Family associations in economic status

Markus Jäntti[1]

[1]Swedish Institute for Social Research, Stockholm University

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Three approaches to assessing the importance of family background

- intergenerational persistence/mobility
- sibling correlations
- equality of opportunity (the importance of circumstances vs. effort)
- for reviews, see Solon (1999), Björklund and Jäntti (2009), Roemer (1998), Ferreira and Gignoux (2008)

Acknowledgements: I am drawing on work conducted jointly with Anders Björklund, Gary Solon, John Roemer, and several other colleagues on papers such as Jäntti et al. (2006) and Björklund, Jäntti, and Lindquist (2009).

Notation

i, j, t	individual, family, time period (year)
y_O	long-run economic status (log income) of offspring
y_P	long-run economic status (log income) of parent(s)
β	the intergenerational elasticity (IGE)
ρ	the sibling correlation
$\mathbf{X}$	a set of circumstances an individual (offspring) can not be held responsible for

The measure of economic status

- in theory:
  - permanent income
  - wealth
- in practice:
  - long-run earnings / income (multi-year average)
  - annual earnings / income + instruments
  - status indices

To the figure

Measuring long-run income

- the traditional method of measuring long-run income is to assume (conditional on an age-income profile in the first moments) a classical measurement error model:

$$y_{it} = y_i + v_{it}; \quad y \perp v, \text{Var}[v] = \sigma_v^2 \tag{1}$$

- unfortunately, data from several countries support far more complicated processes, such as Haider and Solon (2006):

$$y_{it} = \lambda_t y_i + v_{it}; \quad y \perp v \tag{2}$$

- when $\lambda_t \approx 1$, this is close to classical; measuring incomes as multi-year average around age 40 yields close to equation 1
- the short version of this says that measuring long-run/permanent/life-time income is complicated (e.g., v unlikely white noise)

Intergenerational persistence

- the intergenerational income elasticity is an empirical quantity of enduring interest:

$$y_O = \alpha + \beta y_P + \varepsilon \tag{3}$$

- two interpretations for β:
  - the slope of the conditional expectation of offspring income, given parental income ("mechanical"):

$$\beta := \frac{\partial \mathrm{E}[y_O | y_P]}{\partial y_P} \tag{4}$$

  - the causal effect of a change in parental income on child income ("economic"):

$$\beta := \frac{\partial y_O^*}{\partial y_P} \tag{5}$$

    Note the y_O^*, intended to convey the sense in the second equation/interpretation that offspring income is at least in part the results of optimizing behavior on the part of parents.

The mechanical interpretation

- the short version:
  - interest in properties of the bivariate distribution $F(y_P, y_O)$, in particular the association of y_P and y_O
  - many measures of association may be of interest, including β, but also $\rho = \beta \times \sigma_P / \sigma_O$
- the "origin-education-destination" type approach (see Goldberger, 1989)

The causal interpretation

- the Becker and Tomes (1979, 1986) model gives many inspiration
- a simple version is due to Solon (2004);

$$y_{i,O} = \mu^* + [(1-\gamma)\theta p] y_{i,P} + p e_{i,o}. \tag{6}$$

  - p is the return on human capital
  - e is offspring human capital endowment
  - γ measures the progressivity in human capital
  - θ measures how effectively human capital investments turn into capital
  - λ captures the IG transmission of the endowment

The causal interpretation

- in steady state, the IGE is

$$\beta = \frac{(1-\gamma)\theta p + \lambda}{1+(1-\gamma)\theta p \lambda} \tag{7}$$

- the intergenerational persistence *increases* in
  - the heritability of human capital endowments λ
  - the productivity of human capital investments θ
  - the income or earnings return to human capital p

  and *decreases* with
  - progressivity of public education spending γ
- the IGE is also positively correlated with cross-section inequality

Evidence

- estimates of IGE *hugely* sensitive to a wide variety of details in estimation (within dataset; within country etc)
- life-cycle biases from generalized errors in variable models appear large
- little or no evidence on IG correlations on comparable basis
- very little (cross-national) evidence of *causal* estimates
- but, here some IGE:s ▸ To the figure

Persistence vs. mobility

- the intergenerational *persistence* is not the same thing as intergenerational mobility Go to illustration 1 Go to illustration 2
- interesting things take place in the corners of the bivariate distribution
  - US: To the table To the table
  - comparative: To the figure

Why sibling correlations?

Long-run income

Suppose long-run income of individual j in family i can be written as

$$y_{O,ij} = \mu + \varepsilon_{O,ij}; \quad \varepsilon_{O,ij} = a_i + b_{O,ij}, \quad a \perp b \tag{8}$$

The variance of income is the sum of the family and individual components

$$\sigma_\varepsilon^2 = \sigma_a^2 + \sigma_b^2. \tag{9}$$

Share of income variance due to family

$$\rho = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_b^2}. \tag{10}$$

This is also the correlation coefficient of pairs of randomly drawn brothers' incomes.

Sibling correlation vs. intergenerational elasticity

Father's income is $y_{P,i}$, write family component as

$$a_i = \beta y_{P,i} + z_i. \tag{11}$$

β is the intergenerational elasticity. Substituting into 8 yields

$$y_{O,ij} = \underbrace{\beta y_{P,i} + z_i}_{a_i} + b_{O,ij}. \tag{12}$$

The family component's variance

$$\sigma_a^2 = \beta^2 \sigma_{y_P}^2 + \sigma_z^2. \tag{13}$$

The sibling correlation can thus be expressed as

$$\rho = \frac{\beta^2 \sigma_{y_f}^2}{\sigma_y^2} + \frac{\sigma_z^2}{\sigma_y^2} (= \beta^2 + \sigma_z^2/\sigma_y^2 \quad \text{in steady state}) \tag{14}$$

Evidence and comparisons

- comparative evidence ▸ To the figure
- the parental IGE / other things decomposition ▸ To the decomposition
- trends in the brother correlation in Sweden ▸ To the trends
- IQ: IG and brother correlations compared ▸ To the IGE IQ table
  ▸ To the brother correlation IQ table

Remarks I

- Some stylized estimates and the implied R^2:

Brother correlation (US)	0.40	0.40
Father-son elasticity (US) [non-causal]	0.40	0.16
Father-son elasticity (US) [causal]	0.10	0.01

- Increasingly clever research designs to capture a decreasing share of the variance of permanent income? Or should we focus on that 39% of the variance of permanent income that is captured by brother correlations?

Remarks II

- the bulk of evidence is on *brothers* and *father-son* pairs
- women's labour markets have become a lot more like those of men, but have changed differently in different countries
- gender differences in the importance of family background should be done using family income for greater comparability
- highlights the importance of assortative mating and (differential) labour supply response to spousal earnings

Remarks III

- apart from the Solon rendition of the Becker-Tomes model, there is little mention of genetic transmission above
- the nature-nurture debate is quite fruitless, but may gain some new material from advances in gene sequencing (and neuroscience)

Remarks IV

- siblings are drawn from (almost) the same marginal distribution
- useful in e.g. the study of the importance for family background for immigranst vs. natives

The importance of family background and social justice

- much has been learnt about the importance of family background for economic status (intergenerational income persistence and mobility, sibling correlations; country differences, changes across time, gender differences in)
- interest in importance of family background (vaguely) motivated by concern for *equality of opportunity* (who is *against* eq. opp?)
- a persistent question is: how much persistence is ethically acceptable?
  - liberty: reproductive rights, right to privacy, agency (on the part of persons as parents)
  - equality: inequalities due to circumstances beyond a person's control violate justice norms (equality of opportunities, not outcomes)

Equality of opportunity

- see Roemer (1998) (also e.g. Ferreira and Gignoux (2008), Niehues and Peichl (2011), Aaberge, Mogstad, and Peragine (2011), Fleurbaey and Peragine (2009))
- individual accomplishments in some space of ethical concern depend on primarily their own choices and efforts
- inequalities due to circumstances beyond an individual's control violate eq. opp. norms
- let $u = u(e, t)$ be an outcome of interest (in the present paper, long-run income)
  - e is an individual's effort
  - t indexes *circumstance* beyond an individual's control, called their *type*
- variations in the outcome that are driven by (suitably normalized) variation in effort are ethically acceptable, whereas those driven by variation in type are not

Data

- illustrate empirically the role of circumstances in inequality of long-run income in Sweden (Björklund, Jäntti, and Roemer, 2011)
- focus on Swedish men
- examine total market income
- average income across ages 32-38
- data from numerous registers (tax data; censuses; military enlistment; formal educational degrees etc)

Circumstances

6 background characteristics

- parental income quartile group (income of both bio parents when son was 13-17; 4 groups)
- parental education group (degree of the more highly educated bio parent; 3 groups)
- family structure/type (live with both bio parents or not; 2 groups)
- number of siblings (0, 1-2 or 3+; 3 groups)
- IQ quartile groups (military enlistment cog. test; 4 groups)
- body mass index quartile group (military enlistment data; 4 groups)

  Combining all background charateristics yields
  $4 \times 3 \times 2 \times 3 \times 4 \times 4 = 1152$ distinct types.

The empirical procedure

- measure inequality of outcomes by standard relative inequality measures (Gini, GE(0,1), CV2)
- regress income on background characteristics
- measure the importance of a particular factor by comparing inequality of income when that factor is allowed to affect income, and when not (using estimated regression coefficients)
- decompose inequality into importance of circumstances and remainder ("effort"):
  - the distribution of ε_i^t may be heterogeneous wrt. type
  - a person can not be held accountable "extra" variation in effort due to type
  - solution: neutralize heterogeneity (add and subtract a homogenous effort with variance $\sigma^2 = \sum_t f_t \sigma_t^2$; this is an additional circumstance)
- use the Shapley-value decomposition to additively decompose indices

Contribution of types to inequality of long-run income

- Heterogeneous effort controlled using smoothed residual variance
  - All cohorts Go to table
  - Cohorts 1955-1959 Go to table
  - Cohorts 1963-1967 Go to table
- Heterogeneous effort controlled using actual residual variance
  - All cohorts Go to table
- No effort heterogeneity
  - All cohorts Go to table

Concluding remarks

- comparative evidence on intergenerational transmission of advantage needs to be updated:
  - correlations, not (only) elasticities
  - generalized errors-in-variables models suggest very large biases in estimates
  - the persistence of *what* should be revisited
- clear intellectual distinction between causal and descriptive parameters should be maintained
- comparative evidence on sibling correlations scarce and should be provided
- the relationship between statistical measures of importance of family background and equality of opportunity should be further explored
- better and more measures of economic status should be uncovered on a comparative basis

Transitory errors and long-run income

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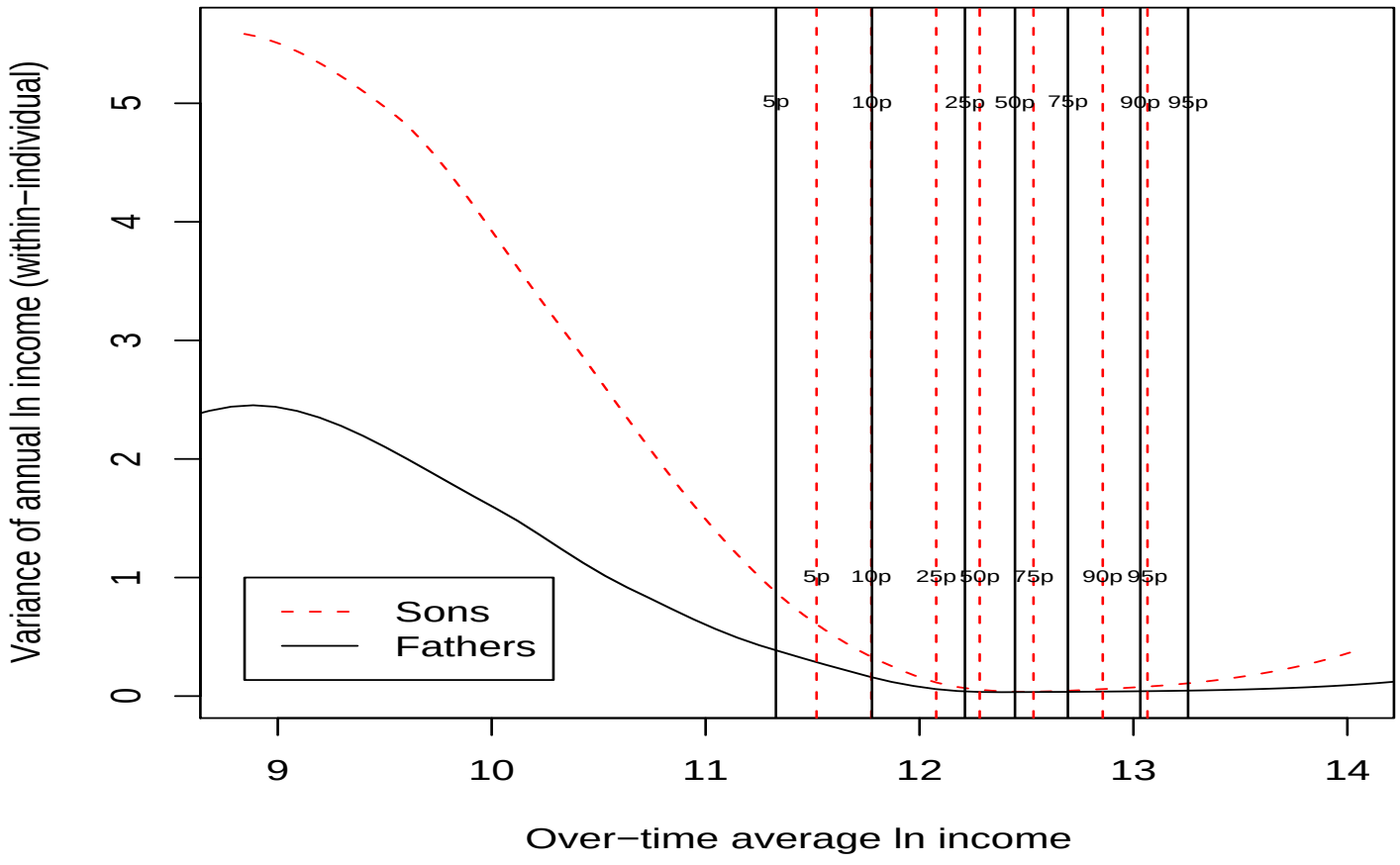
The variation of annual ln income across over-time mean of ln income – Swedish fathers and sons



Evidence on intergenerational associations

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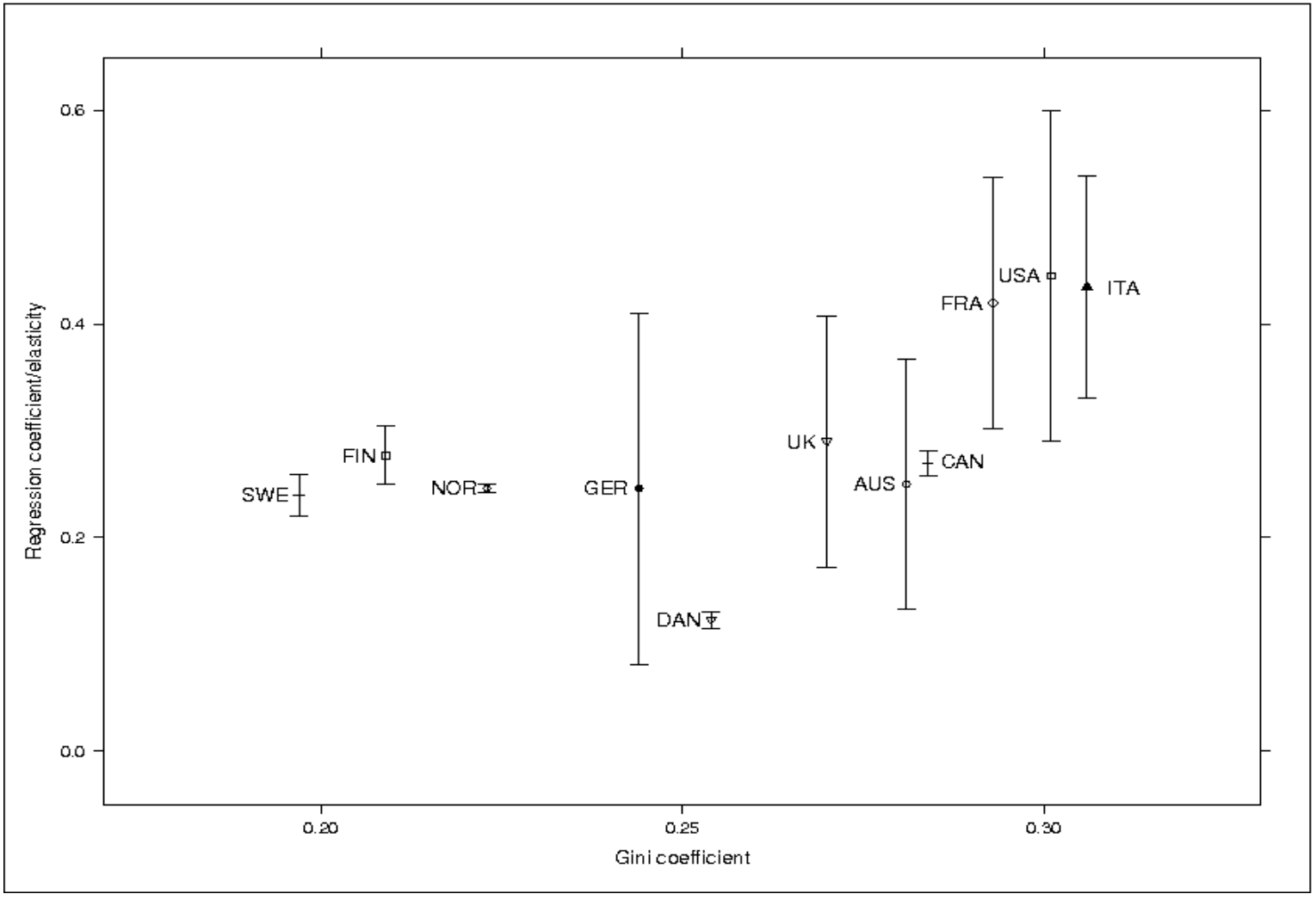

Source: Björklund and Jäntti (2009)

Persistence vs mobility

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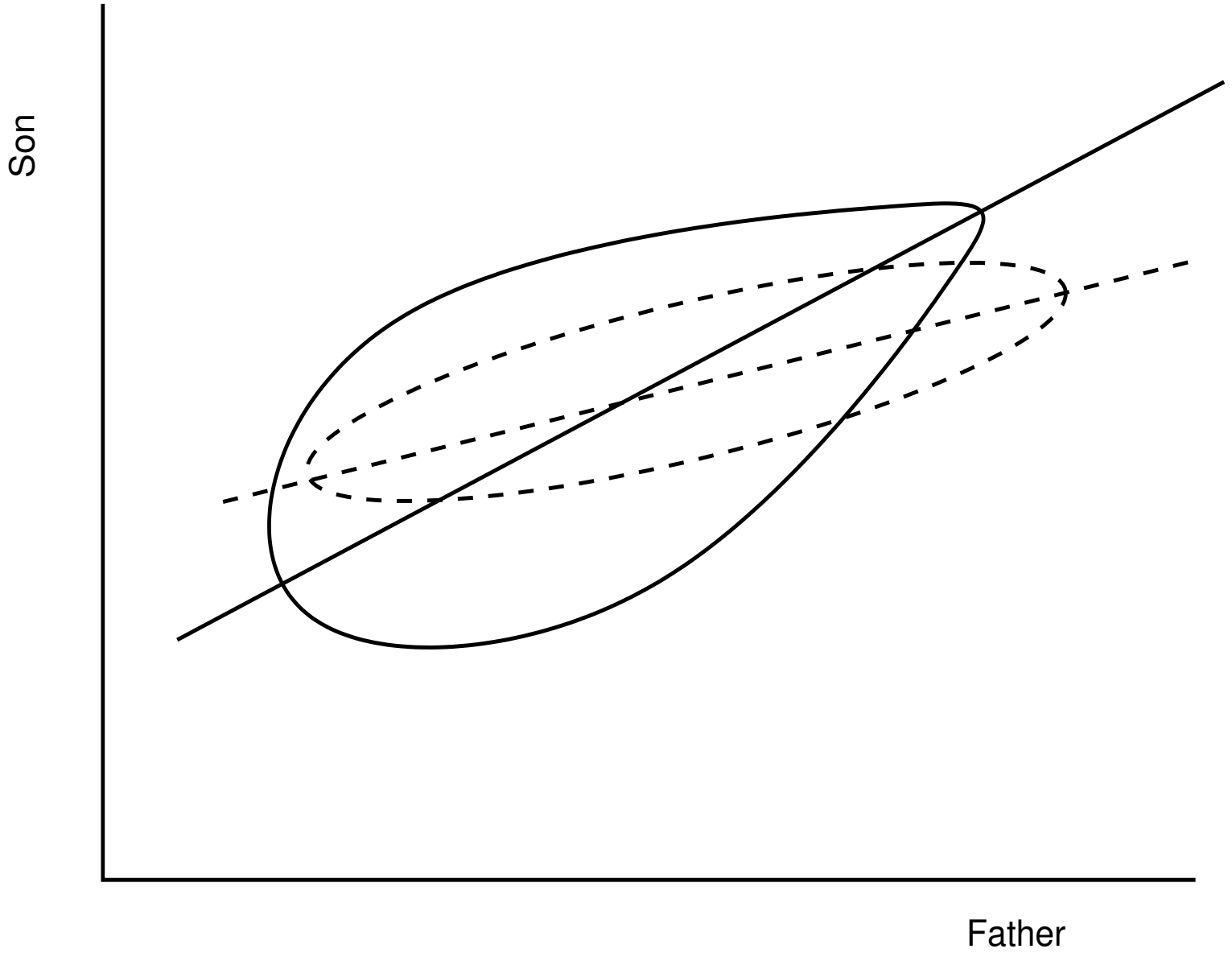
Persistence in economy A and B

Persistence vs mobility

Back to the text

Persistance and mobility in A and B



A mobility matrix: US(NLSY)

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USNLSY (n = 1798)

	Son				
Father	oq1	oq2	oq3	oq4	oq5
fq1	0.422 [0.363,0.482]	0.245 [0.189,0.302]	0.153 [0.107,0.202]	0.102 [0.065,0.142]	0.079 [0.047,0.116]
fq2	0.194 [0.142,0.250]	0.283 [0.230,0.341]	0.208 [0.159,0.260]	0.174 [0.128,0.221]	0.140 [0.097,0.185]
fq3	0.194 [0.145,0.247]	0.186 [0.131,0.241]	0.256 [0.198,0.318]	0.202 [0.148,0.259]	0.162 [0.111,0.216]
fq4	0.125 [0.082,0.176]	0.182 [0.129,0.247]	0.198 [0.133,0.263]	0.252 [0.198,0.311]	0.243 [0.187,0.300]
fq5	0.095 [0.057,0.137]	0.122 [0.076,0.170]	0.189 [0.135,0.243]	0.234 [0.176,0.294]	0.360 [0.296,0.421]

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Corner probabilities

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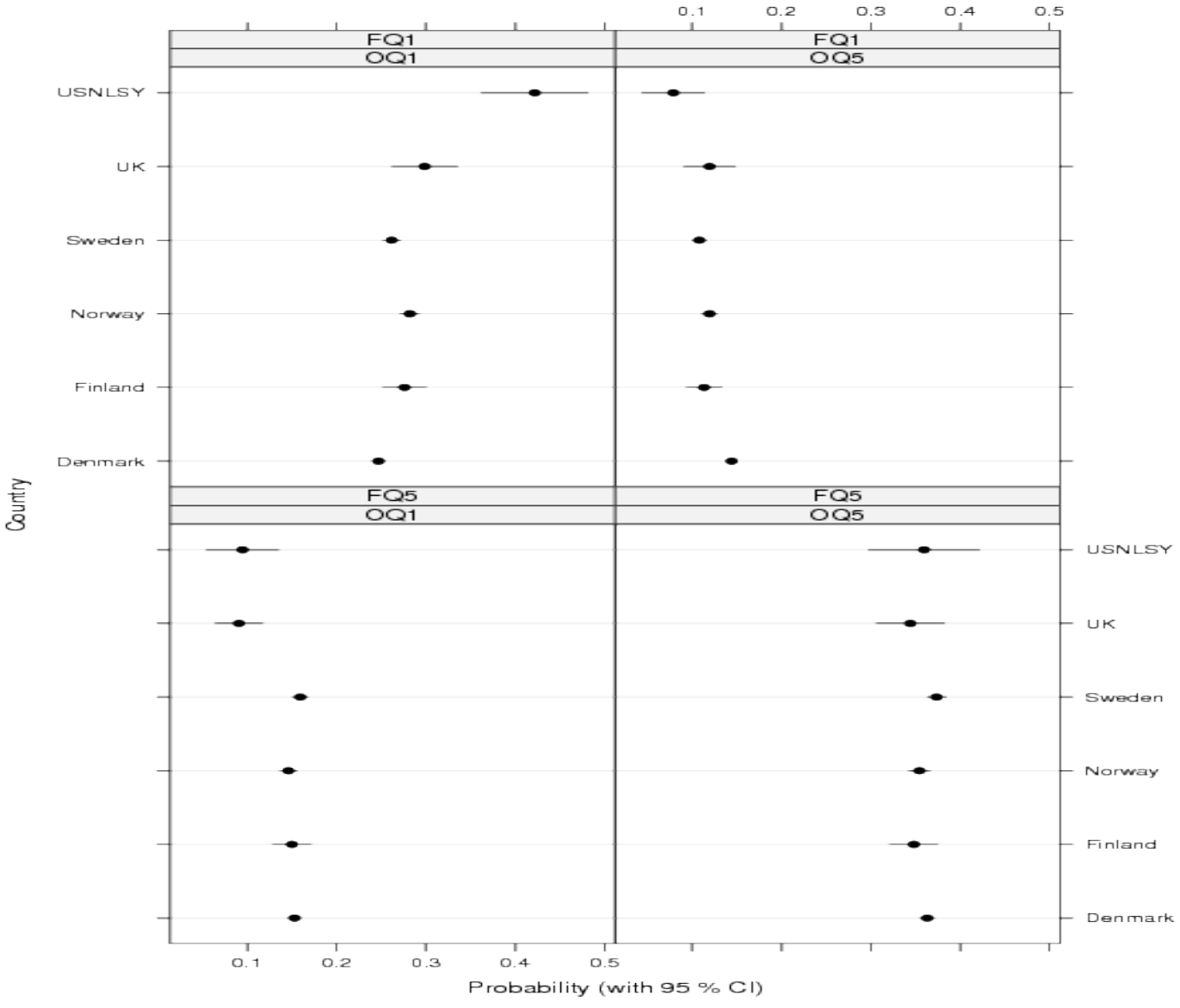

Evidence on sibling associations

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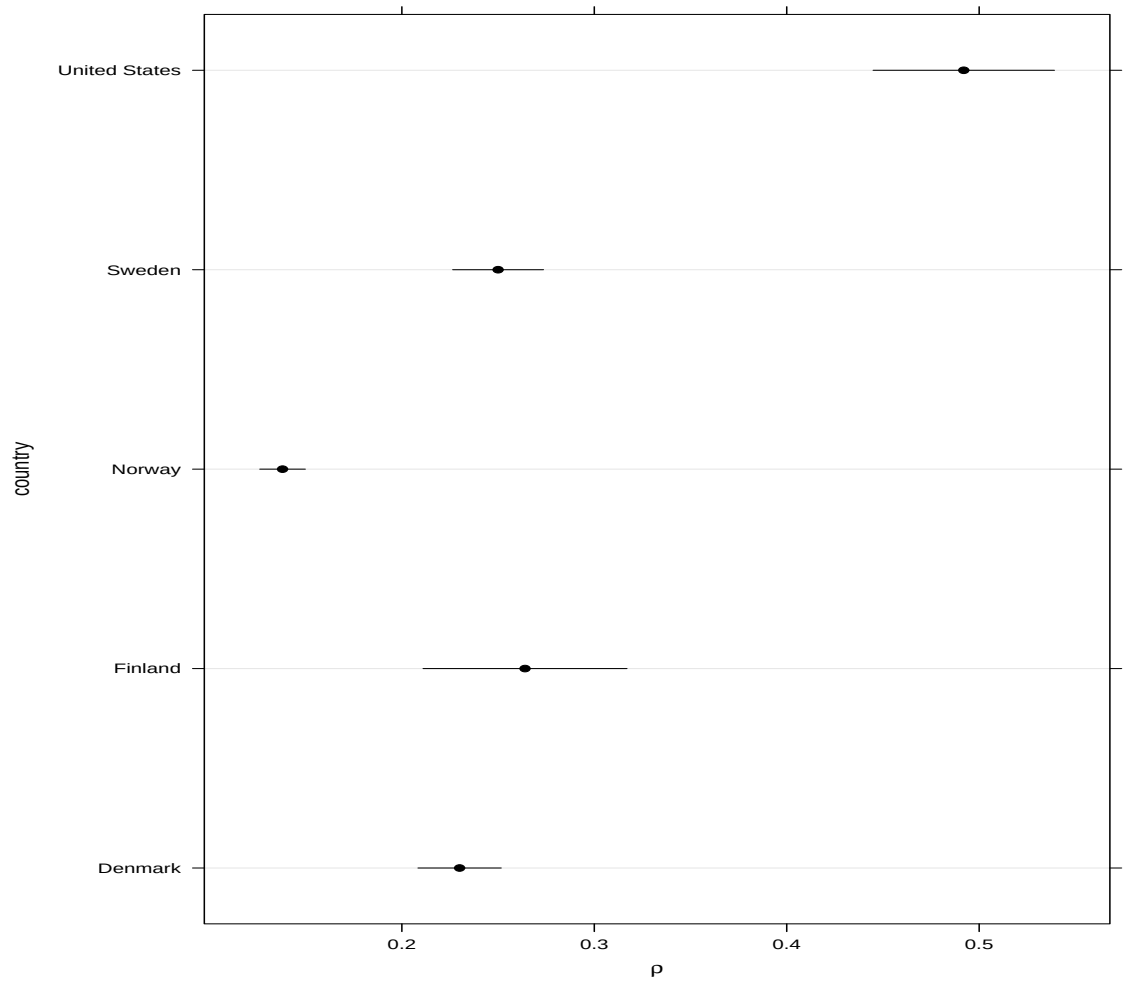

Source: Björklund and Jäntti (2009)

Father-son and brother correlations compared

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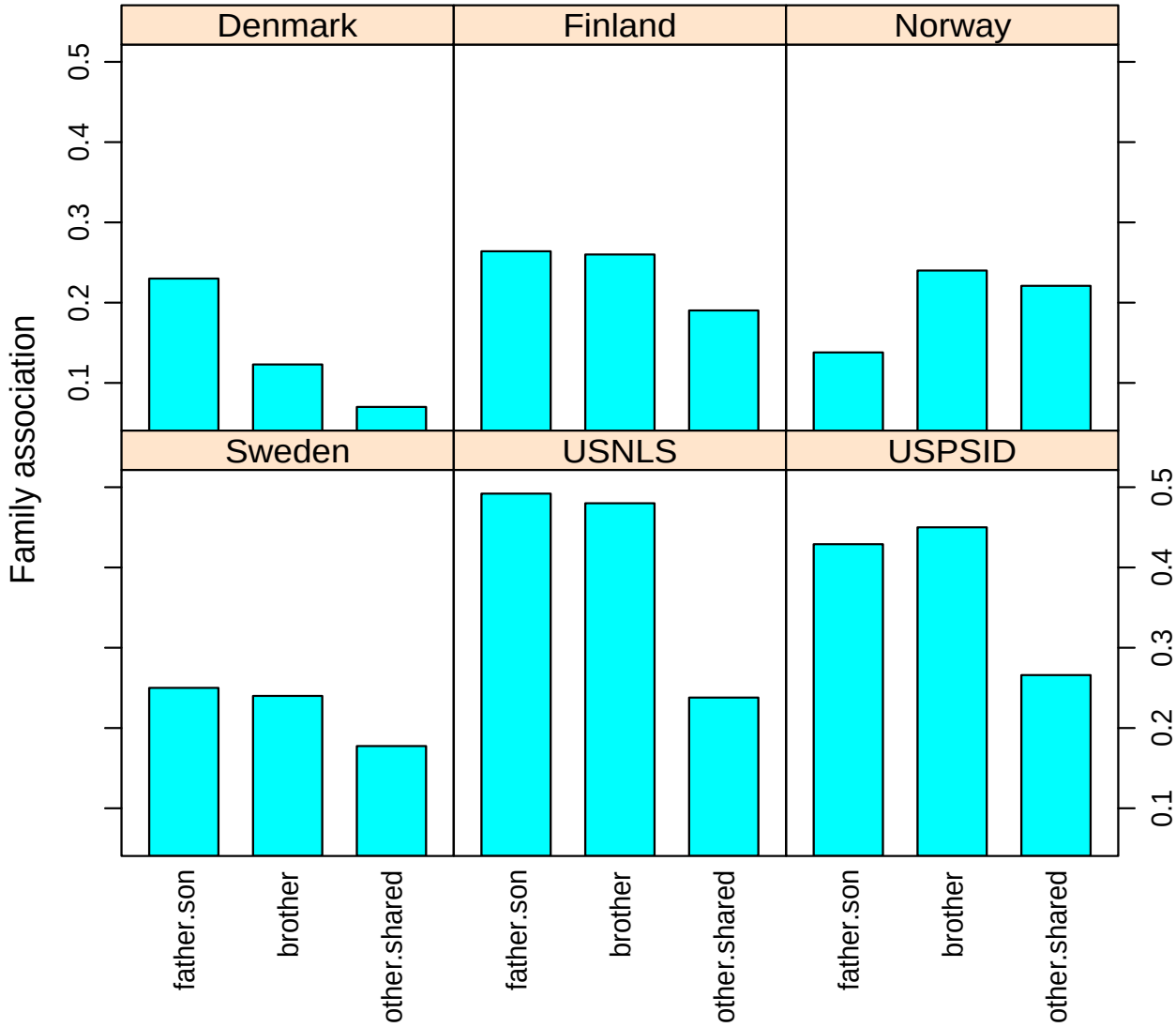

The estimated sibling correlation – baseline case

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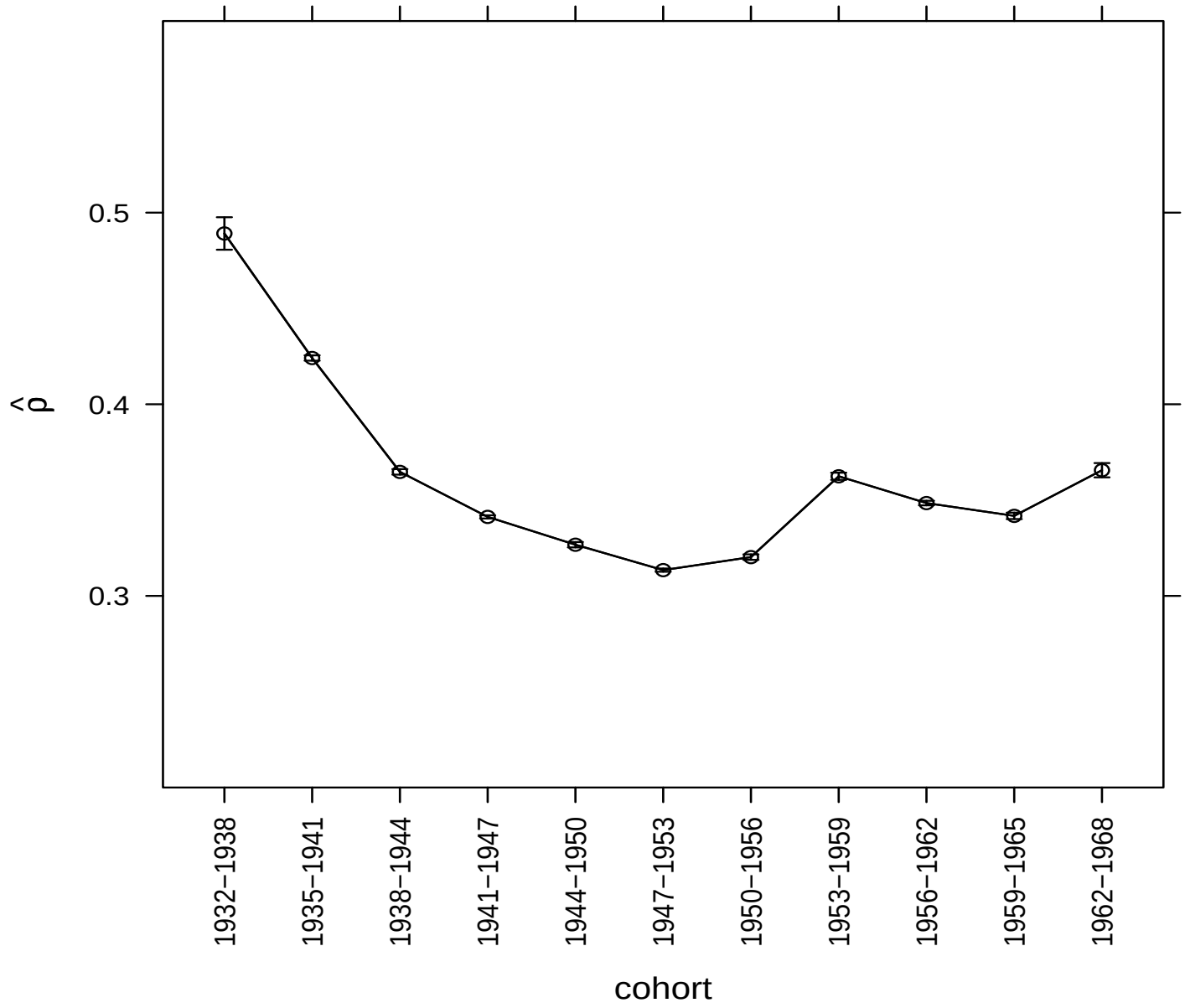

Estimated intergenerational IQ correlations

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Dependent variable	IQ	Log(IQ)	Adjusted R^2
Father's IQ	0.347	-	0.132
	(0.006)		
Log (father's IQ)	-	0.327	0.120
		(0.007)	
Father's IQ in nine levels	Not reported	-	0.132

Note: The reported estimates are unstandardized regression coefficients, but since the standard deviations for fathers' and sons' IQ are almost the same, the estimates can be interpreted as correlations. The equations also include birth year controls for fathers and sons.
Source: Björklund, Eriksson, and Jäntti (2010)

Estimated brother IQ correlations

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Years of birth and spacing	All	Twins	Only non-twins
All brothers born 1951-68	0.473	0.654	0.470
	(0.002)	(0.036)	(0.003)
All brothers born 1951-56	0.489	0.664	0.480
	(0.009)	(0.063)	(0.003)
All brothers born 1957-62	0.488	0.645	0.480
	(0.003)	(0.065)	(0.003)
All brothers born 1963-68	0.513	0.653	0.507
	(0.010)	(0.060)	(0.020)

Note: Estimates obtained using the lme function from package nlme in R (Ihaka and Gentleman, 1996; Pinheiro and Bates, 1999). Standard errors are computed using the the delta method from the estimated variance matrix of the variance components.
Source: Björklund, Eriksson, and Jäntti (2010)

Contribution of types to overall inequality of long-run average income – all cohorts

Back to Type inequality contributions

Heterogeneous effort controlled using smoothed residual variance

A. All (born 1955-1967)

	Gini	GE(0)	GE(1)	CV2
Index value				
	0.257	0.150	0.159	2.196
Relative contributions				
ParentIncType	7.1	2.8	3.2	5.4
ParentEducType	0.4	0.1	0.1	0.1
IQType	11.5	4.9	4.9	3.8
SibType	0.9	0.2	0.3	0.6
FamilyType	1.7	0.5	0.3	−2.2
BMIType	0.8	0.1	0.2	0.4
Type heterogeneity	5.1	2.6	7.3	24.5
Residual	72.6	88.7	83.8	67.4

Contribution of types to overall inequality of long-run average income – cohorts 1955-1959

Back to Type inequality contributions

Heterogeneous effort controlled using smoothed residual variance

B. Cohorts born 1955-1959

	Gini	GE(0)	GE(1)	CV2
Index value				
	0.228	0.120	0.104	0.320
Relative contributions				
ParentIncType	7.2	2.8	3.2	2.1
ParentEducType	0.0	−0.2	−0.2	−0.2
IQType	11.1	4.6	5.4	4.5
SibType	0.7	0.2	0.2	0.1
FamilyType	1.8	0.6	0.7	0.8
BMIType	0.9	0.2	0.2	0.4
Type heterogeneity	4.3	0.8	2.2	3.8
Residual	74.1	91.0	88.4	88.6

Contribution of types to overall inequality of long-run average income – cohorts 1963-1967

Back to Type inequality contributions

Heterogeneous effort controlled using smoothed residual variance

C. Cohorts born 1963-1967

	Gini	GE(0)	GE(1)	CV2
Index value				
	0.270	0.166	0.189	3.034
Relative contributions				
ParentIncType	5.7	2.1	1.7	0.1
ParentEducType	0.3	0.1	0.1	0.0
IQType	12.6	5.3	4.5	−0.6
SibType	0.8	0.2	0.3	0.6
FamilyType	2.3	0.7	0.7	1.1
BMIType	0.7	0.1	0.1	0.2
Type heterogeneity	6.4	4.1	12.1	32.0
Residual	71.3	87.4	80.7	66.6

Contribution of types to overall inequality of long-run average income – all cohorts

Back to Type inequality contributions

Heterogeneous effort controlled using actual residual variance

A. All (born 1955-1967)

	Gini	GE(0)	GE(1)	CV2
Index value				
	0.257	0.150	0.159	2.196
Relative contributions				
ParentIncType	6.8	2.8	3.1	4.9
ParentEducType	0.4	0.1	0.1	0.1
IQType	11.0	4.9	4.9	3.5
SibType	0.9	0.2	0.3	0.6
FamilyType	1.6	0.5	0.3	−1.8
BMIType	0.8	0.1	0.2	0.4
Type heterogeneity	6.6	1.7	5.4	29.4
Residual	72.0	89.6	85.7	63.0

Contribution of types to overall inequality of long-run average income – all cohorts

Back to Type inequality contributions

No effort heterogeneity correction

A. All (born 1955-1967)

	Gini	GE(0)	GE(1)	CV2
Index value				
	0.262	0.156	0.175	2.970
Relative contributions				
ParentIncType	7.9	3.5	4.7	7.2
ParentEducType	0.5	0.2	0.2	0.2
IQType	12.5	5.8	7.2	11.7
SibType	1.0	0.3	0.3	0.7
FamilyType	1.6	0.3	0.3	0.9
BMIType	0.9	0.1	0.2	0.5
Residual	75.6	89.8	87.0	78.8

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