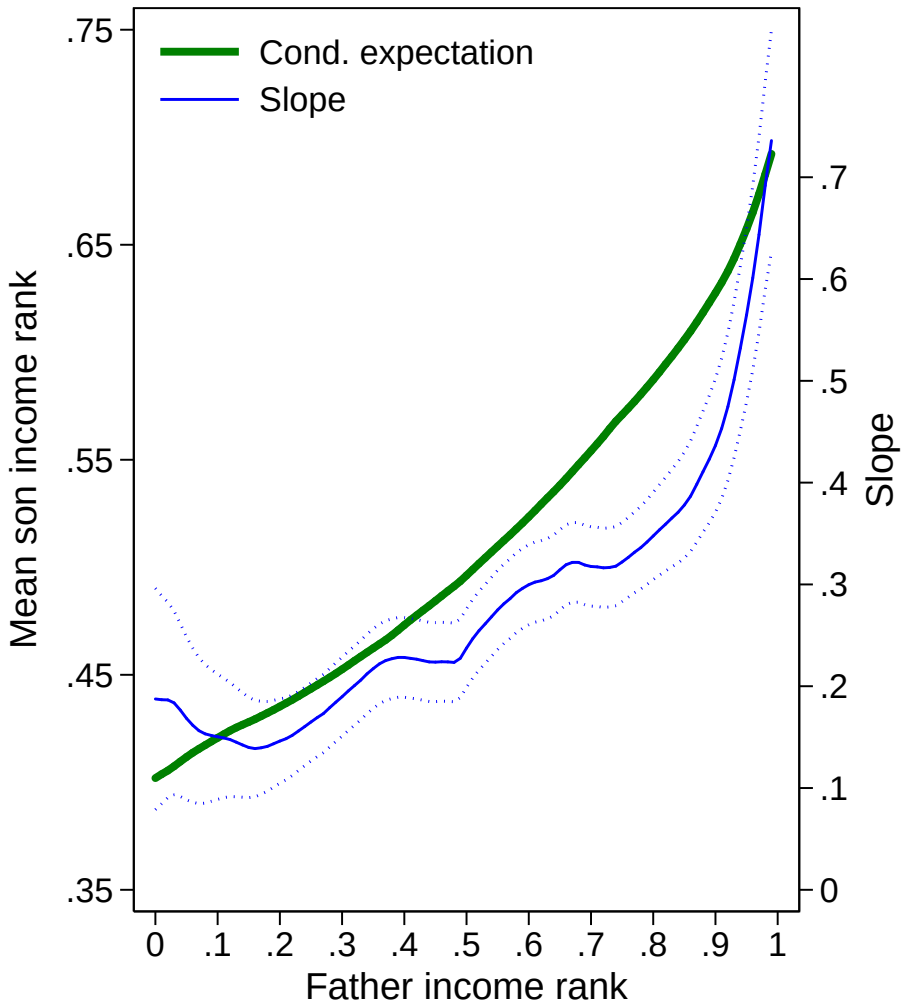
Now add local linear fit

Local linear estimates



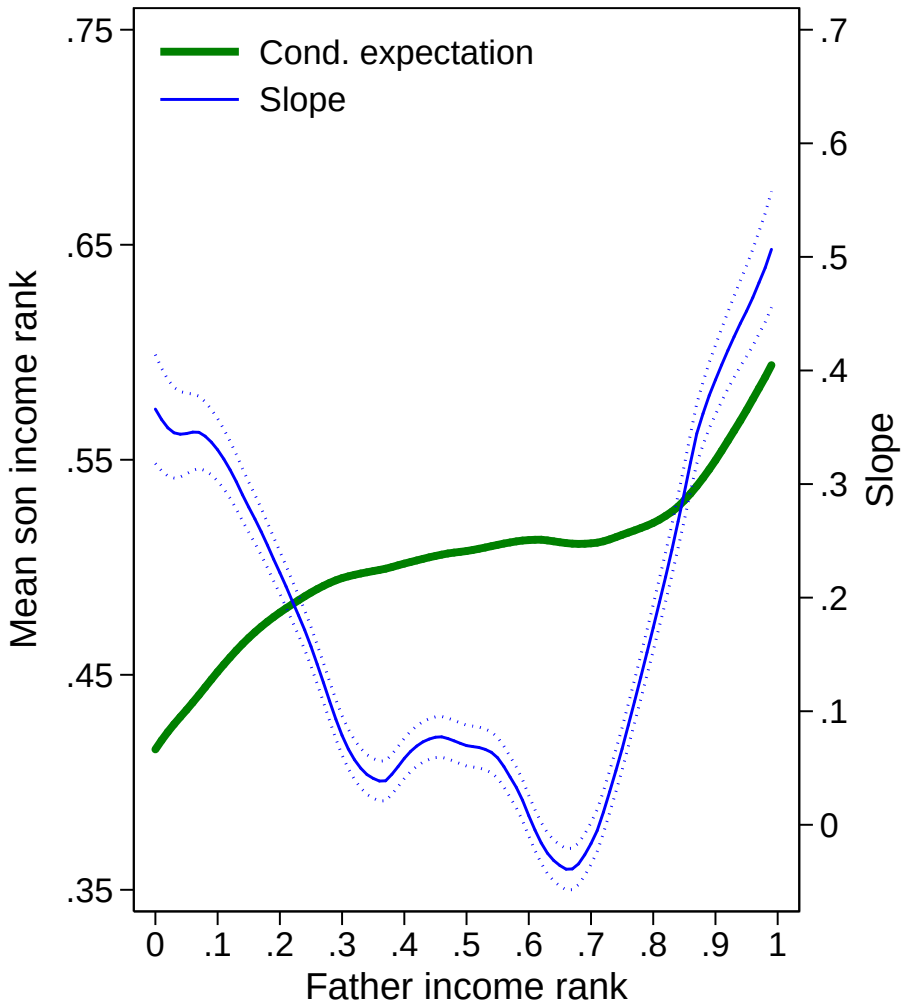
This figure plots the association between son's average income rank as a function of his father's income rank for the 1932–33 (son) birth cohort

Now add local linear fit
... and plot its slope

Interpretation: marginal changes in father's rank matter more as we move up the income distribution

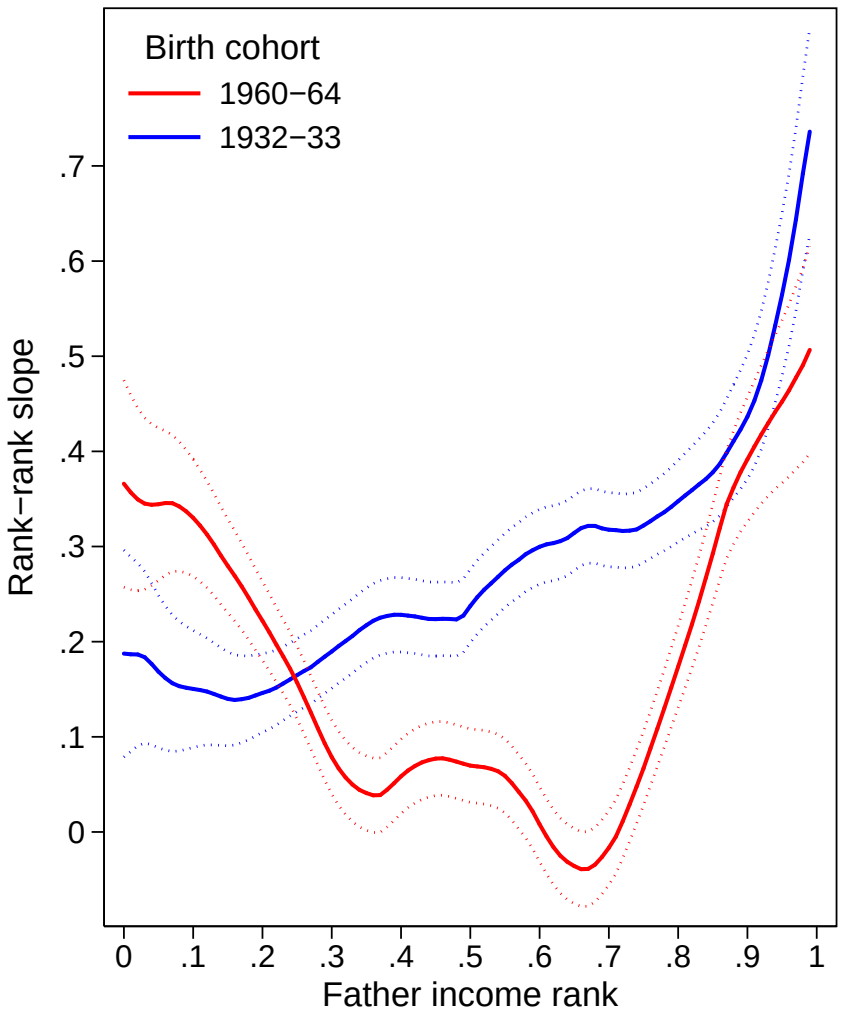
Note: this differs from Chetty et al (2014) finding of a linear rank-rank assocation in the U.S.

Local linear estimates



Let's do the same for 1960–64 cohort

Local linear estimates

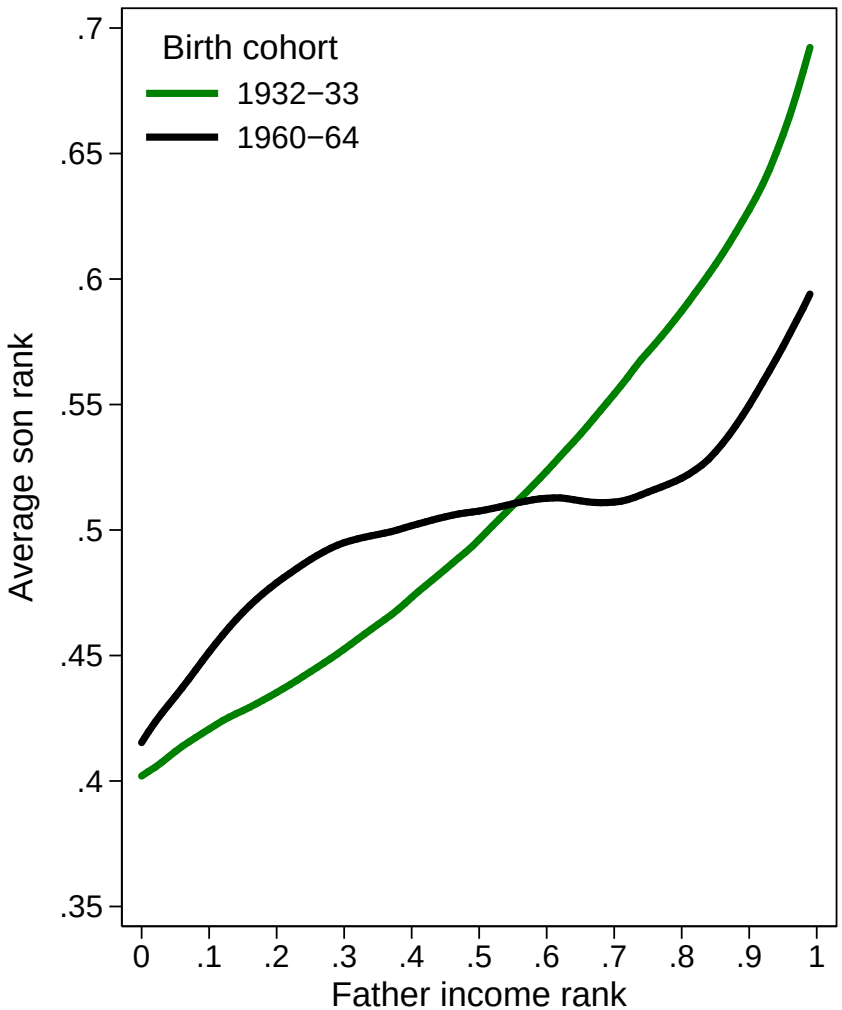


Let's do the same for 1960–64 cohort ... and compare to 1932–33 cohort

Interpretation:
Within the middle-class, fathers income rank becomes a weak predictor of sons income rank

Local associations become stronger at the bottom, weaker at the top

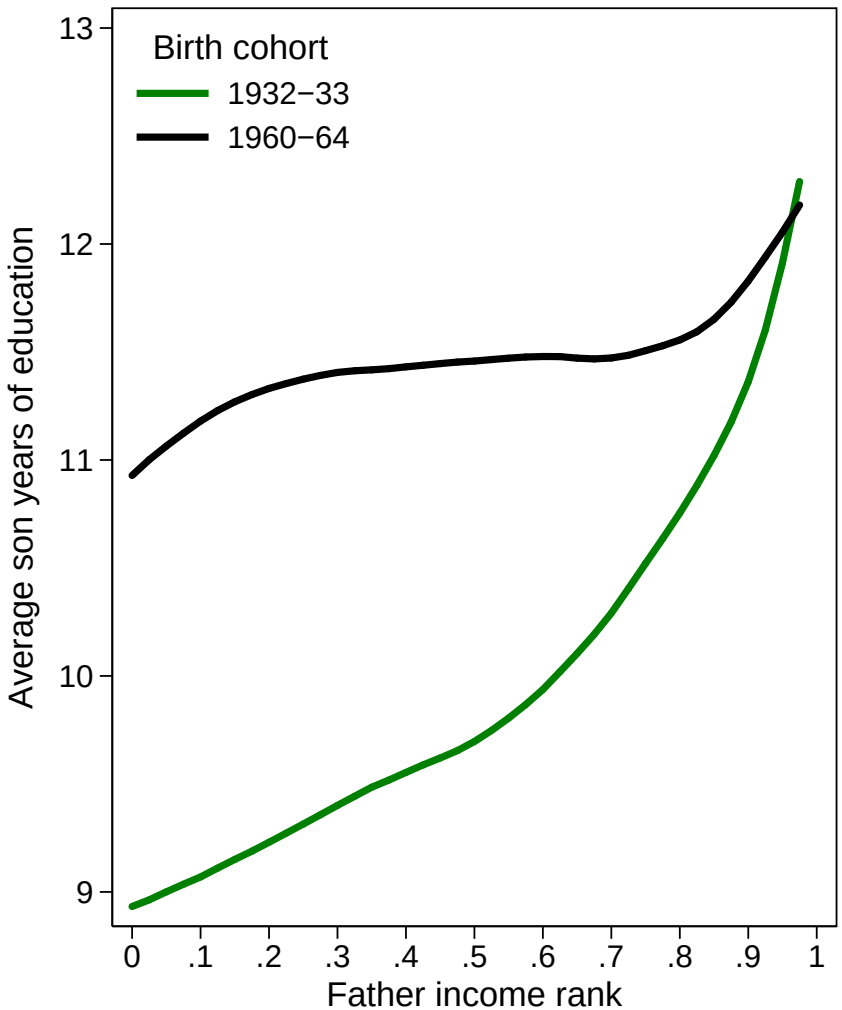
Average income rank by father income rank



Note that larger local associations do not need to imply lower expected rank

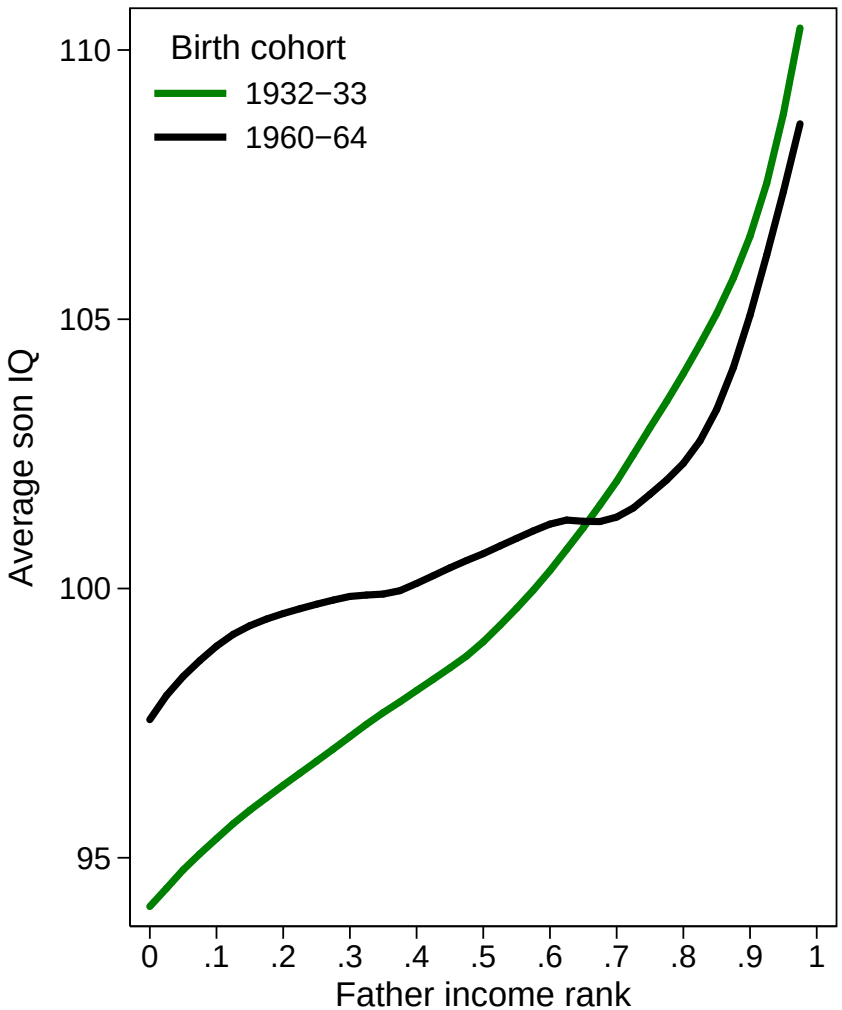
In fact, the expected rank of a boy growing up with a low-income father increases between the 1930s and 1960s birth cohorts

Average years of educaiton by father income rank



Similar pattern for the average years of education

Average IQ by father income rank



Similar pattern for the average years of education ... and for average IQ

Conclusions

- Intergenerational mobility increased in Norway between cohorts born in 1930s and 1960s
  - patterns similar for brother correlations, father-son elasticities and father-son rank correlations
  - mobility in the middle increased the most

Conclusions

- Intergenerational mobility increased in Norway between cohorts born in 1930s and 1960s
  - patterns similar for brother correlations, father-son elasticities and father-son rank correlations
  - mobility in the middle increased the most
- Changes coincide with the building of the welfare state
  - ... and with rapid economic growth and structural change
- No claims (yet) about the role of policies vs. other factors
  - work in progress: impact of specific policy reforms

Appendix

Previous literature

- United States
  - father-son associations decreased between the 19th century and the 1950s (Long and Ferrie, 2013; Olivetti et al, 2014)
  - Moblity increased for cohrots born 1950-1980, decreased after (Aaronson and mazumderg)
  - Stable recent decades (Lee and Solon, 2009; Chetty et al, 2014)
- Sweden
  - brother correlations declined between cohorts born in the 1930s and 1950s; stable/increasing since (Björklund et al 2009)
  - IIE constant since late-1920s birth cohorts *in Malmö* (Lindahl et al, forthcoming)
  - stable mobility rates *among the elite* since 1700s (Clark, 2013) [similar results for Chile, China, England, India, Japan, South Korea, US]
- Norway
  - IIE constant between 1950–1965 birth cohorts (Bratberg et al 2005)

"Clarke's Law"

> *"While it has been argued that rigid class structures have eroded in favor of greater social equality, The Son Also Rises proves that movement on the social ladder has changed little over eight centuries [...] mobility rates are lower than conventionally estimated, do not vary across societies, and are resistant to social policies. The good news is that these patterns are driven by strong inheritance of abilities and lineage does not beget unwarranted advantage. The bad news is that much of our fate is predictable from lineage."*

Princeton University Press promotion for Clark's *The Son Also Rises* [http://press.princeton.edu/titles/10181.html, visited Oct 10, 2014]

Sibling correlations: estimation

Björklund, Jäntti, Lindquist (2009)

log income (conditional on age, year)

$$y_{ijt} = a_i + b_{ij} + v_{ijt}$$

a_i: permanent component common to all siblings in family i

b_{ij}: deviation of individual j from family mean

v_{ijt}: deviation of annual from long-run income

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We want to estimate

$$\rho = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_b^2}$$

i.e. the share of income variance that can be attributed to family background

Sibling correlations: estimation

Björklund, Jäntti, Lindquist (2009)

Assuming AR(1)

$$v_{ijt} = \lambda v_{ijt-1} + u_{ijt}$$

where u_{ijt} is mean zero i.i.d. shock

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Assuming AR(1)

$$v_{ijt} = \lambda v_{ijt-1} + u_{ijt}$$

where u_{ijt} is mean zero i.i.d. shock

The variance components can be estimated using

$$\mathbb{E}\left[\epsilon_{ijt}\epsilon_{kls}\right] = \begin{cases} \sigma_a^2 + \sigma_b^2 + \sigma_v^2 & i = k, j = l, t = s \\ \sigma_a^2 + \sigma_b^2 + \lambda^{(t-s)}\sigma_v^2 & i = k, j = l, t \neq s \\ \sigma_a^2 & i = k, j \neq l, \forall t, s \\ 0 & i \neq k, j \neq l, \forall t, s \end{cases}$$

where $\epsilon_{ijt} = a_i + b_{ij} + v_{ijt}$

Sibling correlations: estimation

- We deviate from BJL in two ways
  - use bootstrap brother pairs for inference
  - measure log income at ages 35–44 (instead of 30–38)

Robustness: log-log

	Birth cohort						
	1932 –33	1935 –39	1940 –44	1945 –49	1950 –54	1955 –54	1960 –64
Baseline	0.231	0.200	0.164	0.081	0.104	0.130	0.137
	(0.007)	(0.006)	(0.005)	(0.003)	(0.003)	(0.004)	(0.005)
Real father		0.140	0.136	0.153	0.171	0.169	0.158
inc. (45-54)		(0.019)	(0.007)	(0.005)	(0.005)	(0.004)	(0.004)
Real father		0.111	0.084	0.087	0.093	0.096	0.085
inc. (55-64)		(0.005)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)

Robustness: rank-rank

	Birth cohort						
	1932 –33	1935 –39	1940 –44	1945 –49	1950 –54	1955 –54	1960 –64
Baseline	0.248	0.193	0.159	0.156	0.138	0.123	0.106
	(0.006)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Father's real		0.285	0.238	0.232	0.213	0.215	0.213
income at age 55-64		(0.006)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Father's real				0.252	0.234	0.234	0.236
income at age 45-54				(0.003)	(0.003)	(0.003)	(0.003)