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







Abdel Abdellaoui *Amsterdam UMC*
Oana Borcan *University of East Anglia*
Pierre Chiappori *Columbia*
David Hugh-Jones *Idle Bum*
Fartein Ask Torvik *Norwegian Institute of Public Health*
Eivind Ystrøm *Norwegian Institute of Public Health*


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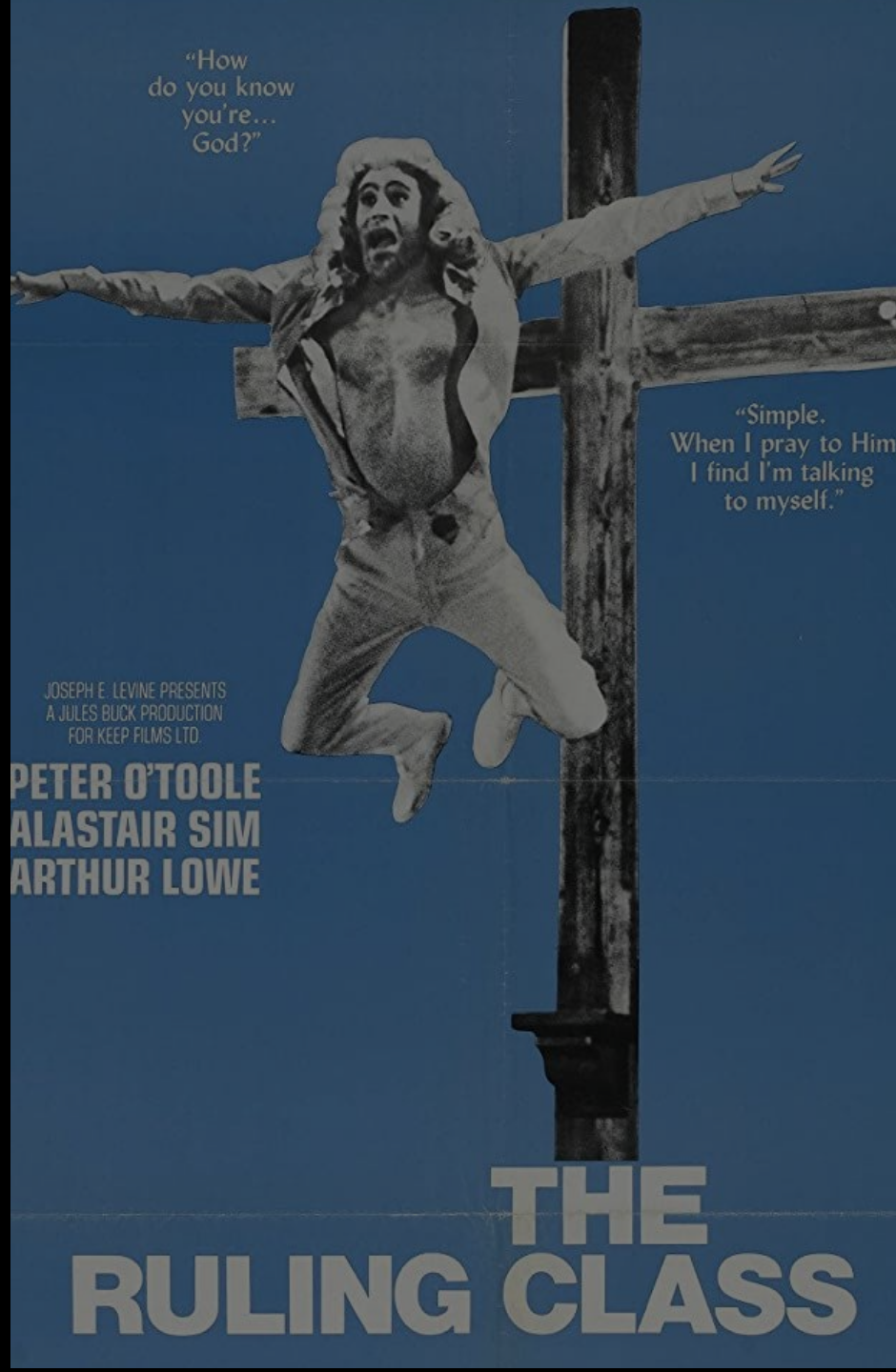


# Background

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 for **health outcomes**, differ between people of low and high socio-economic status (SES).

Explanations include meritocracy; confounding; and **assortative mating**.

- If you are rich or privileged, you may marry someone intelligent or good-looking.
- The next generation inherits genetics (via biology), and SES (via social organization).

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).

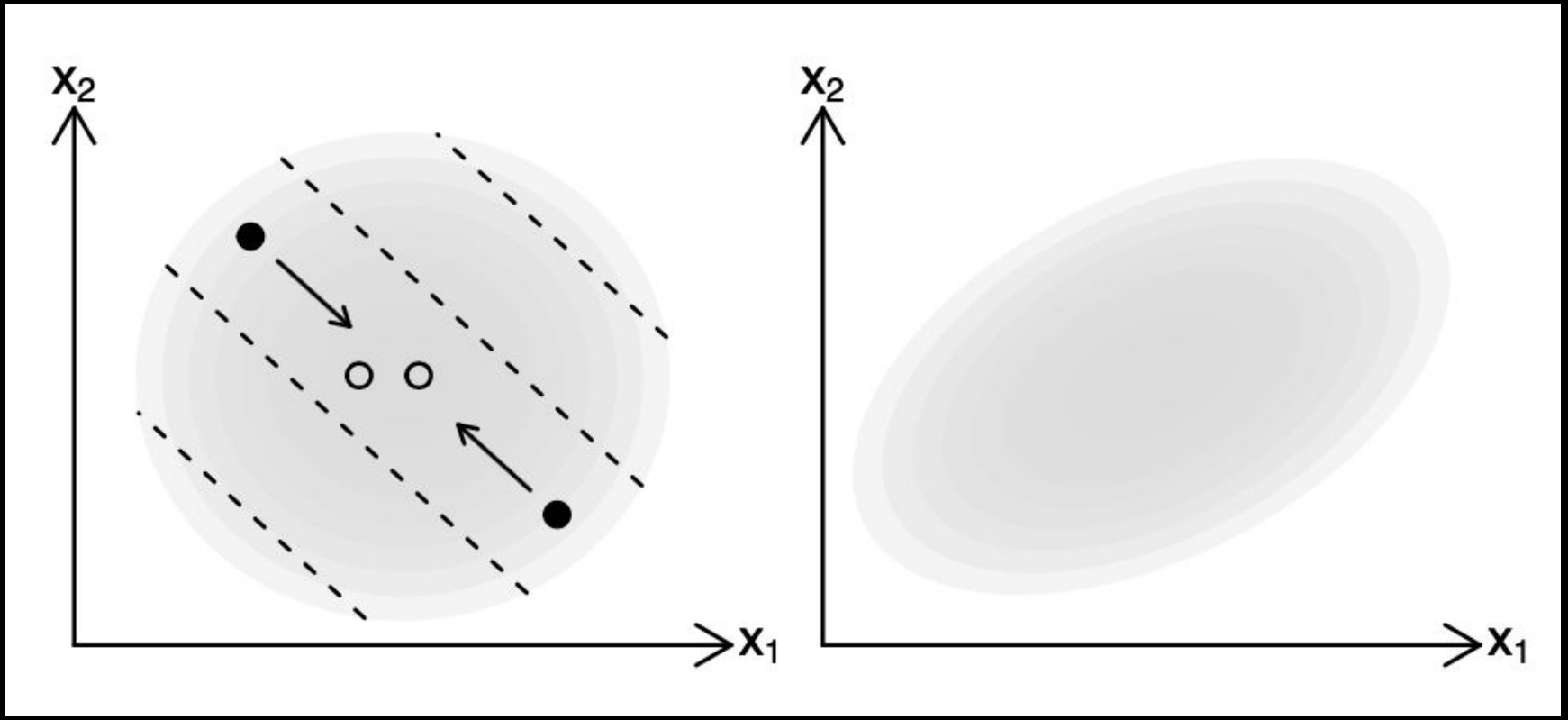
**Economics**: models and empirics on assortative mating and inequality, including cross-trait assortative mating (Fernández and Rogerson 2001; Fernandez, Guner, and Knowles 2005; Eika, Mogstad, and Zafar 2019; Chiappori, Dias, and Meghir 2018).

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

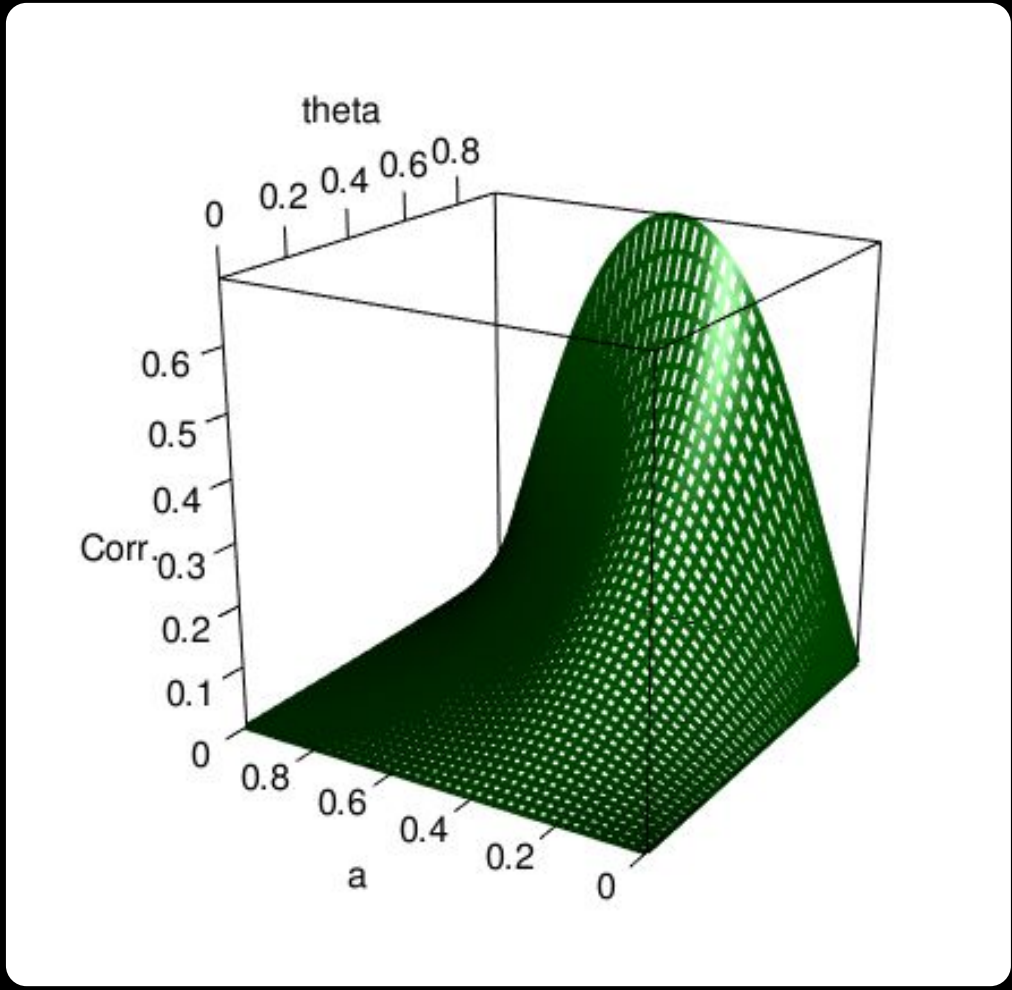



Parents (●) mate along iso-attractiveness curves for “genetics” (x1) and SES (x2).
Their children (○) are between them.
As a result, the children’s distribution is squashed along the attractiveness gradient.

# Model result

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

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

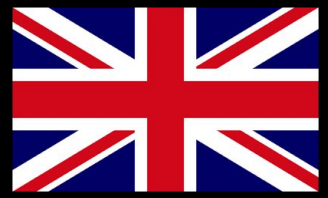


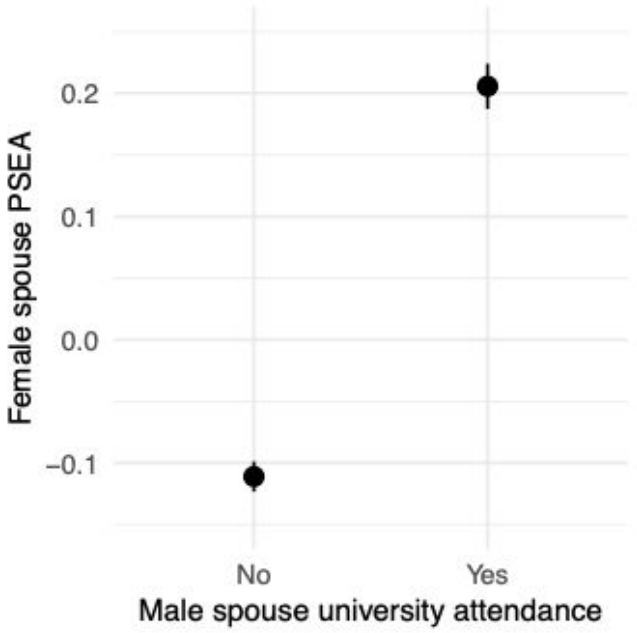

Long-run correlation between genetics and SES.
**Theta** measures intergenerational transmission of SES.

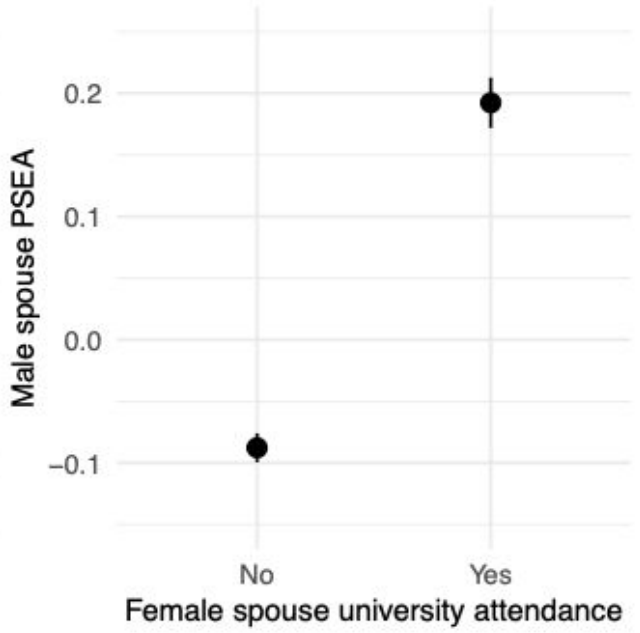
# Data

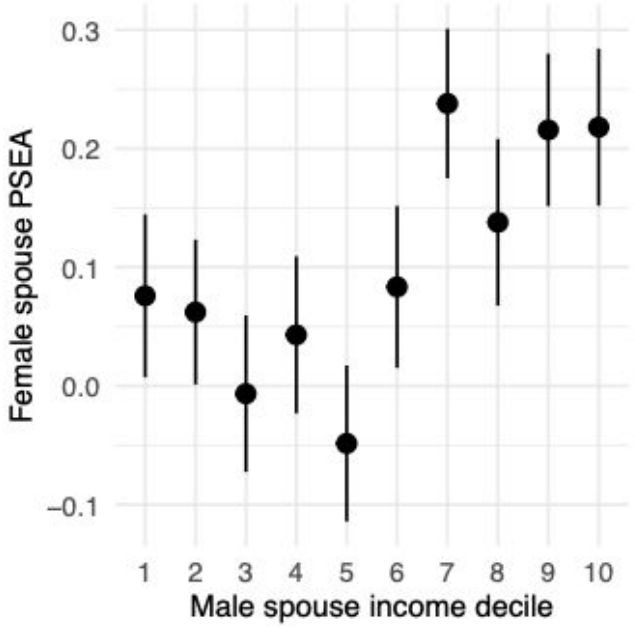
- **UK Biobank**, a study of about 500,000 individuals born 1935-1970.

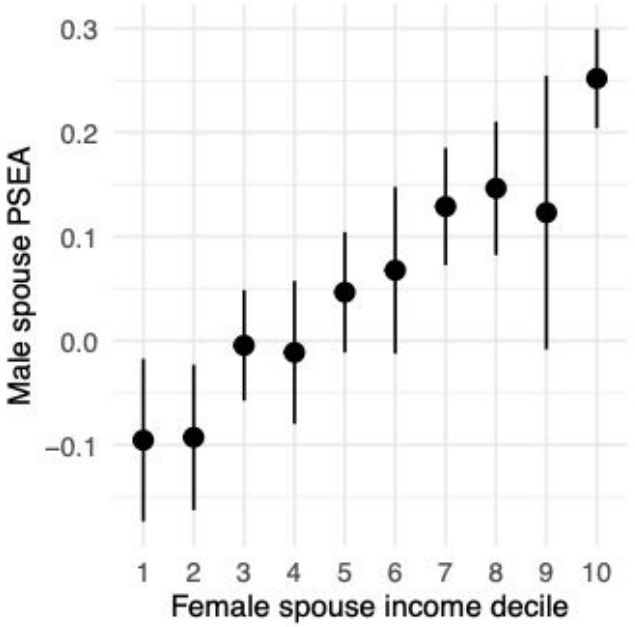
  UKBB has no explicit information on spouse pairs. We match pairs manually, and check using genetic children of the pairs. This gives 35,682 spouse pairs.
- **MOBA**, a study of about 90,000 mothers and babies born in **Norway** 1998-2008. About 70,000 fathers are included.
- Our dependent variable is spouse polygenic score for educational attainment (UK: EA3, Norway: EA4).




Female spouse PSEA
0.2
0.1
0.0
−0.1
No
Yes
Male spouse university attendance


Male spouse PSEA
0.2
0.1
0.0
−0.1
No
Yes
Female spouse university attendance


Female spouse PSEA
0.3
0.2
0.1
0.0
−0.1
1 2 3 4 5 6 7 8 9 10
Male spouse income decile


Male spouse PSEA
0.3
0.2
0.1
0.0
−0.1
1 2 3 4 5 6 7 8 9 10
Female spouse income decile

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).

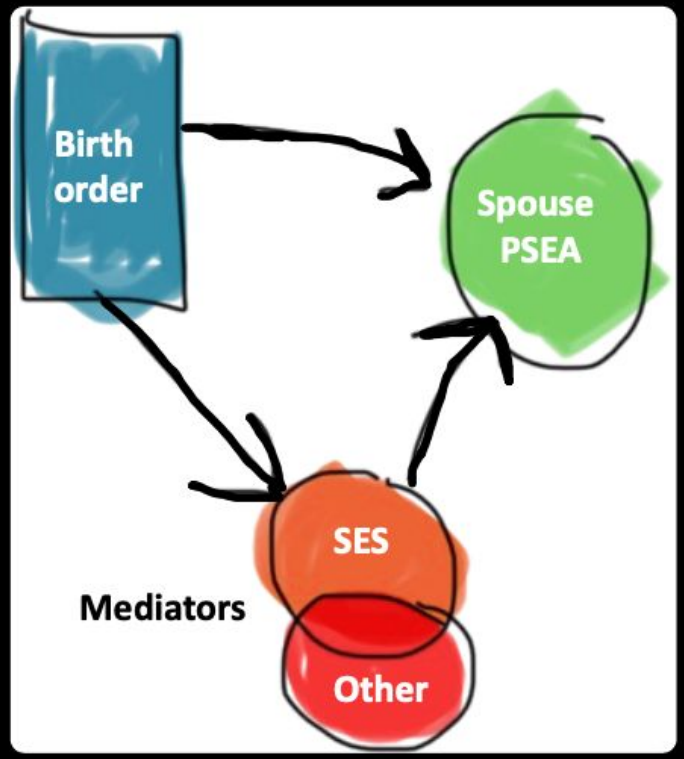
For an environmental "shock" to SES, we use **birth order**.

- 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



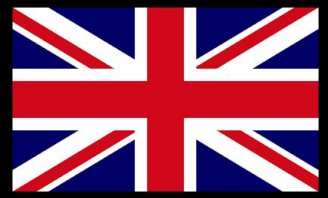
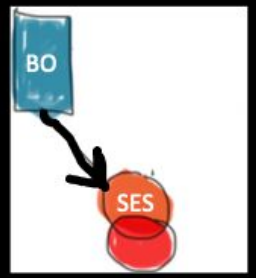


Table 1: Regressions of mediators on birth order

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



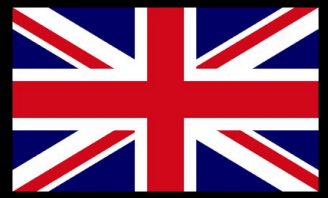
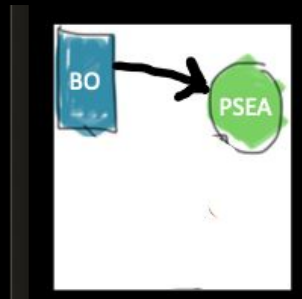
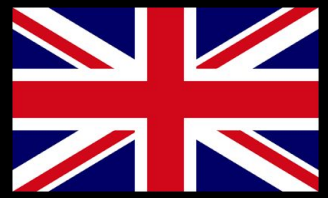


Table 2: Regressions of spouse PSEA on birth order

| | (1) | (2) | (3) |
|---|---|---|---|
| Birth order | −0.0091 | −0.0075 | −0.0314 * |
| | (0.0074) | (0.0074) | (0.0146) |
| Own PSEA | | 0.0650 *** | 0.0573 *** |
| | | (0.0065) | (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

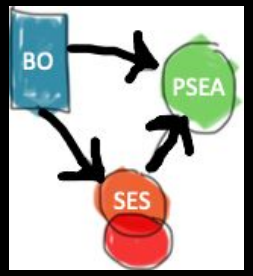



Table 3: Regressions of spouse PSEA on birth order and mediators (Great Britain)

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

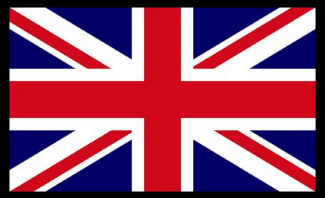
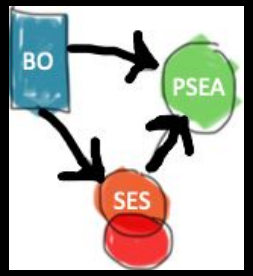
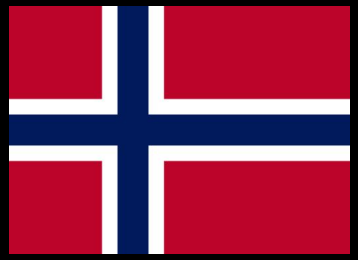


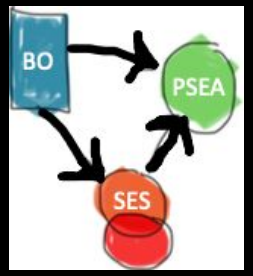
Table 4: Percent of birth order effects accounted for by mediators (Great Britain)

| | 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 *** | −0.0426 *** | −0.0652 *** | −0.0428 *** |
| | (0.0051) | (0.0054) | (0.0054) | (0.0054) |
| University | | 0.3049 *** | | 0.3091 *** |
| | | (0.0075) | | (0.0076) |
| Income | | | 0.0053 *** | −0.0043 ** |
| | | | (0.0013) | (0.0014) |
| Height | | 0.0033 *** | 0.0061 *** | 0.0032 *** |
| | | (0.0004) | (0.0004) | (0.0004) |
| BMI | | −0.0206 *** | −0.0240 *** | −0.0208 *** |
| | | (0.0009) | (0.0009) | (0.0009) |
| Own PSEA | 0.1193 *** | 0.0699 *** | 0.1068 *** | 0.0704 *** |
| | (0.0034) | (0.0036) | (0.0035) | (0.0036) |
| Parents' age at birth | 0.0132 *** | 0.0085 *** | 0.0125 *** | 0.0085 *** |
| | (0.0008) | (0.0008) | (0.0008) | (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 |

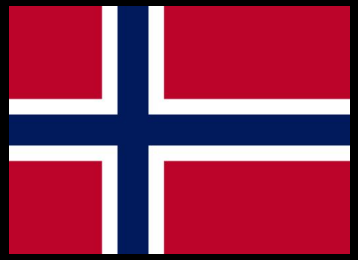
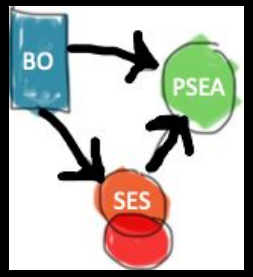


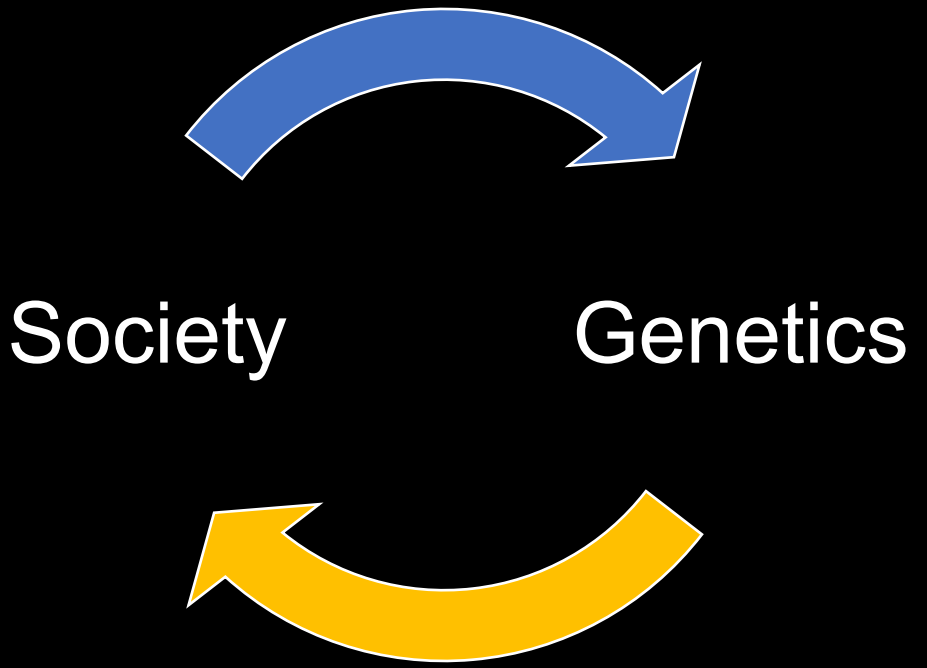
Table 7: Percent of birth order effects accounted for by mediators (Norway)

| | 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).

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