

Trading social status for genetics in marriage markets: Evidence from Great Britain and Norway



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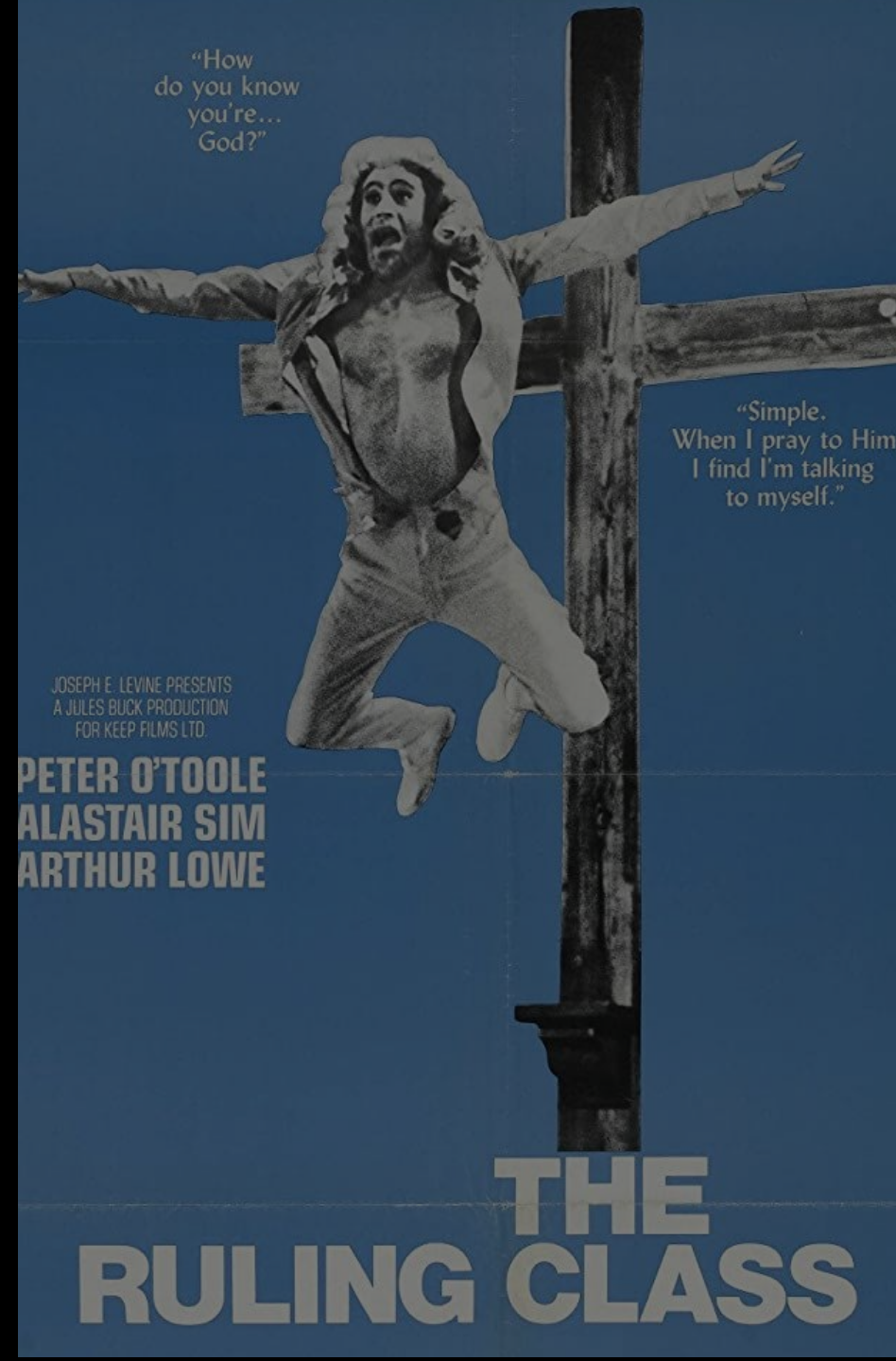
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Background

Genetics explains about 50% of variation in many human characteristics. What's a social scientist to do?

One answer: **make genetics the dependent variable.**

Migration

- Abdellaoui, Hugh-Jones, ..., Visscher (2019). Genetic Correlates of Social Stratification in Great Britain. *Nature Human Behaviour* 3.

Natural selection

- Hugh-Jones and Abdellaoui (2022). Human Capital Mediates Natural Selection in Contemporary Humans. *Behavior Genetics* 52:4.

Assortative mating

- Hugh-Jones, Abdellaoui et al. (2016). Assortative Mating on Education Leads to Genetic Spousal Resemblance for Causal Alleles. *Intelligence* 59.
- This paper.

Many genetic measures, including polygenic scores for education and health outcomes, differ between people of low and high socio-economic status (SES).

The leading explanation for this **genes-SES gradient** is meritocracy: genetic variants that cause success in *labour markets* lead to upward mobility.

An alternative explanation: both some genetic variants, and high SES, are desirable qualities in **marriage markets**.

If you are rich or privileged, you may marry someone intelligent or good-looking.

Both SES and genetics are then inherited by the next generation.

Under **Social-Genetic Assortative Mating**:

- Shocks to SES are reflected in the DNA of subsequent generations.
- The size of the genes-SES gradient depends on social structure and policy variables.

Literature

Large, mostly separate, literatures on assortative mating in economics and genetics.

Genetics: genetic assortative mating (GAM) (Rao, Morton, and Yee 1976; Heath and Eaves 1985; Otto, Christiansen, and Feldman 1995), including cross-trait assortative mating (Beauchamp et al. 2010; Sundet et al. 2005; Border et al. 2022).

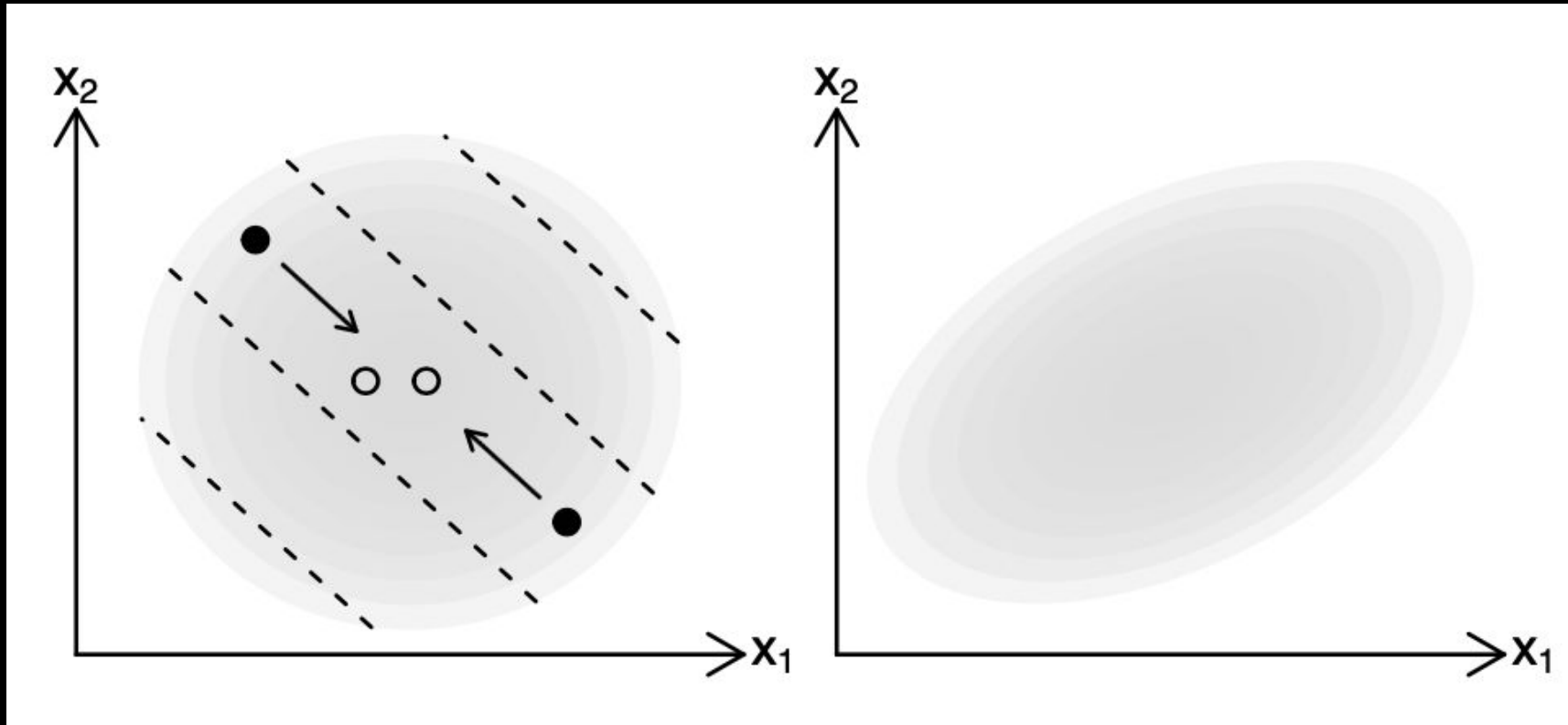
Economics: models and empirics on assortative mating and inequality, including cross-trait assortative mating (Fernández and Rogerson 2001; Fernandez, Guner, and Knowles 2005; Eika, Mogstad, and Zafar 2019; Chiappori, Dias, and Meghir 2018).

Genetic theory predicted in the 1970s that genetically and culturally transmitted traits could become associated in the population (Rao, Morton, and Yee 1976).

Despite this, previous work has not drawn conclusions for the genes-SES gradient (e.g. Rimfeld et al. 2018) or made the link with social structure.

- Ours is the first post-genomic revolution empirics to directly demonstrate SGAM.
- Our model provides a microeconomic foundation for SGAM.

Model intuition

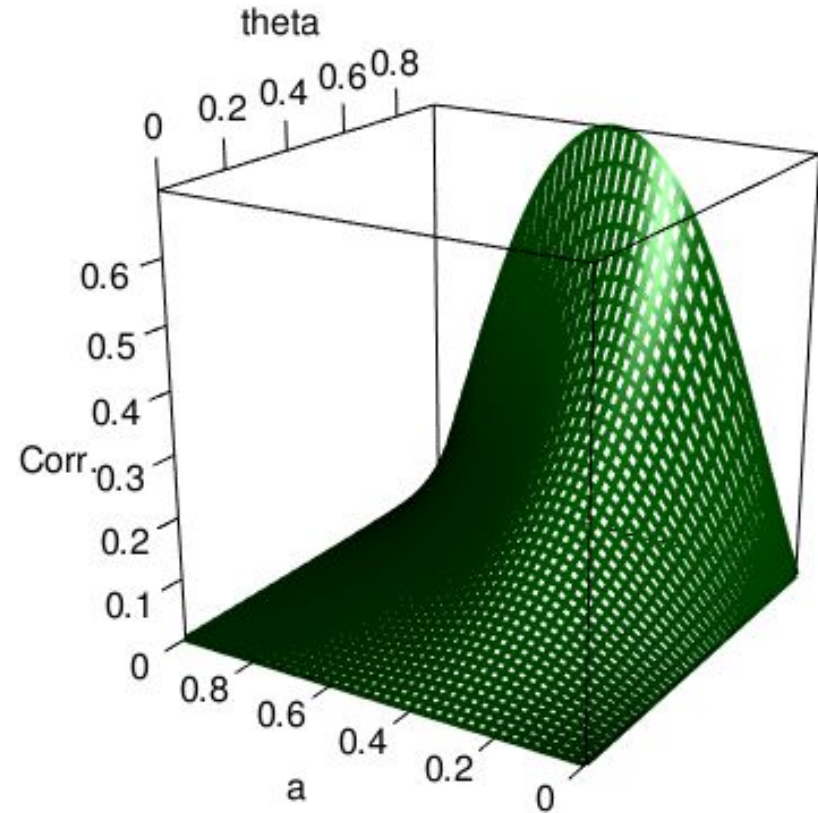


Parents (●) mate along iso-attractiveness curves for “genetics” (x_1) and SES (x_2).
Their children (○) are between them.
As a result, the children’s distribution is squashed along the attractiveness gradient.

Result

If parents' genetics and SES are independent, children's genetics and SES are positively correlated.

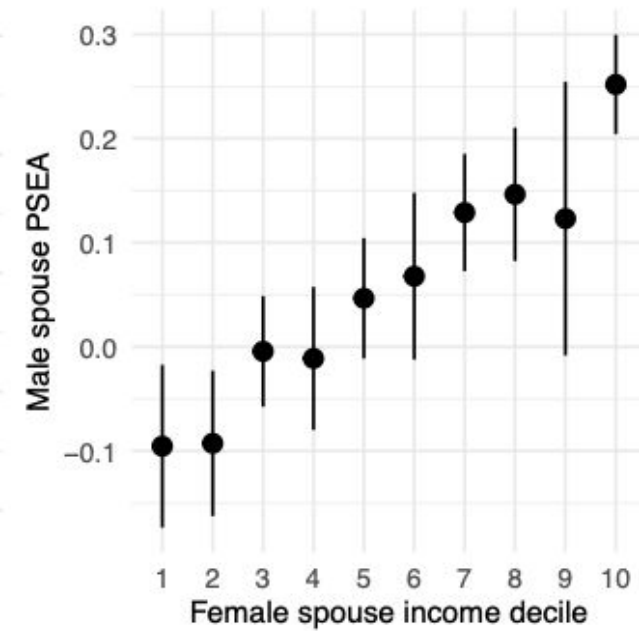
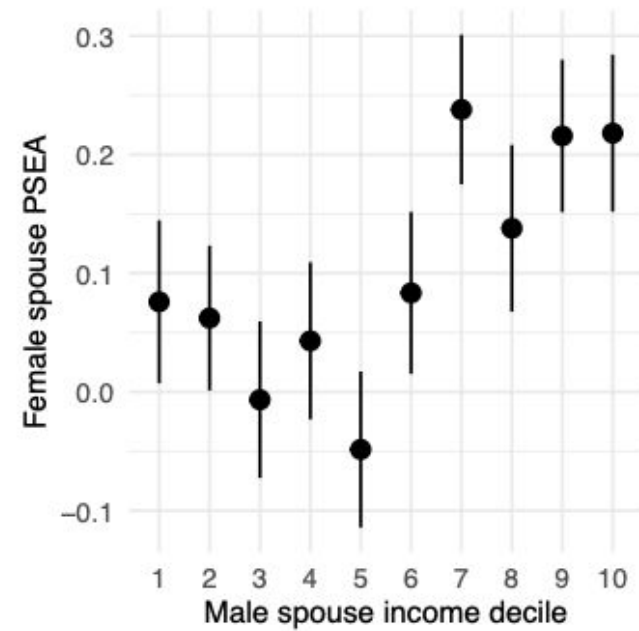
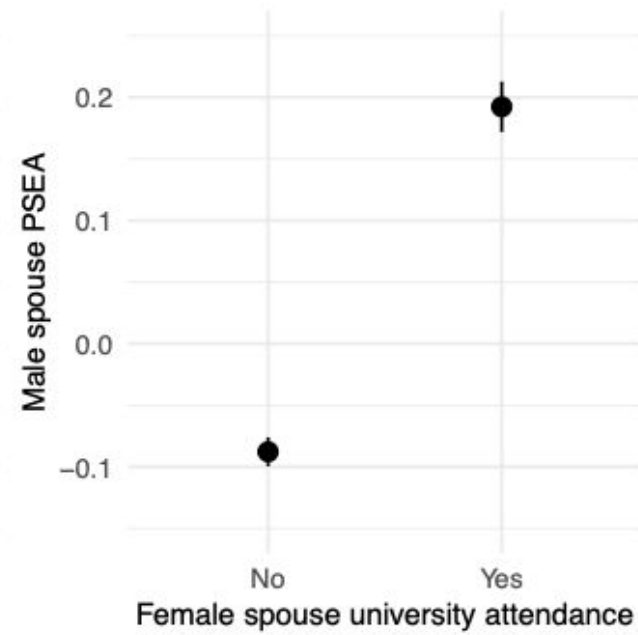
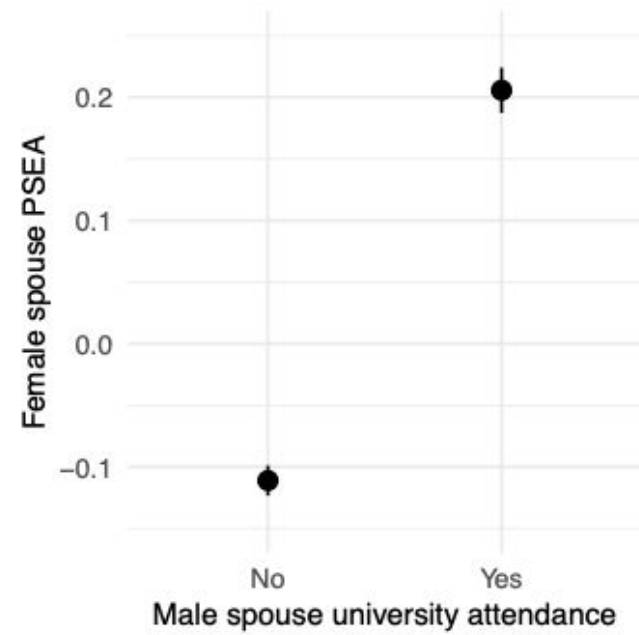
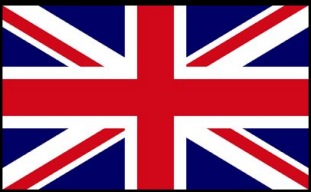
The correlation increases with social inheritance of SES (e.g. redistribution, inheritance tax).



Long-run correlation between genetics and SES.
Theta measures intergenerational transmission of SES.

Data

- UK Biobank, a study of about 500,000 individuals born 1935-1970. UKBB has no explicit information on spouse pairs. We match pairs manually, and check using genetic children of the pairs. This gives 35,682 spouse pairs.
- MOBA, a study of about 90,000 mothers and babies born in Norway 1998-2008. About 70,000 fathers are included.
- Our dependent variable is spouse polygenic score for educational attainment (EA3).



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

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

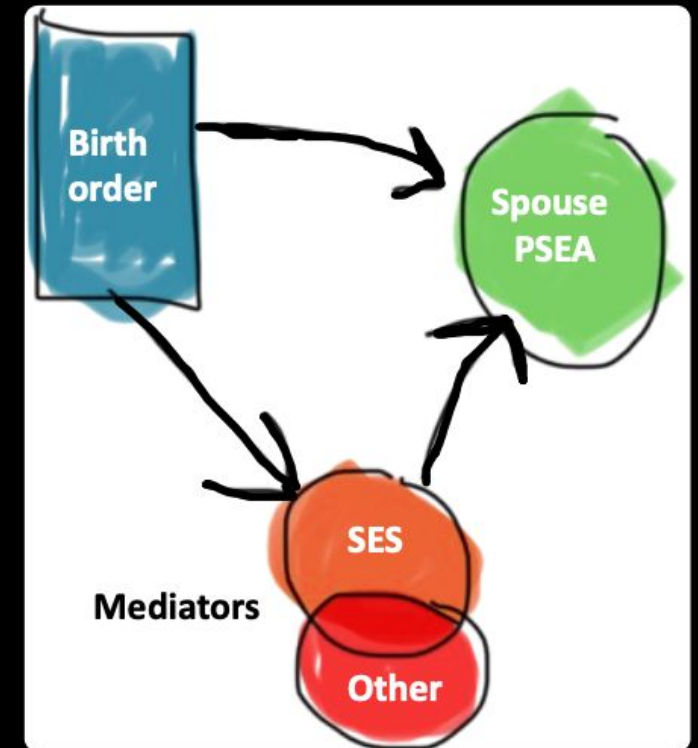
For an environmental “shock” to SES, we use **birth order**.

- 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)**.

Estimation strategy

We run a **mediation analysis**:

- Does birth order affect spouse's PSEA?
- Is the effect mediated by measures of SES?
- We include SES mediators (university, income in first job) and non-SES mediators as controls (e.g. height, BMI)
- Controls: family size, birth year, birth month, parents' age at birth, own PSEA



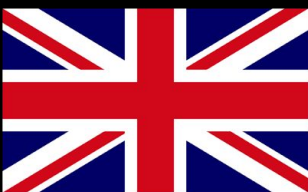


Table 1: Regressions of mediators on birth order

	University	Income	Fluid IQ	Height	BMI	Health
Birth order	−0.0790 *** (0.0067)	−1.0899 * (0.4264)	−0.2733 *** (0.0304)	−0.7012 *** (0.1355)	0.1907 ** (0.0662)	−0.0430 *** (0.0103)
PSEA	0.0889 *** (0.0046)	1.5144 *** (0.3307)	0.3180 *** (0.0200)	0.1970 * (0.0921)	−0.4281 *** (0.0456)	0.0533 *** (0.0068)
Parents' age at birth	0.0163 *** (0.0012)	0.2623 *** (0.0722)	0.0588 *** (0.0053)	0.1514 *** (0.0241)	−0.0989 *** (0.0117)	0.0110 *** (0.0018)
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	10220	3412	10220	10220	10220	10220
R2	0.074	0.026	0.058	0.017	0.023	0.018

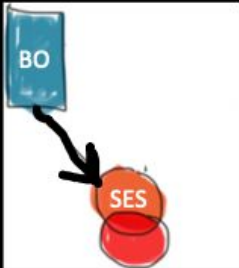
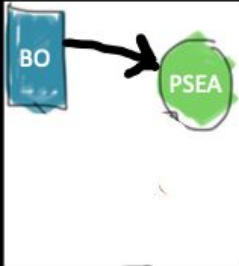
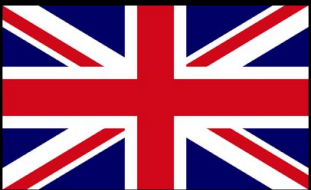




Table 2: Regressions of spouse PSEA on birth order

	(1)	(2)	(3)
Birth order	−0.0091 (0.0074)	−0.0075 (0.0074)	−0.0314 * (0.0146)
Own PSEA		0.0650 *** (0.0065)	0.0573 *** (0.0100)
Parents' age at birth			0.0116 *** (0.0026)
Family size dummies	Yes	Yes	Yes
Birth month dummies	No	Yes	Yes
Birth year dummies	No	Yes	Yes
N	23840	23797	10206
R2	0.003	0.010	0.013





SES mediators

Non-SES
mediators

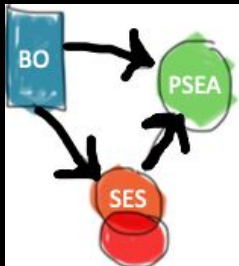


Table 3: Regressions of spouse PSEA on birth order and mediators (Great Britain)

	(1)	(2)	(3)	(4)
Birth order	−0.0314 * (0.0145)	−0.0045 (0.0145)	−0.0106 (0.0270)	−0.0042 (0.0270)
University		0.2179 *** (0.0225)		0.1538 *** (0.0375)
Income			0.0037 *** (0.0011)	0.0031 ** (0.0011)
Fluid IQ		0.0172 ** (0.0052)	0.0201 * (0.0092)	0.0112 (0.0096)
Height		0.0029 ** (0.0011)	0.0046 * (0.0020)	0.0043 * (0.0020)
BMI		−0.0109 *** (0.0022)	−0.0114 ** (0.0040)	−0.0109 ** (0.0040)
Self-reported health		0.0181 (0.0152)	0.0145 (0.0275)	0.0077 (0.0273)
Own PSEA	0.0573 *** (0.0120)	0.0263 * (0.0121)	0.0218 (0.0202)	0.0118 (0.0203)
Parents' age at birth	0.0116 *** (0.0026)	0.0053 * (0.0026)	0.0091 + (0.0047)	0.0078 + (0.0047)
Family size dummies	Yes	Yes	Yes	Yes
Birth month dummies	Yes	Yes	Yes	Yes
Birth year dummies	Yes	Yes	Yes	Yes
N	10206	10206	3407	3407
R ²	0.013	0.032	0.030	0.034

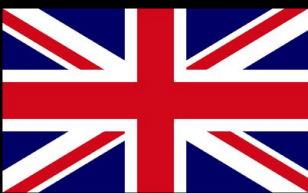
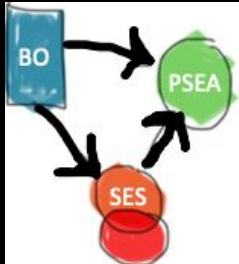
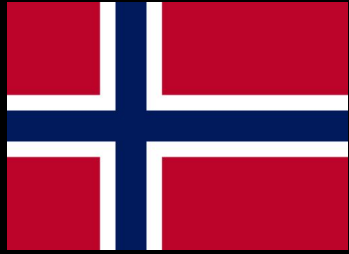


Table 4: Percent of birth order effects accounted for by mediators
(Great Britain)

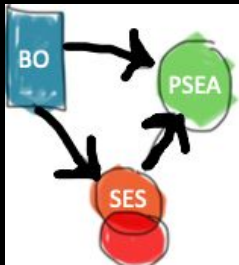
	Model 2 (%)	Model 3 (%)	Model 4 (%)
University	54.9		38.7
Income		13.0	10.6
Fluid IQ	15.0	17.6	9.7
Height	6.6	10.4	9.5
BMI	6.6	7.0	6.6
Self-reported health	2.5	2.0	1.1



Robustness



	(1)	(2)	(3)	(4)
Birth order	−0.0684 *** (0.0051)	−0.0426 *** (0.0054)	−0.0652 *** (0.0054)	−0.0428 *** (0.0054)
University		0.3049 *** (0.0075)		0.3091 *** (0.0076)
Income			0.0053 *** (0.0013)	−0.0043 ** (0.0014)
Height		0.0033 *** (0.0004)	0.0061 *** (0.0004)	0.0032 *** (0.0004)
BMI		−0.0206 *** (0.0009)	−0.0240 *** (0.0009)	−0.0208 *** (0.0009)
Own PSEA	0.1193 *** (0.0034)	0.0699 *** (0.0036)	0.1068 *** (0.0035)	0.0704 *** (0.0036)
Parents' age at birth	0.0132 *** (0.0008)	0.0085 *** (0.0008)	0.0125 *** (0.0008)	0.0085 *** (0.0008)
Family size dummies	Yes	Yes	Yes	Yes
Birth month dummies	Yes	Yes	Yes	Yes
Birth year dummies	Yes	Yes	Yes	Yes
N	89308	80465	80503	80465
R^2	0.032	0.060	0.041	0.060



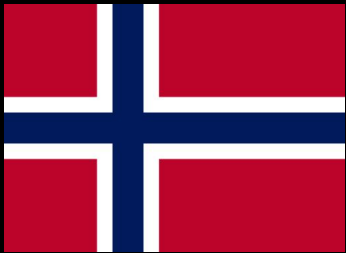
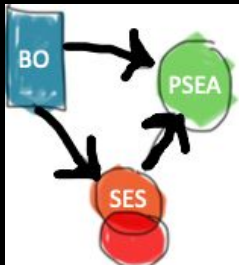


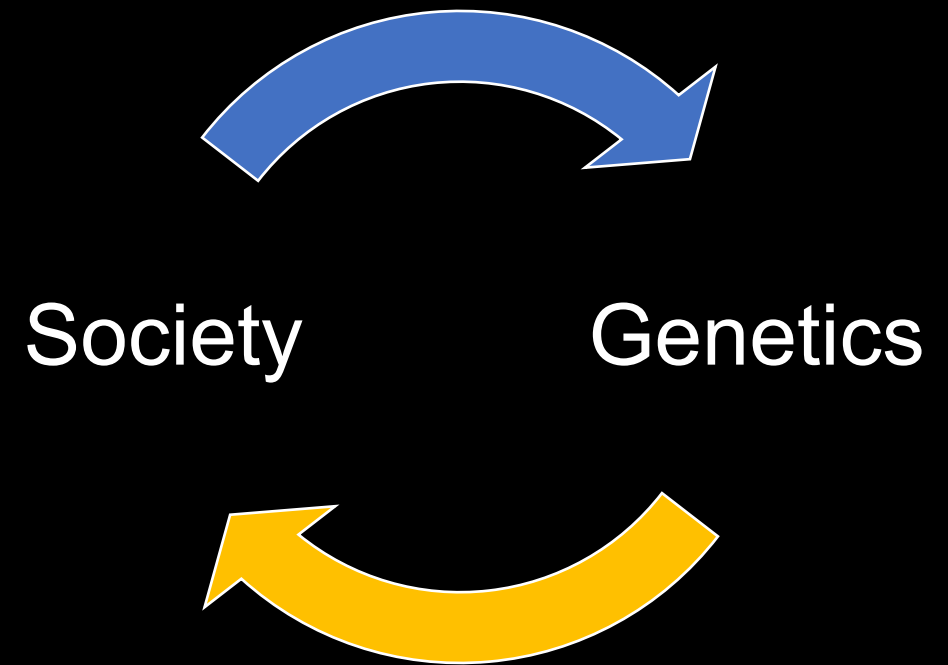
Table 7: Percent of birth order effects accounted for by mediators
(Norway)

	Model 2 (%)	Model 3 (%)	Model 4 (%)
University	35.5		36.0
Income		0.9	−0.7
Height	2.3	4.3	2.3
BMI	0.7	0.8	0.7



Conclusions

- Via assortative mating, environmental shocks to SES affect the genetic endowment of subsequent generations.
- The correlation between genetics and SES is an outcome of socio-economic structure.
- Some early evidence that SGAM is driven by income more in the UK, a relatively unequal society, than in Norway, a more equal society.



Spouse pairs

Some respondents in the Biobank sample have a genetic child who is also in the sample.

Among our spouse pairs, 511 have a genetic child of at least one partner in the sample.

For 86% (441) of these, the child is the genetic child of both partners.

Comparison: 11% of families with dependent children included a stepchild in England and Wales in 2011 (National Statistics 2014).

Bibliography

- Abdellaoui, Abdel, David Hugh-Jones, LÖic Yengo, Kathryn E Kemper, Michel G Nivard, Laura Veul, Yan Holtz, et al. 2019. "Genetic Correlates of Social Stratification in Great Britain." *Nature Human Behaviour* 3 (12): 1332–42.
- Black, Sandra E, Paul J Devereux, and Kjell G Salvanes. 2011. "Older and Wiser? Birth Order and IQ of Young Men." *CESifo Economic Studies* 57 (1): 103–20.
- Booth, Alison L, and Hiau Joo Kee. 2009. "Birth Order Matters: The Effect of Family Size and Birth Order on Educational Attainment." *Journal of Population Economics* 22 (2): 367–97.
- Clark, Gregory. 2021. "For Whom the Bell Curve Tolls: A Lineage of 400,000 English Individuals 1750-2020 Shows Genetics Determines Most Social Outcomes." Working Paper. <http://faculty.econ.ucdavis.edu/faculty/gclark/ClarkGlasgow2021.pdf>.
- Clark, Gregory, and Neil Cummins. 2015. "Intergenerational Wealth Mobility in England, 1858–2012: Surnames and Social Mobility." *The Economic Journal* 125 (582): 61–85.
- Eika, Lasse, Magne Mogstad, and Basit Zafar. 2019. "Educational Assortative Mating and Household Income In- equality." *Journal of Political Economy* 127 (6): 2795–835.
- Fernandez, Raquel, Nezih Guner, and John Knowles. 2005. "Love and Money: A Theoretical and Empirical Analysis of Household Sorting and Inequality." *Quarterly Journal of Economics* 120 (1): 273–344.
- Fernández, Raquel, and Richard Rogerson. 2001. "Sorting and Long-Run Inequality." *Quarterly Journal of Economics* 116 (4): 1305–41.
- Furnham, Adrian. 1993. "Just World Beliefs in Twelve Societies." *Journal of Social Psychology* 133 (3): 317–29.
- Gramsci, Antonio. 1971. Selections from the Prison Notebooks. Lawrence; Wishart London.
- Greenwood, Jeremy, Nezih Guner, Georgi Kocharkov, and Cezar Santos. 2014. "Marry Your Like: Assortative Mating and Income Inequality." *American Economic Review* 104 (5): 348–53.

Halsey, AH. 1958. "Genetics, Social Structure and Intelligence." *British Journal of Sociology* 9 (1): 15–28.

Hugh-Jones, David, Karin JH Verweij, Beate St Pourcain, and Abdel Abdellaoui. 2016. "Assortative Mating on Educational Attainment Leads to Genetic Spousal Resemblance for Polygenic Scores." *Intelligence* 59: 103–8.

Hugh-Jones, David and Abdel Abdellaoui. 2022. "Human capital mediates natural selection in contemporary humans ". Working paper.

Lindahl, Lena. 2008. "Do Birth Order and Family Size Matter for Intergenerational Income Mobility? Evidence from Sweden." *Applied Economics* 40 (17): 2239–57.

National Statistics. 2014. "Stepfamilies in 2011." <https://webarchive.nationalarchives.gov.uk/20160105222243/http://www.ons.gov.uk/ons/rel/family-demography/stepfamilies/2011/stepfamilies-rpt.html>.

Rimfeld, Kaili, Eva Krapohl, Maciej Trzaskowski, Jonathan R. I. Coleman, Saskia Selzam, Philip S. Dale, Tonu Esko, Andres Metspalu, and Robert Plomin. 2018. "Genetic Influence on Social Outcomes During and After the Soviet Era in Estonia." *Nature Human Behaviour* 2 (4): 269–75.

Schwartz, Christine R, and Robert D Mare. 2005. "Trends in Educational Assortative Marriage from 1940 to 2003." *Demography* 42 (4): 621–46.

Shakespeare, William. 1595. *A Midsummer Night's Dream*.

Solon, Gary. 2018. "What Do We Know so Far about Multigenerational Mobility?" *The Economic Journal* 128 (612): F340–52.

Tambs, Kristian, Jon Martin Sundet, Per Magnus, and K re Berg. 1989. "Genetic and Environmental Contributions to the Covariance Between Occupational Status, Educational Attainment, and IQ: A Study of Twins." *Behavior Genetics* 19 (2): 209–22.

Trzaskowski, Maciej, Nicole Harlaar, Rosalind Arden, Eva Krapohl, Kaili Rimfeld, Andrew McMillan, Philip S. Dale, and Robert Plomin. 2014. "Genetic Influence on Family Socioeconomic Status and Childrens Intelligence." *Intelligence* 42 (January): 83–88