

Intergenerational mobility, intergenerational effects, sibling correlations, and equality of opportunity: a comparison of four approaches

Anders Björklund (Markus Jäntti)

SOFI, Stockholm University

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Our goal

Approach	Questions	Results
1. Intergenerational mobility (or persistence)		
2. Intergenerational effects		
3. Sibling correlations		
4. Equality of opportunity		

Our motivation



1. We want to know how important family background (broadly defined) is for inequality in economic outcomes: (long-run) income and education.
2. The four approaches give very different answers to the question how important family background is.
3. The reason for 2 is that the approaches capture quite different mechanisms. By considering all four approaches we also learn about the importance of different mechanisms.
4. The four literatures are quite separated but have much to learn from each other.
5. Public policy: Is family background *very* important, or only *somewhat* important? Crucial when we evaluate societies from an egalitarian point of view.³

Roadmap for my talk

1. Intergenerational mobility: approach and findings
2. Intergenerational effects: approach and findings
3. Sibling correlations: approach and findings
4. Equality of opportunity: approach and findings
5. Conclusions/synthesis:
 - a. Which family background mechanisms are important and which are not so important?
 - a. What is important to learn more about?
 - b. What can scholars in the four literatures learn from each other?

The presentation is not as comprehensive as it might look:

1. We don't cover structural modelling of, e.g., parental investment behaviour. But hopefully, we provide useful input for such modelling approaches.
2. We don't consider social mobility, i.e., class mobility. We stick to:
 - a. long-run (log) income and earnings
 - b. years of education
3. The gender dimension is treated very poorly!

1. Intergenerational mobility

Meaning: The descriptive association
between two (or more) generations

Main claim:

The intergenerational associations are not very strong and imply quite much mobility (except possibly in the very top when capital income is included)

1. Intergenerational mobility

Prototypical model:

$$Y_i^{son} = \alpha + \beta Y_i^{father} + e_i$$

β : regr. coefficient or elasticity (IGE)

$$\text{Correlation} = \text{IGC} = \beta (\sigma^{\text{father}} / \sigma^{\text{son}})$$

Sometimes nonlinearities

Sometimes rank correlations

Sometimes transition matrices

Cross-national results

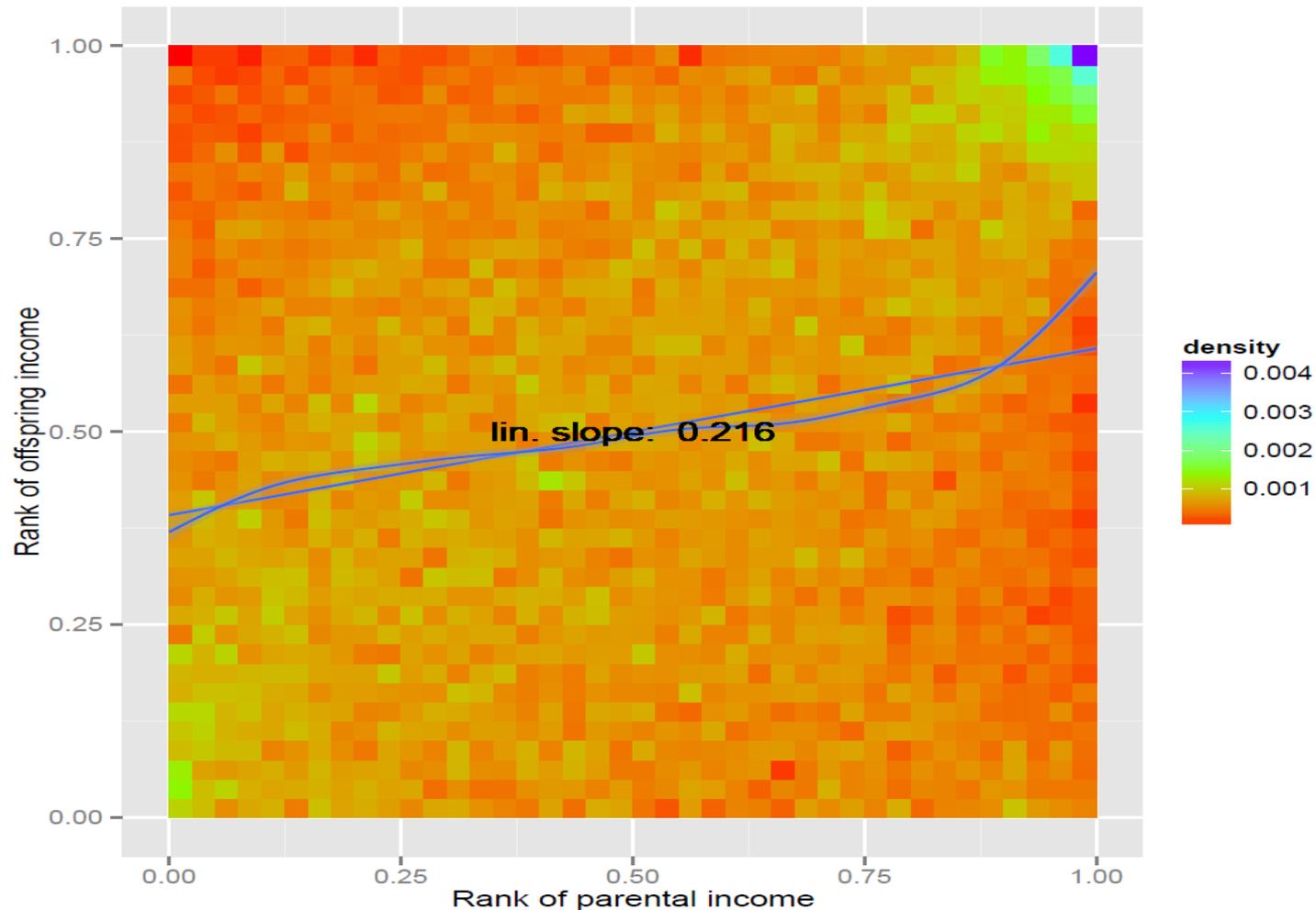
IGEs: 0.15-0.50 (e.g. Corak 2013)

Great Gatsby Curve: IGEs and conventional income inequality positively related across countries! Inequality of opportunity and inequality of outcomes positively related! But how robust is this curve?

IGCs: possibly less variation (according to Corak, Lindquist & Mazumder 2014) but there is less comparable information about IGCs.

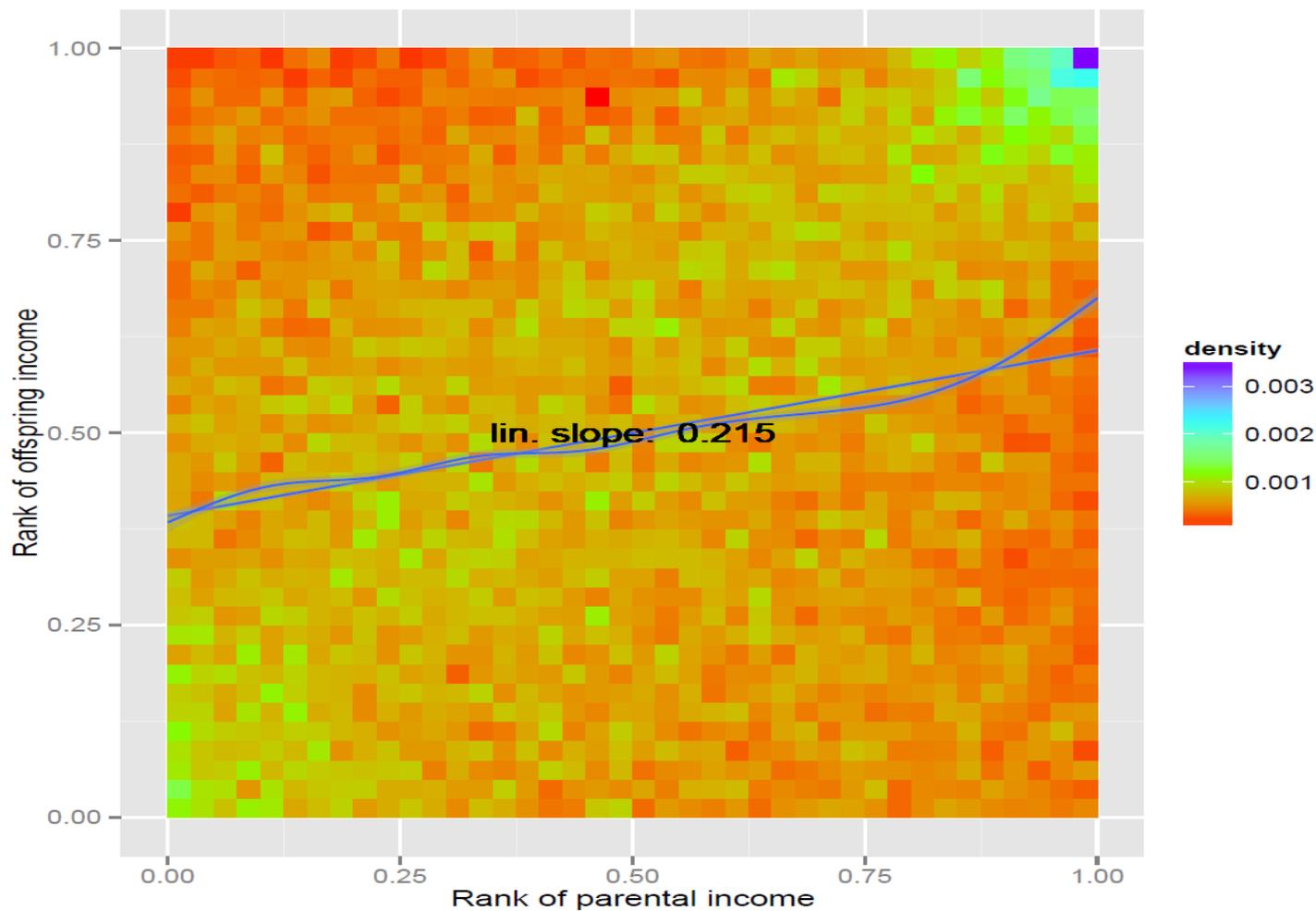
Thus: R-squares (IGC^2) from 0.02-0.25.

Swedish illustration: 7-year averages for sons and parents, total income. IGE: 0.265 and IGC: 0.153

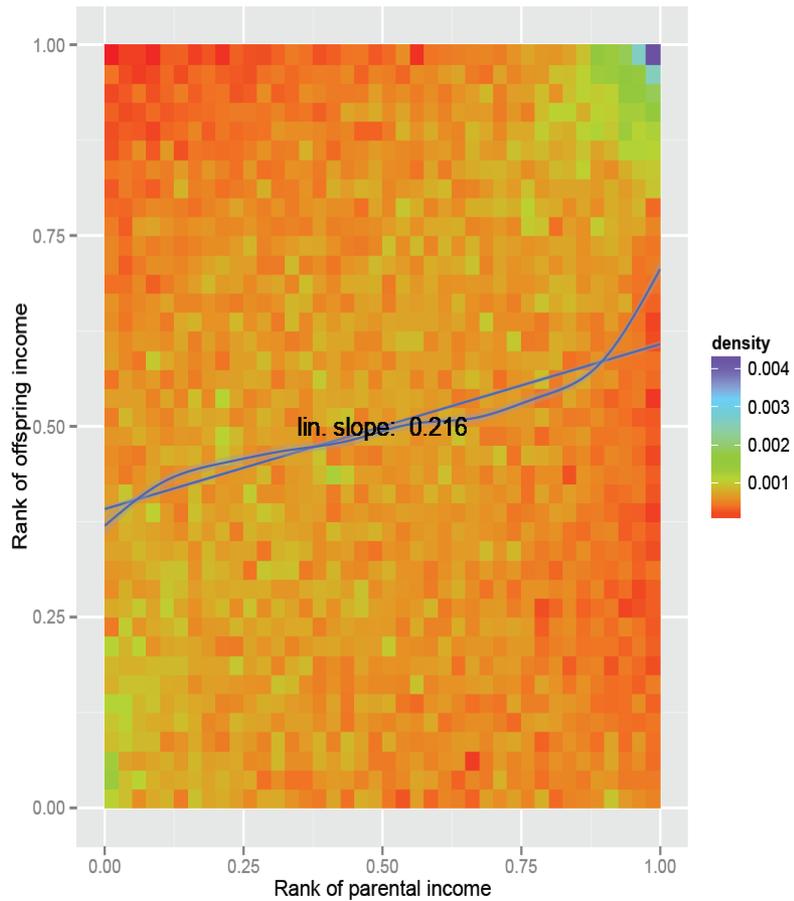


Swedish illustration: 7-year averages for sons and fathers, labour earnings.

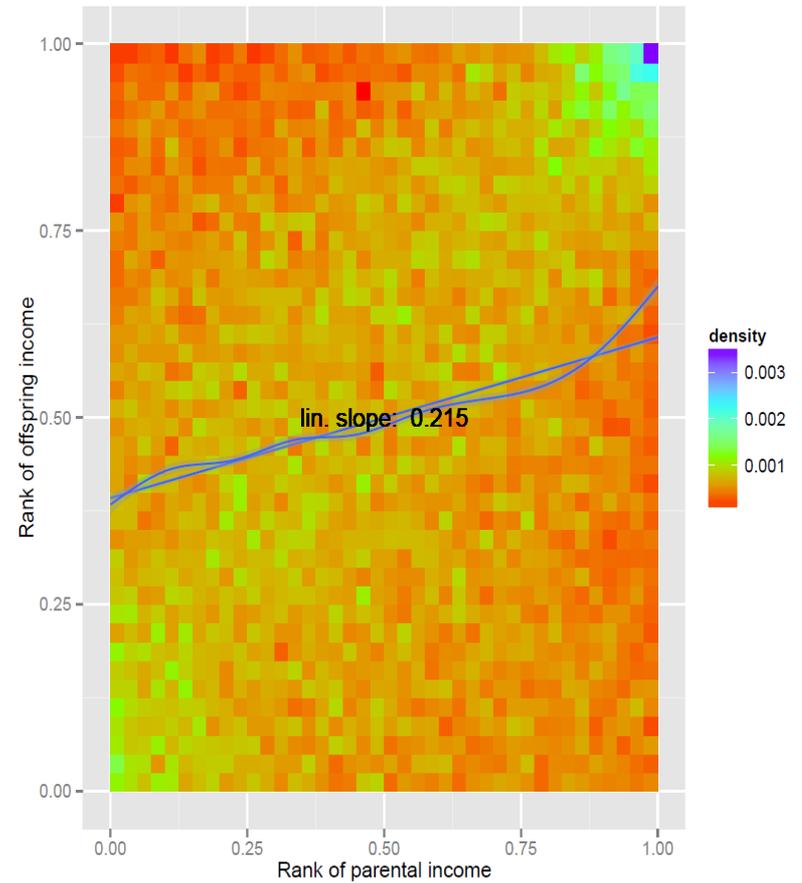
IGE: 0.159 and IGC: 0.127.



Income



Earnings



Some results, years of schooling (from Hertz, BEJEAP 2008)

Country	Regression coefficient	Correlation
USA	.46	.46
Denmark	.49	.30
Finland	.48	.33
Norway	.40	.35
Sweden	.58	.40
Great Britain	.71	.30
The Netherlands	.58	.36
Belgium	.41	.40
Italy	.67	.40

Main results:

- Income associations are not that strong. Correlations from 0.15 to 0.5 imply R-squares of 0.02-0.25.
 - Scatter plots also reveal a lot of mobility. Except possibly in the very top, when capital income is included.
- Education associations are slightly stronger.

2. Intergenerational effects

- **Meaning:**
 - What are the causal effects of thought interventions that change parents' income or education?
 - This is something (potentially very) different from descriptive intergenerational mobility patterns
- **Main claim:**
 - Intergenerational effects are clearly smaller than IGM-estimates reveal.

Intergenerational effects

Prototypical model

$$Y_i^{offspring} = \alpha + \beta_1 Y_i^{father} + \beta_2 Y_i^{mother} + e_i$$

Intergenerational effects: empirical strategies.

Strategies to get the "causal effect":

1. Twin-differences: $\Delta Y^{\text{cousins}} = \alpha + \beta \Delta Y^{\text{twinparents}}$
-- takes some genetics and common environment out
2. Adoptive parents
-- eliminates genetic transmission (if random assignment)
3. IV, (often reforms)
-- gives exogenous variation in parental resources

General pattern in the results

Estimates of causal effects in general in the range 0-60% of the IG-associations

In some contexts, however, the causal income (education) effects might be very large

3. The sibling correlation

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

a_i common to all siblings in family i

b_{ij} unique to individual j in family i

a_i and b_{ij} orthogonal by construction. Thus:

$$\sigma_y^2 = \sigma_a^2 + \sigma_b^2$$

The family share of the outcome variance is:

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

ρ is also the sibling correlation

A sibling correlation captures more than an intergenerational correlation (IGC)

Sibling correlation = $(IGC)^2$ + other shared factors that are uncorrelated with parental y

An omnibus measure! Captures both observed and unobserved family background (and neighborhood) factors

Yet it is a lower bound, because all family background factors are not shared.

Some estimates of brother correlations in long-run earnings

Country	Estimate	Study
USA	.49	Mazumder (2008)
Denmark	.23	Björklund et al. (2002)
Finland	.26	Björklund et al. (2002)
Norway	.14	Björklund et al. (2002)
Sweden	.25	Björklund et al. (2002)
Sweden	.32	Björklund, Jäntti & Lindquist (2009)
Germany	.43	Schnitzlein (2013)

Some estimates of sibling correlations in years of schooling

Country	Sibling type	Estimate	Study
USA	Mixed sexes	.60	Mazumder (2008)
Norway	Mixed sexes	.41	Björklund & Salvanes (2010)
Sweden	Brothers	.43	Björklund & Jäntti (2012)
Sweden	Sisters	.40	Björklund & Jäntti (2012)
Germany	Brothers	.66	Schnitzlein (2013)
Germany	Sisters	.55	Schnitzlein (2013)

These quite high numbers are only lower bounds. What is missing?

1. Full siblings have only about half of (initial) genes in common. But each individual has 100% of her (initial) genes from the parents.
2. Not all environmental experience and "shocks" are shared, only some. Thus some environmental stuff is missing.
3. Differential treatment by parents. Will not be captured if it creates differences, but is part of family background.

Raising the lower bound: MZ-twins?

1. They share all (initial) genes (GOOD)
2. They share more environment and more "shocks" (GOOD)
3. They might interact more and affect each other in ways that have no counterpart in the general population (BAD)

Because of (3), an MZ-correlation might be an upper bound of family background

Sibling correlations for MZ-twins vs. full siblings: Swedish results

Outcome	Sibling type	Full sibling	MZ-twins
Earnings	Brothers	.22	.73
Schooling	Brothers	.44	.75
Schooling	Sisters	.40	.73

Raising the lower bound: differential treatment

Birth order is one candidate: see below

How much do IG-mobility estimates “explain” (account for)?

Use:

Sibling correlation = $(IGC)^2$ + other shared factors that are uncorrelated with parental y

Swedish estimates:

Sibling correlations vs. intergenerational correlations, Sweden

Outcome	Sibling correlation	(IGC) ² =R ²	Other factors
<u>Brothers</u>			
Earnings	.24	.02	.22
Schooling	.46	.15	.31
<u>Sisters</u>			
Schooling	.40	.11	.29

An extension

Adding one more parent, or higher-order income terms, to the IGM-equation does not change the results very much.

Summing up about sibling correlations:

1. Sibling correlations reveal a large role for something in the family (or the neighborhood). Unobserved factors, not captured by IGM-estimates, must be quite important.
2. Candidate unobserved factors:
 - a. Parental skills, uncorrelated with parental income
 - b. Sibling interaction effects
 - c. Genes
3. And yet sibling correlations are lower bounds. MZ-twin-correlations are possibly upper bounds, but not necessarily so. They suggest a very big role for family background

4. Equality of opportunity approach

A very stylized version:

$$Y_i = \alpha C_i + \beta E_i + \varepsilon_i$$

$$E_i = \delta C_i + v_i$$

C : set of circumstances: factors beyond individual control, for which individuals should not be held responsible (such as parental resources)

E : set of effort variables: all choices for which society holds the individual accountable (such as labor supply). "Justifiable" inequality.

Reduced form: $Y_i = (\alpha + \beta\delta)C_i + \beta v_i + \varepsilon_i$

EO-approach: implementation

- Estimate the reduced form above
- Measure:
 - Derive the inequality (according to a suitable measure of inequality) that is generated by circumstances. Compare this inequality with total inequality.: $Ineq(\text{due to circ.})/Ineq(\text{total})$.
 - Or the fraction of variance which is explained by circumstances: R^2
- Claim in the field:
 - lower bound of such inequality since only a subset of circumstances are observed in available data
- Some empirical approaches consider the role of luck. Some try to measure effort and control for it in the outcome equation. Also other nice tricks.

Pros and cons of the EO-approach



Pros

1. Recognizes that ineq. of opp. cannot be measured by one SES-indicator as the IGM-app. does
2. Flexible about the measure of inequality
3. Can include multiple measures of SES (cf. Clark). **Mothers too!**
4. Can include grandparents that belong to a general IGM-model
5. Can include factors not shared by siblings, e.g., birth order.
6. Can include assortative mating as interactions.

Cons

1. Ideally requires a multivariate causal model. Otherwise must assume that the omitted-variables bias variables also capture circumstances.
2. Cannot account for unobserved family background variables as the sib-corr app. can
3. Requires rich data and large sample sizes

What circumstance variables have been used? And which are valid ones?

Some results:

Study	Country, outcome	Circumstances	R ²	Gini	GE(0), GE(1))
Bourguignon et al. (2007)	Brazil, earnings	Race, par educ, region, father's occ status	.24-.30		.13-.34
Bourguignon et al. (2007)	Brazil, schooling	Race, par educ, region, father's occ status	.34-.43		N.a.
Ferreira et al. (2011)	Turkey, wealth	Region, Par educ, # of sibs, language	.27		.31
Björklund et al. (2012)	Sweden, earnings	Par inc (4), Par educ (3), Par sep (2), # of sibs (3), IQ age 18 (4), BMI age 18 (4)	.06	.24	.10

Study	Country, outcome	Circumstances	R ²	Gini	MLD
Niehuis & Peichl (2014)	Germany. Long-run earnings	Gender, foreign-born, father's occ and edu, urbanization, height, year of birth			Ca. .25
Niehuis & Peichl (2014)	USA, Long-run earnings	Gender, foreign-born, father's occ and edu, urbanization, height, year of birth			Ca. .25

Some new (preliminary) Swedish results,



	Gini	GE(0)	GE(1)	CV2	R-sq
Overall inequality	0.258	0.156	0.166	1.280	
Model	Circumstances' share of overall inequality				
A. Linear income, log.	0.186			0.023	0.023
B. Linear income, level.	0.203	0.032	0.029	0.008	0.023
C. Linear+quadratic income, level.	0.226	0.038	0.037	0.010	0.026
D. C+Par occ+par educ	0.282	0.055	0.052	0.014	0.038
E. D+grand parents education	0.283	0.055	0.053	0.014	0.038
F. E+birth order	0.283	0.055	0.053	0.014	0.038
G. F+ own IQ and Noncognitive skills at age 18.	0.418	0.114	0.108	0.029	0.080

How do the results compare to those from sibling correlations? Has the gap between IGM-estimates and the sib corr estimates been filled?

- In general clearly lower explanatory power than what sibling correlations predict (but the latter never reported).
- And yet sibling correlations are lower bounds of the importance of family background. Note the omitted genetic influence captured by MZ-twins: clearly a circumstance according to Roemer!
- But are all factors shared by siblings really circumstances?

Major problem: are correlated omitted variables effort or circumstances?

For many circumstance variables there is a causal effect literature:

Variable	Results from causal effect studies	Are omitted variables circ.stances?
Parental income and education	Intergenerational effects considerably lower than IG-coefficients	Maybe, because that is what is controlled away by twinning and using adoptive parents
Parental separation	Effects lower than descriptive regression coefficients	?
Family size, # of siblings	Effects lower than descriptive regression coefficients	?

Thus: the claim that the results are lower bounds on unjustifiable inequality does not (necessarily) hold

The same problem applies to sibling correlations:

- Are all factors shared by siblings really to be considered circumstances?
 - If unobserved parental skills: yes!
 - If sibling spillover effects?
 - of skills: yes!
 - of effort ? Maybe sibling spillover effects are circumstances since you have not chosen your siblings yourself.
- To find out more, we have to understand the mechanisms behind what siblings share. A key challenge for future research.

Circumstance variables that have not been used

- School and teacher quality
- Health indicators from early childhood, including birth weight
- Explicit genetic information. Difficult though.

**Time to sum up and conclude about
the four approaches:**

Factors captured by the various approaches

	Causal par income effects	Correlates of par income	Observed factors shared by sibs, uncorr. with par income	Unobs. factors shared by sibs, uncorr. with par income	Observed factors not shared by siblings	Unobserved factors not shared by siblings
IGM	Yes	Yes	No	No	No	No
IGEff	Yes	No	No	No	No	No
Sib corr	Yes	Yes	Yes	Yes, but c-stances?	No	No
EOp	Yes	Yes, but c-stances?	Yes	No	Yes	No

Magnitudes in terms of fraction of inequality (the variance), Sweden

IGM	IGC ² = 0.02-0.06		-	-	-	-
IGEff	0-0.03	0-0.03	-	-	-	-
Sib Corr	IGC ² + other factors = 0.25-0.30 (a lower bound)				-	-
EOp	IGC ² + our other Xs (incl. Grandparents, IQ and NC, etc.)=0.08			ca 0.20	0.00 (birth order)	- 43

1. Intergenerational mobility:

- Does not directly address the inequality-of-opportunity question!
- But: provides an easy-to-understand picture that the public policy debate seems to appreciate:
 - It tells us about "the rise and fall of families".
 - The cross-country pattern has received a lot of public attention
- Maybe easier to study and interpret country-differences and trends in intergenerational mobility than in the combined importance of a set of circumstances
- Associations are not that strong

2. Intergenerational effects:

- This approach addresses well-defined questions of high scientific and public-policy importance
- Some approaches incorporate mothers
- But estimated effects are small in the sense that they explain very little of inequality of income and schooling: thus such effects do not violate egalitarian norms very much
- But effects might be large in other dimensions: the benefit-cost ratio of some interventions that change parental income and education might be high

3. Sibling correlations:



- A sibling correlation does not provide the direct answer to any well-defined scientific or public-policy questions. But has a clear statistical interpretation.

- A sibling correlation should rather be used as a warning signal ("benchmark") whether researchers have missed important family background factors

- And this signal has had the right light on (for a long time):
 - Considering that sibling correlations are lower bounds, the high magnitudes can make persons with egalitarians attitudes really concerned!
 - Key challenge: to understand what siblings share but is, so far, unobserved!

4. Equality of opportunity:

- Finding the explanatory power of circumstances is the natural correct approach to measuring inequality of opportunity!
 - But ideally: a multivariate model of circumstances' causal effects is needed.

- But many important circumstances are not observed in typical data sets. And are probably not observable even with very ambitious data collection efforts.

- But maybe one can find the most important circumstances. But that should ideally be done with a causal analysis.

- Challenge: how to treat gender (mothers and daughters)