Trading social status for genetics in marriage markets: Evidence from UK Biobank



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IFO Genes and Inequality conference

Basic thesis of modern behavioural genetics:

Genetic data explains social outcomes.

- What's a social scientist to do?

One answer: find out where the genes come from.

- Genetic assortative mating (Hugh-Jones et al. 2016).
- Geographic sorting (Abdellaoui et al. 2019).
- Natural selection (Hugh-Jones and Abdellaoui 2021, working paper).
- This paper.

Inequality persists over generations. It can be surprisingly persistent over time (Clark and Simmons 2015; Solon 2018).

Families are part of the mechanism, since wealth, human capital and other traits are passed from parents to children.

Inherited human genetics help to explain inequality:

- Heritability of occupational class and educational attainment is about 50% (Tambs et al. 1989).
- 2-year-old children's family socio-economic status can be predicted from their genes (Trzaskowski et al. 2014).
- Polygenic scores for educational attainment predict occupational class (Rimfeld et al. 2018).

The leading explanation for this **gene-status gradient** is meritocracy. "Good genes" lead to upward mobility.

We offer a new explanation for the genes-status gradient, based on assortative mating (Fernandez and Rogerson 2000; Fernandez et al. 2005; Schwartz and Mare 2005; Greenwood et al. 2014; Eika et al. 2019).

Social status and “good” genes both contribute to attractiveness in marriage markets.

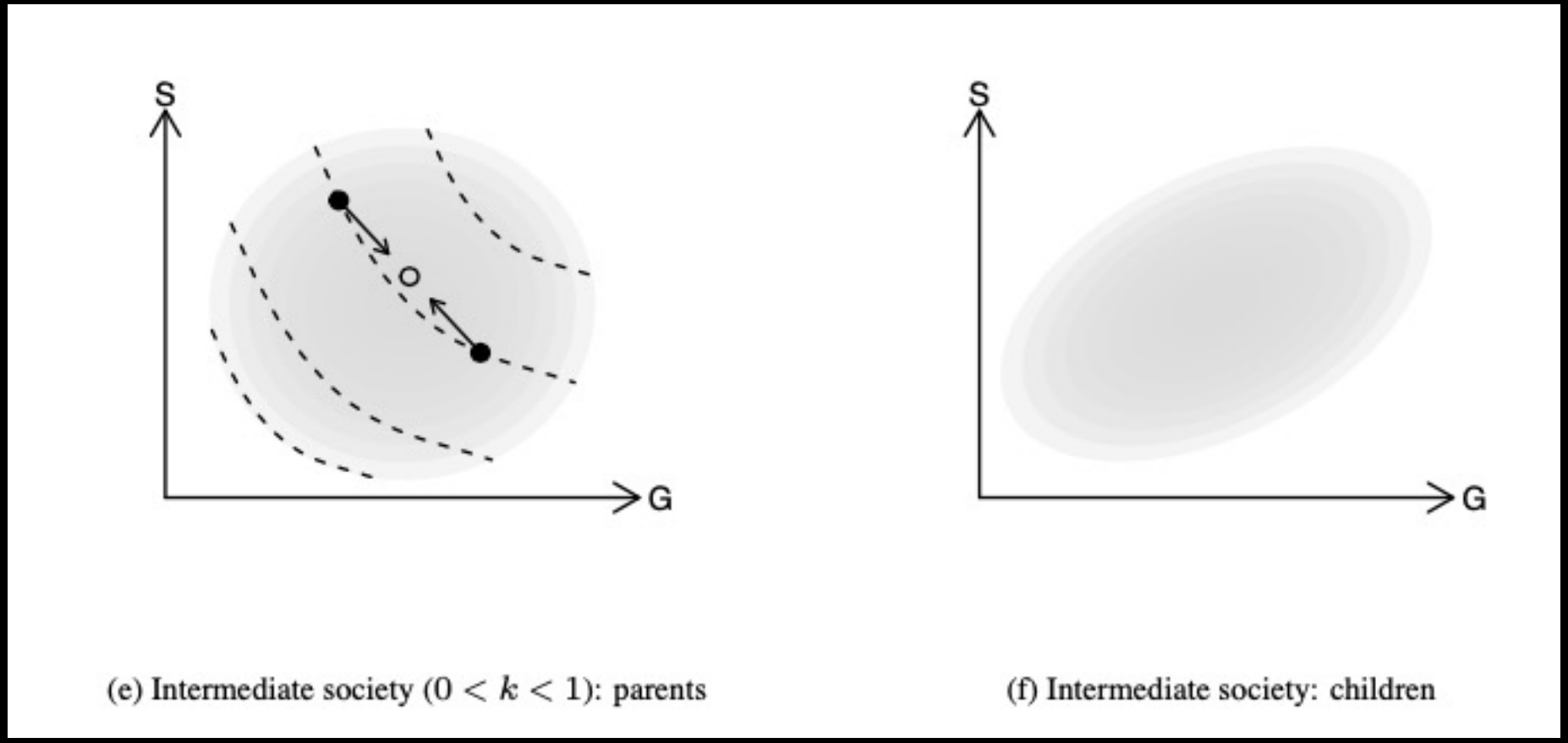
Both are inherited.

As a result, social status and genetics become associated in the next generation.

- Shocks to social status are reflected in children’s genetics.
- Gene-status gradient is likely historically widespread.

We test this theory using data from the UK Biobank.

Model



(e) Intermediate society ($0 < k < 1$): parents

(f) Intermediate society: children

Data

UK Biobank, a study of about 500,000 individuals born 1935-1970. Contains questionnaire data on health and social characteristics, also DNA data. Non-representative!

We don’t have explicit information on spouse pairs.

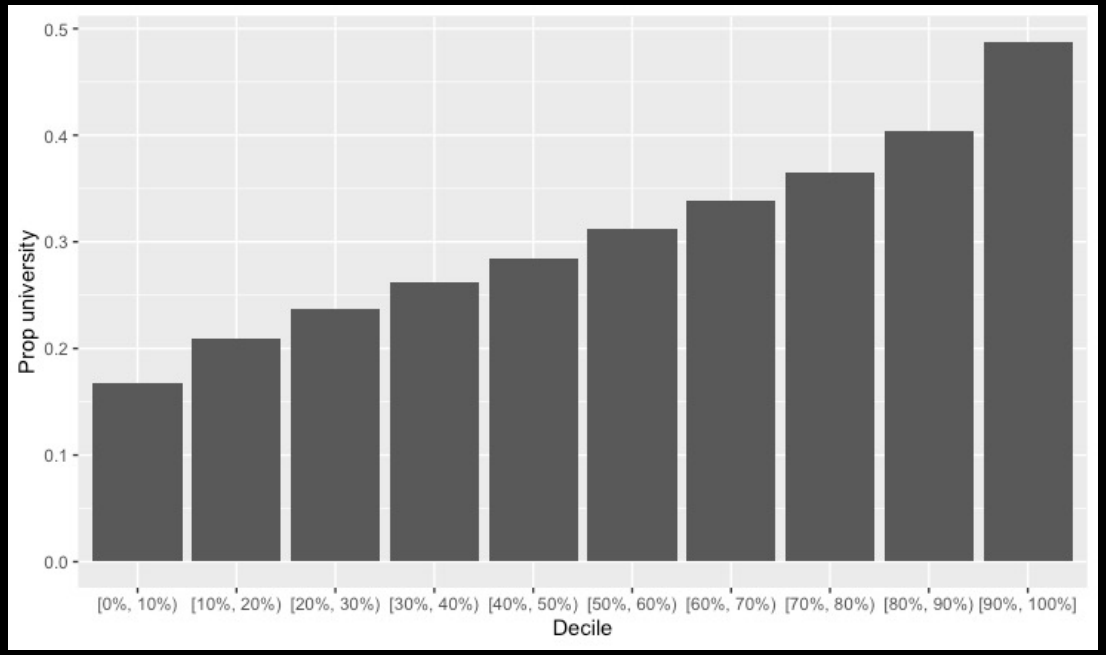
We categorize people as pairs if they:

- had the same home postcode
- have the same homeownership/renting status, length of time at the address, and number of children
- attended the same UK Biobank assessment centre on the same day;
- both reported living with their spouse (“husband, wife or partner”);
- consisted of one male and one female.

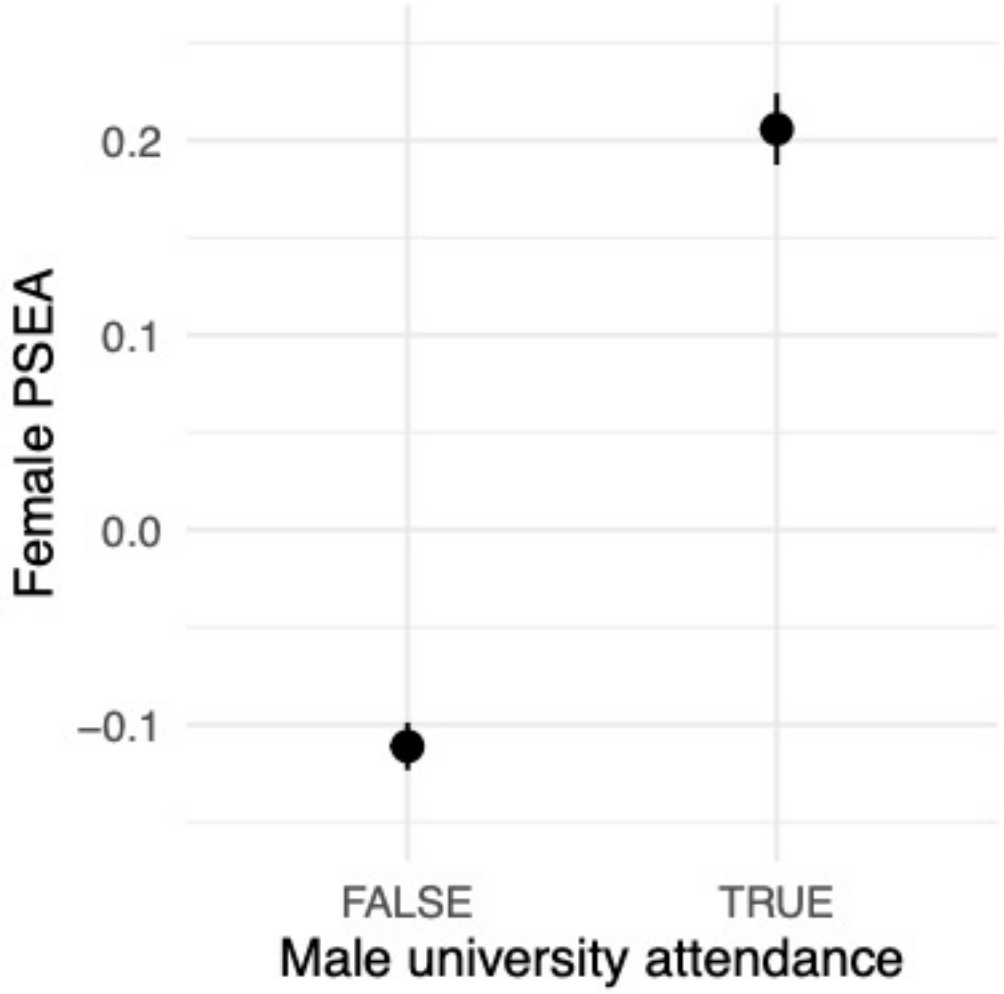
We validate these pairs using genetic children, also in the database.

Our dependent variable is spouse's **Polygenic Score for Educational Attainment** (PSEA).

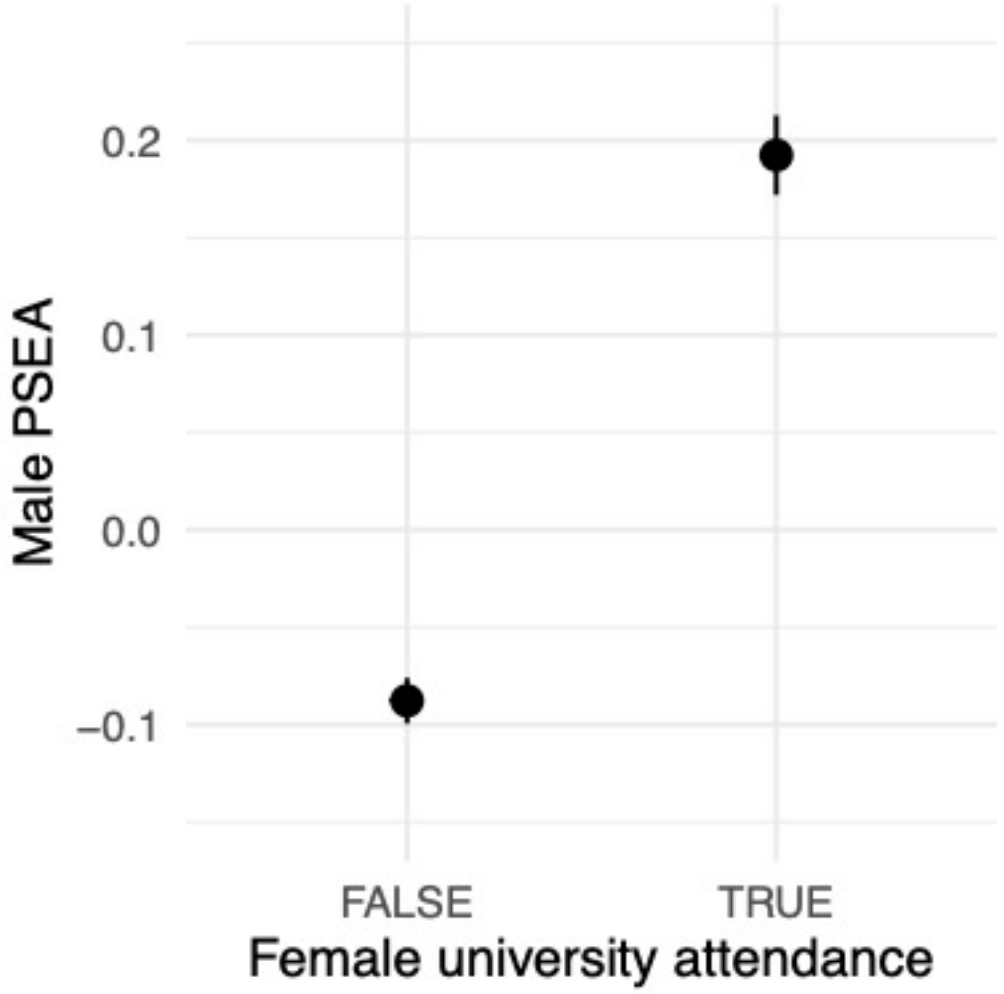
This is a DNA-derived summary statistic which predicts people's level of educational attainment.



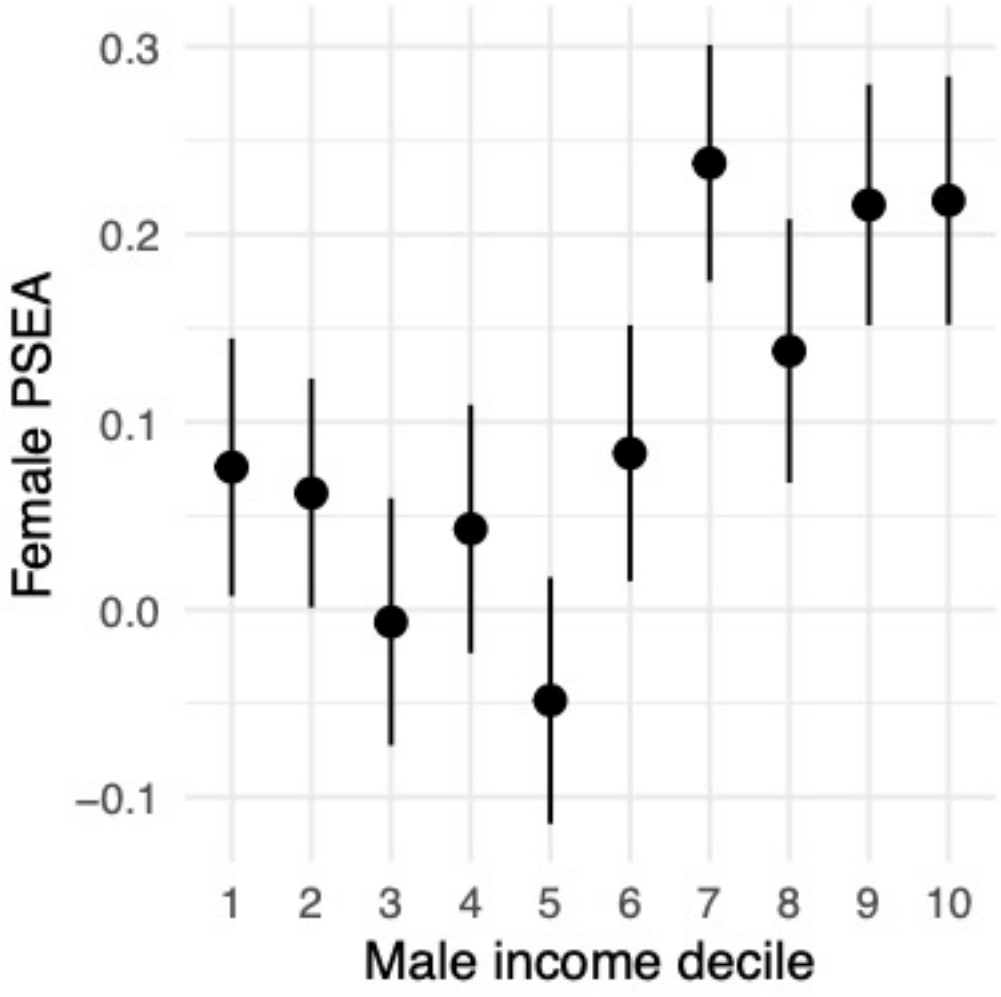
University attendance by PSEA decile



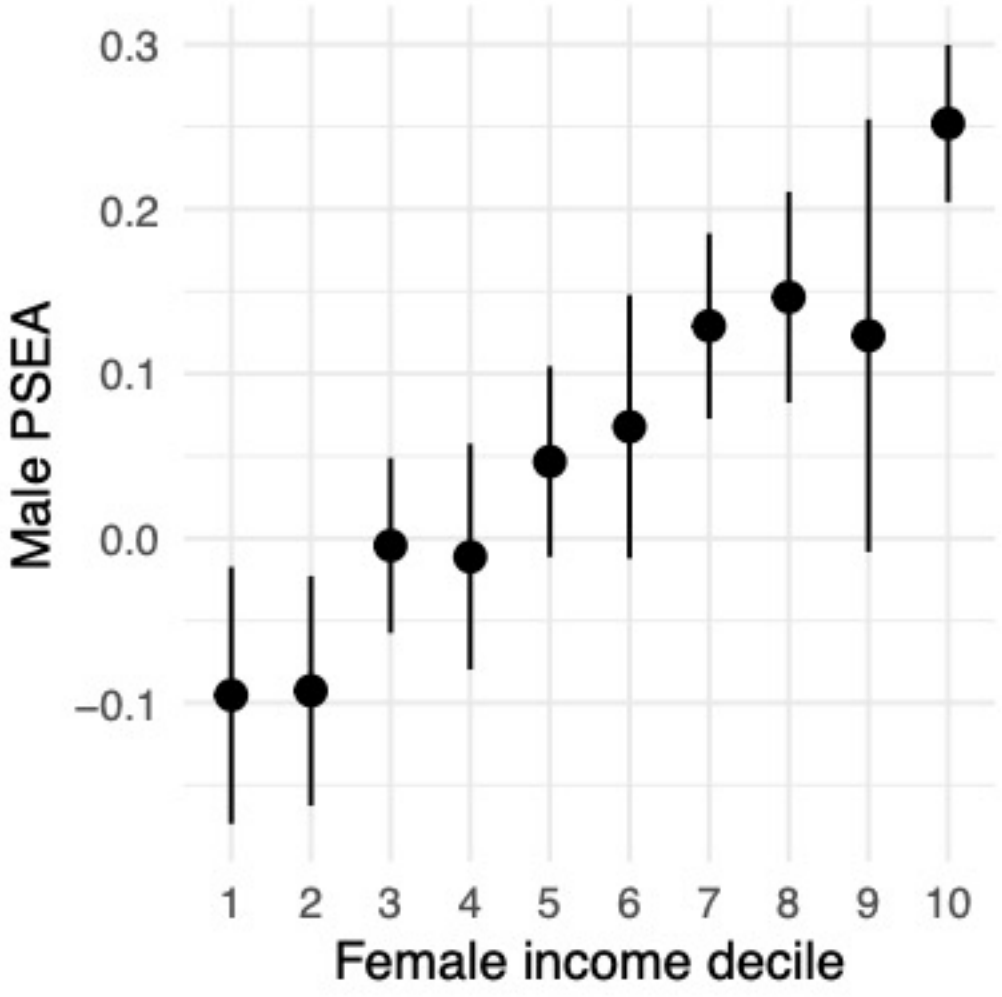
(a) Female PSEA by male educational attainment



(b) Male PSEA by female educational attainment



(a) Female EA3 by male income



(b) Male EA3 by female income

These results could be **confounded** by the individual's own genetics.

- We already know that there is assortative mating on PSEA (Hugh-Jones et al. 2016).

To avoid this, we need an independent variable which is

- independent of genetics;
- available for a large enough N.

We use **birth order**.

- Siblings have the same expected polygenic scores, by the "lottery of meiosis".
- Early-born siblings receive more parental care and have better life outcomes including **socio-economic status** (**SES**: Lindahl 2008; Booth and Kee 2009; Black, Devereux, and Salvanes 2011).

Estimation strategy

Hard to justify instrumental variables:

- Birth order affects other things than SES.
- We only have imperfect measures of SES (rough household income, job, educational attainment).

Instead we run a **mediation analysis**:

- Does birth order affect spouse's PSEA?
- Is the effect mediated by measures of SES?

Controls and mediators

Mediators

University attendance

Median earnings of first job (estimated from 2000 SOC code)

Non-SES mediators

Fluid IQ

Height

Controls

Family size

Month of birth

Year of birth

Parent’s age at birth (correlates with birth order! Only available for some respondents)

Table 1: Regressions of variables on birth order

	University	Income	Fluid IQ	Height
Birth order	−0.0789 ***	−1.0882 *	−0.2718 ***	−0.7051 ***
	(0.0067)	(0.4264)	(0.0304)	(0.1353)
PSEA	0.0890 ***	1.5211 ***	0.3172 ***	0.1921 *
	(0.0046)	(0.3296)	(0.0200)	(0.0919)
Parents' age at birth	0.0164 ***	0.2631 ***	0.0588 ***	0.1515 ***
	(0.0012)	(0.0721)	(0.0053)	(0.0241)
Family size dummies	Yes	Yes	Yes	Yes
Birth month dummies	Yes	Yes	Yes	Yes
Birth year dummies	Yes	Yes	Yes	Yes
N	10243	3419	10243	10243
R2	0.074	0.026	0.058	0.017

Table 2: Regressions of spouse PSEA on birth order

	(1)	(2)	(3)
Birth order	−0.0099	−0.0079	−0.0312 *
	(0.0074)	(0.0074)	(0.0146)
Own PSEA		0.0651 ***	0.0583 ***
		(0.0065)	(0.0100)
Parents' age at birth			0.0113 ***
			(0.0026)
Family size dummies	Yes	Yes	Yes
Birth month dummies	No	Yes	Yes
Birth year dummies	No	Yes	Yes
N	23904	23861	10229
R2	0.003	0.011	0.013

Mediators

Controls

Table 3: Regressions of spouse PSEA on birth order and potential mediators

	(1)
Birth order	−0.0312 *
	(0.0146)
University	
Income	
Own PSEA	0.0583 ***
	(0.0100)
Parents' age at birth	0.0113 ***
	(0.0026)
Fluid IQ	
Height	
Family size dummies	Yes
Birth month dummies	Yes
Birth year dummies	Yes
N	10229
R2	0.013
logLik	−14327.102
AIC	28754.204

Mediators

Controls

Table 3: Regressions of spouse PSEA on birth order and potential mediators

	(1)	(2)	(3)	(4)
Birth order	−0.0312 *	−0.0065	−0.0128	−0.0059
	(0.0146)	(0.0146)	(0.0270)	(0.0269)
University		0.2276 ***		0.1596 ***
		(0.0224)		(0.0377)
Income			0.0037 ***	0.0030 **
			(0.0011)	(0.0011)
Own PSEA	0.0583 ***	0.0320 **	0.0299	0.0189
	(0.0100)	(0.0101)	(0.0184)	(0.0185)
Parents' age at birth	0.0113 ***	0.0061 *	0.0100 *	0.0086 +
	(0.0026)	(0.0026)	(0.0047)	(0.0047)
Fluid IQ		0.0174 ***	0.0198 *	0.0104
		(0.0052)	(0.0093)	(0.0097)
Height		0.0028 **	0.0047 *	0.0043 *
		(0.0011)	(0.0020)	(0.0019)
Family size dummies	Yes	Yes	Yes	Yes
Birth month dummies	Yes	Yes	Yes	Yes
Birth year dummies	Yes	Yes	Yes	Yes
N	10229	10229	3414	3414
R2	0.013	0.029	0.027	0.032
logLik	−14327.102	−14242.367	−4826.981	−4817.738
AIC	28754.204	28590.734	9759.962	9743.475

Table 4: Percent of birth order effects accounted for by mediators, models 2-4

	Model 2	**Model 3**	**Model 4**
University	57.6%	-	40.4%
Income	-	13.0%	10.5%
Fluid IQ	15.2%	17.3%	9.0%
Height	6.3%	10.5%	9.7%

Table 5: Regressions of spouse PSEA on birth order: subsets

	Male respondents	Male respondents	Female respondents	Female respondents	With children	With children
Birth order	−0.030	−0.002	−0.031	−0.011	−0.034 *	−0.009
	(0.022)	(0.022)	(0.019)	(0.019)	(0.015)	(0.015)
University		0.283 ***		0.177 ***		0.227 ***
		(0.033)		(0.031)		(0.024)
Own PSEA	0.059 ***	0.025 +	0.059 ***	0.037 **	0.063 ***	0.035 **
	(0.015)	(0.015)	(0.014)	(0.014)	(0.011)	(0.011)
Parents' age at birth	0.013 **	0.006	0.010 **	0.006 +	0.012 ***	0.007 *
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Fluid IQ		0.020 **		0.015 *		0.023 ***
		(0.008)		(0.007)		(0.006)
Height		0.004 +		0.005 *		0.002 +
		(0.002)		(0.002)		(0.001)
Family size dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth month dummies	Yes	Yes	Yes	Yes	Yes	Yes
Birth year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	4684	4684	5545	5545	9148	9148
R2	0.018	0.041	0.018	0.028	0.015	0.032

Assortative mating in marriage markets can explain the genes-status gradient.

- This explanation applies to a wider range of societies than the key rival.
- Prediction: genes-status gradient should be visible in ancient DNA.

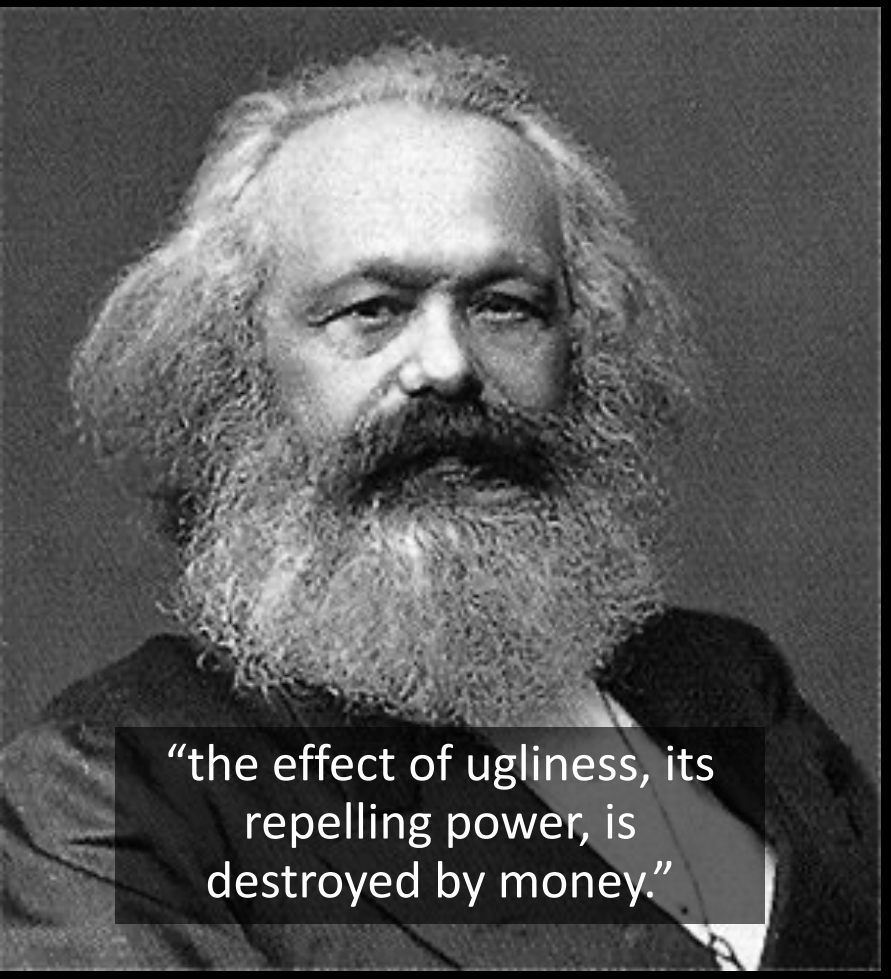
Shocks to socio-economic status are reflected in the DNA of descendants.

- Part of how elite families maintain their position over time (Clark 2015)?

The media (and scientists!) often oppose “nature” to “nurture”.

- The logic is that DNA is fixed at conception, and affects individual outcomes thereafter.

However, across generations, **DNA is a social outcome**.


“the effect of ugliness, its repelling power, is destroyed by money.”

Thanks!


EXIT
“Part of the beauty of me is that I am very rich.”