Parental Responses to Child Endowments

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(Very) Old Question

- How do parental investments respond to child endowments?
  - Compensation or Reinforcement?
    - How this changes as the child ages
      - And family structure changes
  - Typical question in studies of intra-household inequality
- Becker and Tomes (1976), Tomes (1981), Griliches (1979), Behrman et al (1982, 1994), Rosenzweig and Zhang (2009), Pitt et al (1990), Yi et al (2015), Berry et al (2022), Giannola (2023), Carneiro et al (2024),...

Empirical Strategy - Genetic Lotteries

- Mendel's Laws of Inheritance
  - Conditional on parental genotype, variation in children's genotype is random

- Kong et al (2018), Young et al (2022), Tang et al (2026), many more
- Conley (2023), Sanz de Galdeano and Terskaya (2024), Houmark et al (2024), Agostinelli and Weingarten (2025)

- We examine parental responses (PI) to randomly assigned genetic endowments (GE) of children

  - $PI_i = \alpha_0 + \alpha_1 GE_{child,i} + \alpha_2 GE_{mother,i} + \alpha_3 GE_{father,i} + \varepsilon_i$

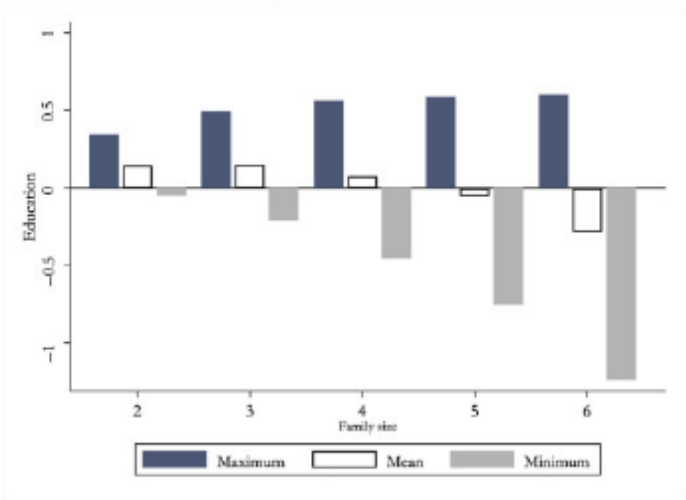
Data

- We use this idea in Millenium Cohort Study
  - Representative sample from England (UK?)
  - Detailed data on parental investments and genetic information (and child outcomes) on parents and children over their entire childhood
- But this research strategy forces us to restrict the sample
  - Only use White families
  - Even within White families the sample skewed towards those with higher socioeconomic status (since we require data on both parents)

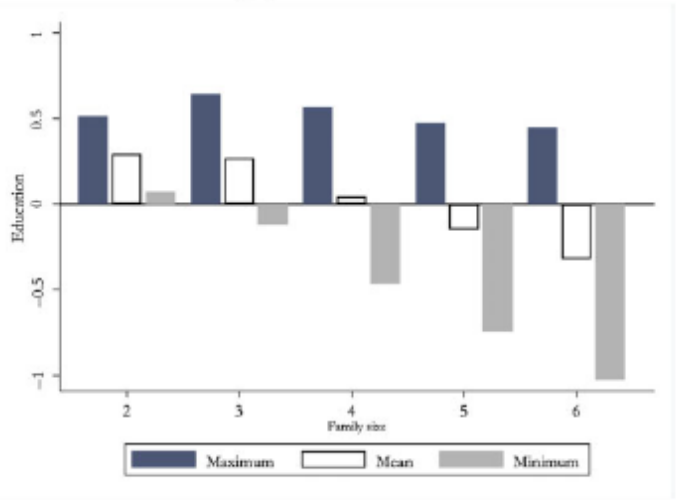
Main Results

- Parents reinforce
  - Better endowments $\Longrightarrow$ Higher investments
  - Similar impacts across different ages
- But reinforcement only observed in families with more than one child
  - No investment-endowment gradient if single child
  - Gradient increases with number of siblings
    - Even after including individual fixed effects
      - Not driven by family type
      - Gradient increases with the birth of new siblings
- Additional results on endowments, skills and parental beliefs; non-linearity in endowment-investment gradients; age and gender differences; reaction to different types of genetic endowments

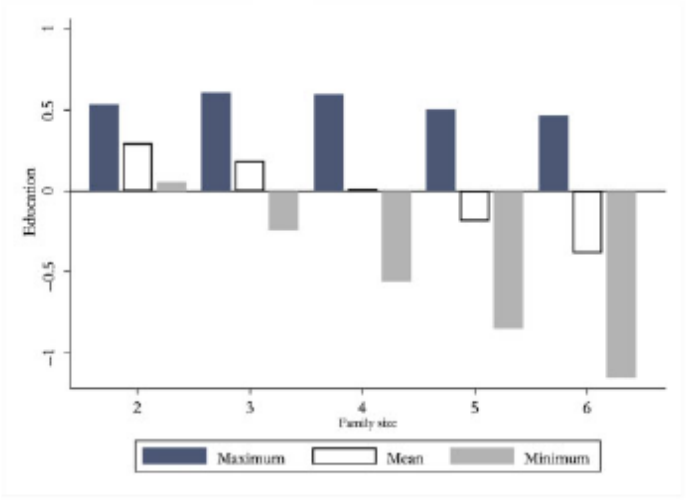
Giannola (2023) – Within household inequality and family size



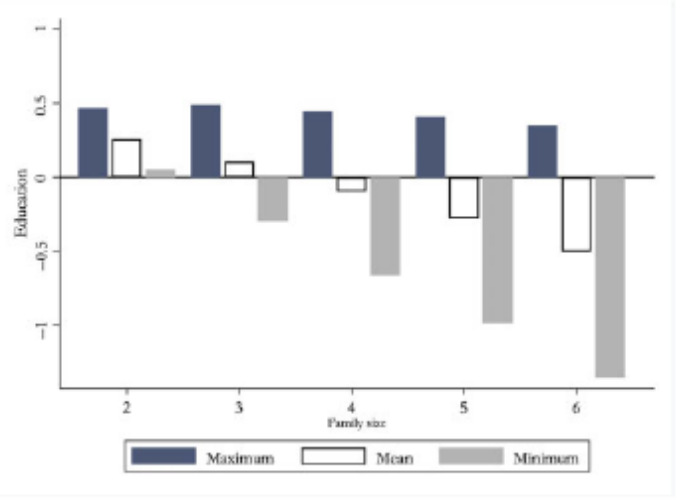
(c) Egypt



(d) Guatemala

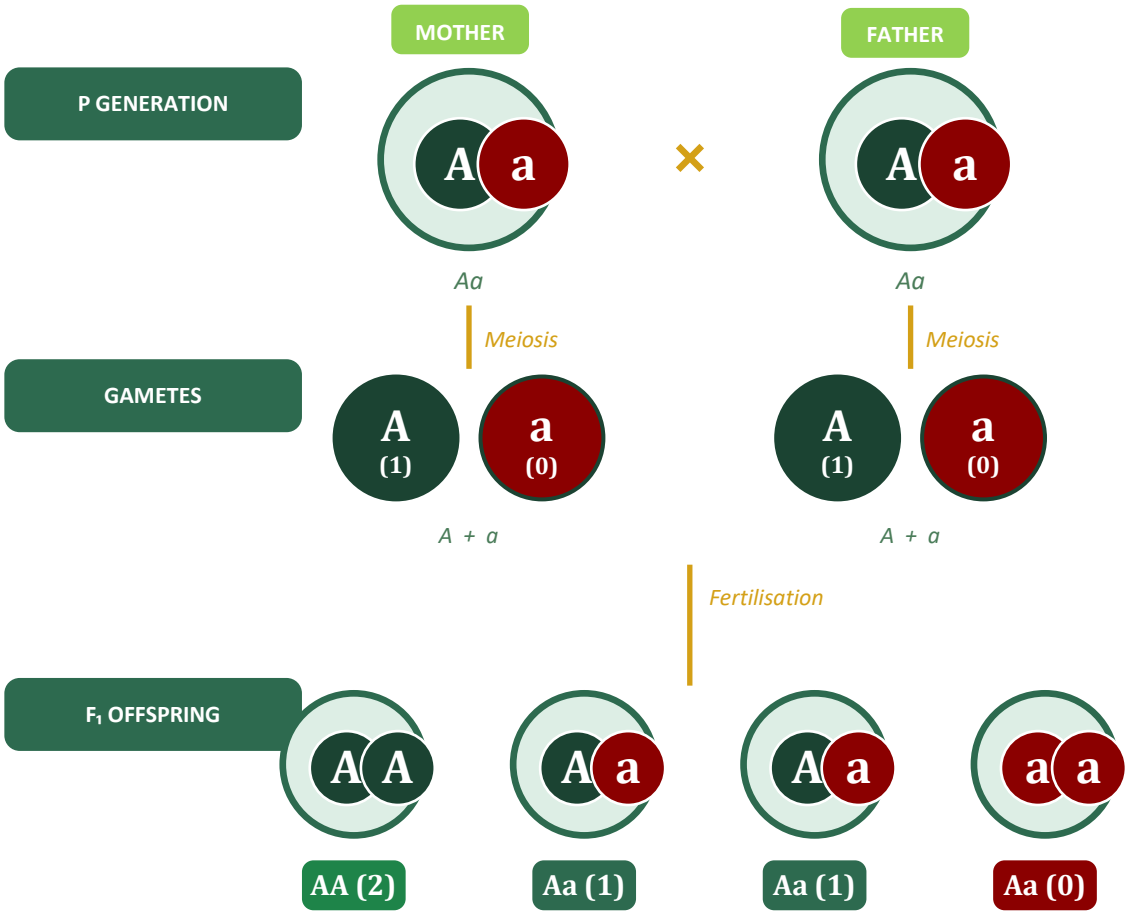


(e) Honduras

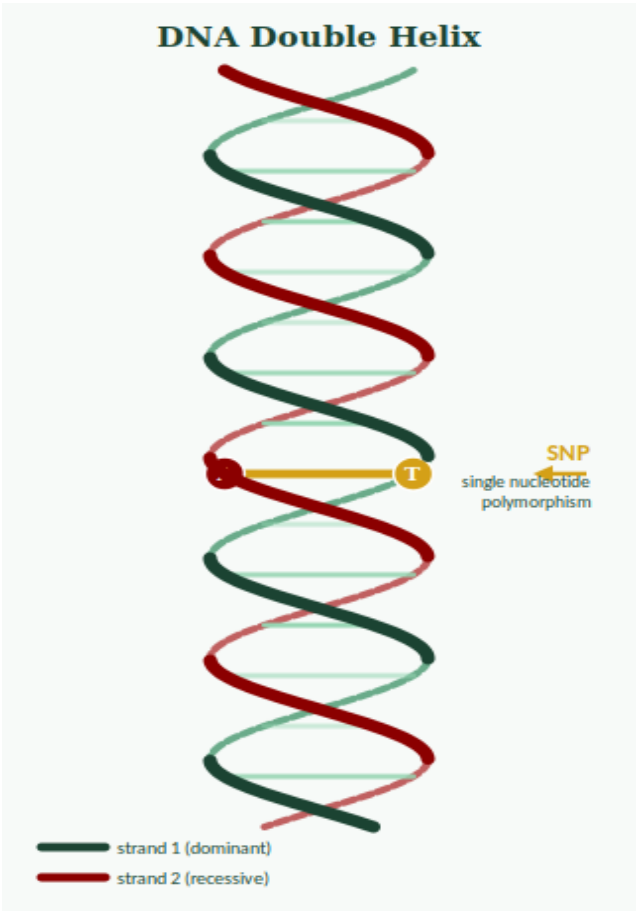


(f) India (whole)

Empirical Strategy – Mendelian Inheritance



P = Parental generation · F_1 = First filial generation



Genotypic Ratio

1 AA : 2 Aa : 1 aa

Phenotypic Ratio

3 Dominant : 1 Recessive

Typical Implementation

- Many outcomes are predicted by multiple (as opposed to single) genes
  - Most research uses indices of SNPs (G_{is}): polygenic scores (PGS)
  - $PGS_i^k = \sum_{s=1}^{S} \gamma_s^k G_{is}$, where k is a particular outcome and i is individual
  - Get γ_s^k from large population studies (e.g. UK Biobank, 23andMe)
  - We will use PGS scores constructed with the BCS genetic data for education, cognition, externalization and BMI (can construct more)

Typical Implementation

- $G_{ij} = h_{ij}^{(from\ mother)} + h_{ij}^{(from\ father)}$,
  - $i \in \{child, mother, father\}, G_{ij} \in \{0,1,2\}$
- $E\left(G_{childj} \middle| G_{motherj}, G_{fatherj}\right) = \frac{1}{2} G_{motherj} + \frac{1}{2} G_{fatherj}$
- $E\left(PGS_{child} \middle| PGS_{mother}, PGS_{father}\right) = \frac{1}{2} PGS_{mother} + \frac{1}{2} PGS_{father}$
- $PGS_{child} = \frac{1}{2} PGS_{mother} + \frac{1}{2} PGS_{father} + v_{child}$
  - v_{child} - residual variation
  - (non-mendelian inheritance?)

Typical Implementation

- Typical estimate of genetic impacts (of PGS *k*) on outcome *j*:
  - $Y_i^{k,j} = \alpha_0^{k,j} + \alpha_1^{k,j} PGS_i^k + \alpha_2^{k,j} PGS_{mi}^k + \alpha_3^{k,j} PGS_{fi}^k + \varepsilon_i^{k,j}$
  - PGS_i^k - child; PGS_{mi}^k - mother; PGS_{fi}^k - father
  - Ignore gene-environment interactions (to start with)
- Most datasets have very incomplete genetic data on parents and children (including all the papers mentioned in the previous slide)
  - Impute parental scores (partly assuming missing at random)

Data

- Millenium Cohort Study
  - Longitudinal study of individuals born in the UK in 2000-2002
- Waves 1-7 (ages 0, 3, 5, 7, 11, 14, 17)
- The survey includes measure of development, education, health, family environments and socioeconomic context across several years
- Genetic information on children and parents

Genetic data and analytic sample

- Saliva was collected at age 14 from cohort members and, when possible, their resident biological parents during home visits.
- Genotyping underwent quality control by the Wellcome Trust Sanger Institute
- These data support polygenic scores and empirical strategies that leverage Mendelian inheritance.
- Most results today are with the education PGS
  - At the end will show what happens with other indices

Parental Investments

- We built an index using MCS parental investment-related questions across childhood and adolescence.
- It is a single latent measure covering care and health, literacy and cognition, physical and creative activity, academic support, and enrichment.
- One index per wave, which implies that the content evolves with child development, from basic care to educational and enrichment inputs.
  - We will also have an anchored measured comparable across ages
- Later measures (holidays abroad, computer access) may be more income driven; consider SES controls when interpreting effects.

Parental Investments

Question	Wave A 9m	B 3y	C 5y	D 7y	E 11y	F 14y	G 17y
Baby sleeps at regular times	✓						
Child received all immunizations	✓						
Frequency take child to park or playground	✓						
Parental response to crying	✓						
Picks up baby when crying	✓						
Child eats fruit/vegetables		✓	✓	✓	✓	✓	
Child has a waterproof coat		✓					
Child has properly fitting shoes		✓					
Help child learn the alphabet		✓					
How many doses of vaccine x[a] has the child received		✓	✓				
How many doses of vaccine x[b] has the child received		✓					
How often do you play with child		✓					
How often do you read to the child		✓	✓	✓			
How often do you try to teach the child counting at home		✓					
How often does the child paint/draw at home		✓	✓	✓			
How often does the child visit the library		✓	✓	✓	✓		
How often teach child songs/poems/rhymes		✓					
Parent is saving money for the child		✓					
How often do you help the child with reading			✓	✓			
How often do you play physically active games with the child			✓	✓	✓		
How often do you tell the child stories			✓				
How often does the child do musical activities			✓	✓			
Parent attends teacher meeting(s)			✓	✓	✓	✓	
Child goes on holidays abroad				✓	✓		
Child has access to a computer				✓	✓	✓	
Child drinks artificially sweetened drinks					✓		
Child eats a variety of foods					✓		
Child has a quiet area where they can do homework					✓	✓	
Child has own bedroom					✓	✓	
Child has paid musical instrument lessons					✓		
Child receives pocket money					✓	✓	✓
How often does anyone at home help with the child's homework					✓	✓	
Reduced spending on child's needs					✓		
Child has extra lessons						✓	
Frequency talks to child about things important to them						✓	✓
How much time do you spend with the child						✓	
Parent feels close to the child							✓
Parent involvement in child's school life							✓

: *BCG*, *HepatitisA*, *pneumococcal*;: polio, diphtheria

Sample Characteristics

	All	Genetic Info	White	Both Parents	Regressions
Parent has Higher Education	0.53	0.53	0.54	0.68	0.68
	(0.50)	(0.50)	(0.50)	(0.47)	(0.47)
Household Income	474.95	474.59	502.15	586.59	583.70
	(286.70)	(285.95)	(286.60)	(275.34)	(270.13)
Average Cognitive Skills	-0.33	-0.18	-0.11	-0.02	0.00
	(0.79)	(0.65)	(0.63)	(0.60)	(0.60)
Average PI Score	-0.09	-0.07	-0.04	-0.00	0.00
	(0.57)	(0.68)	(0.67)	(0.55)	(0.55)
BMI Mother (before)	23.82	23.83	23.88	24.09	24.09
	(4.50)	(4.44)	(4.40)	(4.32)	(4.26)
Grandparents in the HH	0.48	0.97	0.97	0.98	0.98
	(0.50)	(0.18)	(0.16)	(0.13)	(0.12)
Number of Children	1.93	1.93	1.87	1.86	1.85
	(1.04)	(1.03)	(0.98)	(0.92)	(0.92)
Child Polygenic Score	-0.00	-0.00	-0.00	0.13	0.13
	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)
Father Polygenic Score	0.00	0.00	-0.00	0.00	-0.00
	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)
Mother Polygenic Score	-0.00	0.00	0.01	0.11	0.11
	(1.00)	(1.00)	(1.00)	(0.98)	(0.99)
Observations	19557	7836	6382	3331	2571

$$E\left(PGS_{child} \middle| PGS_{mother}, PGS_{father}\right) = \frac{1}{2} PGS_{mother} + \frac{1}{2} PGS_{father}$$

Table: PGS: Child and Parents

	(1) Child's PGS	(2) Child's PGS	(3) Child's PGS
Mother's PGS	0.572***		0.494***
	(0.0170)		(0.0139)
Father's PGS		0.571***	0.497***
		(0.0161)	(0.0132)
Observations	2571	2571	2571
R^2	0.313	0.326	0.554

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Balance: $Y_{i,PRE}^{k,j} = \alpha_0^{k,j} + \alpha_1^{k,j} PGS_i^k + \alpha_2^{k,j} PGS_{mi}^k + \alpha_3^{k,j} PGS_{fi}^k + \varepsilon_i^{k,j}$

	(1) Living >2 years	(2) Own a house	(3) Father Christian	(4) Mother Christian
Child's PGS	0.003	0.010	-0.007	0.020
	(0.013)	(0.011)	(0.015)	(0.014)
Father's PGS	0.012	0.036***††	0.052***†††	0.033***
	(0.011)	(0.009)	(0.012)	(0.012)
Mother's PGS	0.009	0.038***††	0.029**	0.048***††
	(0.011)	(0.010)	(0.012)	(0.012)
Observations	2571	2571	2571	2571
Outcome mean	0.712	0.816	0.438	0.589
R^2	0.002	0.027	0.014	0.025

	(1) Mother age at birth	(2) Father age at birth	(3) Mother BMI (standardised)	(4) Mother height (standardised)	(5) Gestation time
Child's PGS	-0.035	-0.138	-0.061**	0.001	-0.030
	(0.144)	(0.166)	(0.030)	(0.030)	(0.401)
Father's PGS	0.911***†††	0.813***†††	-0.002	0.011	0.203
	(0.121)	(0.140)	(0.026)	(0.025)	(0.338)
Mother's PGS	0.689***†††	0.579***††	-0.050*	0.066***	0.392
	(0.122)	(0.141)	(0.026)	(0.025)	(0.340)
Observations	2532	2473	2405	2528	2523
Outcome mean	30.479	32.886	0.000	0.000	276.382
R^2	0.057	0.030	0.010	0.005	0.001

Balance: $Y_{i,PRE}^{k,j} = \alpha_0^{k,j} + \alpha_1^{k,j} PGS_i^k + \alpha_2^{k,j} PGS_{mi}^k + \alpha_3^{k,j} PGS_{fi}^k + \varepsilon_i^{k,j}$

	(1) Planned pregnancy	(2) Months to conceive	(3) Fertility treatment	(4) Number of older sisters at Wave A	(5) Number of older brothers at Wave A
Child's PGS	0.014	-0.444	-0.003	-0.022	-0.030
	(0.014)	(0.530)	(0.009)	(0.018)	(0.020)
Father's PGS	-0.006	0.090	0.011	0.013	0.025
	(0.011)	(0.447)	(0.007)	(0.015)	(0.017)
Mother's PGS	0.031***	0.003	0.010	-0.012	-0.024
	(0.012)	(0.452)	(0.007)	(0.016)	(0.017)
Observations	2530	1768	1779	2571	2571
Outcome mean	0.704	7.344	0.061	0.378	0.435
R^2	0.007	0.001	0.003	0.002	0.004

	(1) Mother college or more	(2) Father college or more	(3) Mother A-level or more	(4) Father A-level or more
Child's PGS	0.026*	0.000	0.029**	0.006
	(0.014)	(0.014)	(0.013)	(0.014)
Father's PGS	0.060***†††	0.103***†††	0.045***††	0.092***†††
	(0.012)	(0.012)	(0.011)	(0.012)
Mother's PGS	0.112***†††	0.087***†††	0.100***†††	0.075***†††
	(0.012)	(0.012)	(0.011)	(0.012)
Observations	2571	2571	2571	2571
Outcome mean	0.536	0.481	0.679	0.624
R^2	0.094	0.083	0.085	0.073

Balance: $Y_{i,PRE}^{k,j} = \alpha_0^{k,j} + \alpha_1^{k,j} PGS_i^k + \alpha_2^{k,j} PGS_{mi}^k + \alpha_3^{k,j} PGS_{fi}^k + \varepsilon_i^{k,j}$

	(1) Mother bad general health	(2) Father bad general health	(3) Mother long-standing illness	(4) Father long-standing illness	(5) Mother migraine
Child's PGS	-0.011	-0.007	0.003	-0.000	0.009
	(0.010)	(0.010)	(0.012)	(0.013)	(0.011)
Father's PGS	-0.007	-0.016*	0.005	-0.018*	-0.011
	(0.008)	(0.009)	(0.010)	(0.011)	(0.010)
Mother's PGS	-0.024***	-0.008	-0.021**	-0.001	-0.025**
	(0.008)	(0.009)	(0.010)	(0.011)	(0.010)
Observations	2531	2279	2531	2279	2531
Outcome mean	0.122	0.116	0.203	0.198	0.181
R^2	0.011	0.006	0.002	0.002	0.003

	(1) Mother foreign-born	(2) Father foreign-born	(3) Interview region: London	(4) Home language: mostly English
Child's PGS	-0.006	0.002	0.000	0.002
	(0.008)	(0.009)	(0.007)	(0.004)
Father's PGS	0.024***	0.012	0.013**	0.002
	(0.007)	(0.007)	(0.006)	(0.004)
Mother's PGS	0.026***†	0.029***††	0.017***	0.006
	(0.007)	(0.007)	(0.006)	(0.004)
Observations	2571	2571	2532	2532
Outcome mean	0.093	0.096	0.057	0.023
R^2	0.013	0.013	0.009	0.003

Results

- Skills and beliefs
  - There is signal
- Parental Investments
  - Parents reinforce
- Siblings
  - Reinforcement only in families with more than one child
    - Works even with anchored measure
  - Reinforcement increases with number of siblings
    - For the same individual, it increases each time a sibling is born
- What do we see in terms of beliefs and siblings?
  - Learning?
  - What do we see in terms of skills – beliefs plus reaction of skills to past investments
  - Really need a dynamic model which you do not have right now
  - Scarce resources?
    - Ambiguous effects from model
    - Empirically no change in gradient correlated with changes in income
- Skills-PGS gradient increasing all the way, but the PI-PGS gradient really flattens out
  - Reaction to endowments is especially large at the bottom
    - Worst children left behind – double disadvantage (low endowments and low investments); middle children less so because at least they get as much investment as the top children
    - So why isn't the skills-PGS gradient also larger at the bottom?...
- Is this enough?

The education PGS predicts cognitive achievement of children

- Cognitive skill is probably something parents can observe

Table: Pooled Results, all waves

	(1) CogSkills	(2) CogSkills	(3) CogSkills
Child's PGS	0.181***	0.145***	0.128***
	(0.0112)	(0.0171)	(0.0159)
Mother's PGS		0.0442***	-0.000394
		(0.0144)	(0.0139)
Father's PGS		0.0206	-0.0180
		(0.0148)	(0.0142)
Observations	16814	16814	16814
R^2	0.033	0.034	0.066

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Column (1) includes Child's PGS, PI, and Child's PGS × PI. Column (2) adds parents PGS. Column (3) adds socioeconomic characteristics. CogSkills = Cognitive skills index (non-teacher reported).

The education PGS predicts cognitive achievement of children

Table: Wave by wave

	(1) CogSkills	(2) CogSkills	(3) CogSkills	(4) CogSkills	(5) CogSkills	(6) CogSkills	(7) CogSkills
Child's PGS	-0.0339	0.125***	0.133***	0.194***	0.150***	0.212***	0.270***
	(0.0290)	(0.0302)	(0.0295)	(0.0293)	(0.0283)	(0.0287)	(0.0329)
Mother's PGS	-0.0253	0.0475*	0.0781***	0.0682***	0.0228	0.0325	0.0988***
	(0.0255)	(0.0256)	(0.0244)	(0.0246)	(0.0242)	(0.0249)	(0.0283)
Father's PGS	-0.0421*	0.0196	0.0116	0.0344	0.0296	0.0383	0.0630**
	(0.0253)	(0.0257)	(0.0250)	(0.0243)	(0.0241)	(0.0244)	(0.0275)
Observations	2531	2403	2510	2484	2530	2499	1857
R^2	0.006	0.028	0.037	0.066	0.033	0.066	0.136

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The education PGS predicts behaviour problems of children

Table: Pooled Results, waves 2 to 5

	(1) SDQ Total	(2) SDQ Total	(3) SDQ Total
Child's PGS	-0.137***	-0.0913***	-0.0748***
	(0.0143)	(0.0216)	(0.0208)
Mother's PGS		-0.0427**	-0.000631
		(0.0176)	(0.0177)
Father's PGS		-0.0388**	-0.00159
		(0.0185)	(0.0183)
Observations	8794	8794	8794
R^2	0.023	0.025	0.069

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The education PGS predicts parental expectations

	(1) P(very likely)	(2) P(very likely)	(3) P(very likely)	(4) P(very likely)
Child's PGS	0.110***	0.068***	0.061***	0.045***
	(0.007)	(0.012)	(0.011)	(0.011)
Mother's PGS		0.043***	0.016*	0.016*
		(0.010)	(0.010)	(0.009)
Father's PGS		0.032***	0.012	0.013
		(0.010)	(0.010)	(0.009)
Prior skills				0.100***
				(0.006)
Mean outcome	0.420	0.420	0.420	0.421
N	7205	7205	7205	7028
R^2	0.067	0.073	0.117	0.155

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Y = 1 if the parent reports the top category 'very likely' on the 1--4 raw expect-uni scale, 0 otherwise. Parents who disagree (mother vs father half-step averages) are coded 0 | the binary flips only when the raw report is the top category. Columns mirror the ordered-probit ladder of the previous table: (1) child PGS + sex + wave FE; (2) adds parents' PGS; (3) adds SES; (4) adds prior skills. Estimates are linear-probability coefficients.

The education PGS predicts teacher beliefs

	(1) Uni: very likely	(2) Stay on at 16: very likely	(3) Friends: more able
Child's PGS	0.071***	0.068***	0.061***
	(0.018)	(0.018)	(0.019)
Mother's PGS	0.029*	0.003	-0.007
	(0.016)	(0.016)	(0.016)
Father's PGS	0.014	0.014	-0.007
	(0.015)	(0.015)	(0.015)
Mean outcome	0.469	0.631	0.327
N	1431	1440	1439
R^2	0.179	0.160	0.050

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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Table: Pooled Results, all waves

	(1) PI	(2) PI	(3) PI
Child's PGS	0.0757***	0.0522***	0.0400***
	(0.0111)	(0.0162)	(0.0154)
Mother's PGS		0.0238*	-0.00780
		(0.0135)	(0.0133)
Father's PGS		0.0184	-0.00708
		(0.0132)	(0.0128)
Observations	17186	17186	17186
R^2	0.006	0.006	0.025

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Parental Responses to Child Endowments

Table: Wave by wave

	(1) PI	(2) PI	(3) PI	(4) PI	(5) PI	(6) PI	(7) PI
Child's PGS	0.00286	0.0532*	0.0722**	0.0400	0.0327	0.00193	0.0766**
	(0.0289)	(0.0310)	(0.0295)	(0.0294)	(0.0264)	(0.0292)	(0.0321)
Mother's PGS	0.0186	-0.0345	-0.0365	-0.0288	0.0485**	0.000758	-0.0295
	(0.0259)	(0.0275)	(0.0262)	(0.0254)	(0.0232)	(0.0257)	(0.0292)
Father's PGS	0.0246	-0.0221	-0.0194	-0.0376	0.0303	0.00651	-0.0202
	(0.0256)	(0.0263)	(0.0248)	(0.0261)	(0.0217)	(0.0246)	(0.0283)
Observations	2531	2441	2506	2487	2537	2570	2114
R^2	0.013	0.009	0.025	0.029	0.227	0.046	0.013

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Parental Responses to Child Endowments

Table: Grouped-age results: ages 3,5 vs 7,11 vs 14,17

	(1) 3,5	(2) 7,11	(3) 14,17
Child's PGS	0.0625**	0.0402*	0.0359
	(0.0243)	(0.0216)	(0.0238)
Mother's PGS	-0.0352*	0.00869	-0.0131
	(0.0214)	(0.0188)	(0.0211)
Father's PGS	-0.0204	-0.00618	-0.00593
	(0.0202)	(0.0182)	(0.0202)
Observations	4947	5024	4684
R^2	0.015	0.094	0.015

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Parental Responses to Child Endowments (PI anchored)

Table: Grouped-age results: ages 3,5 vs 7,11 vs 14,17

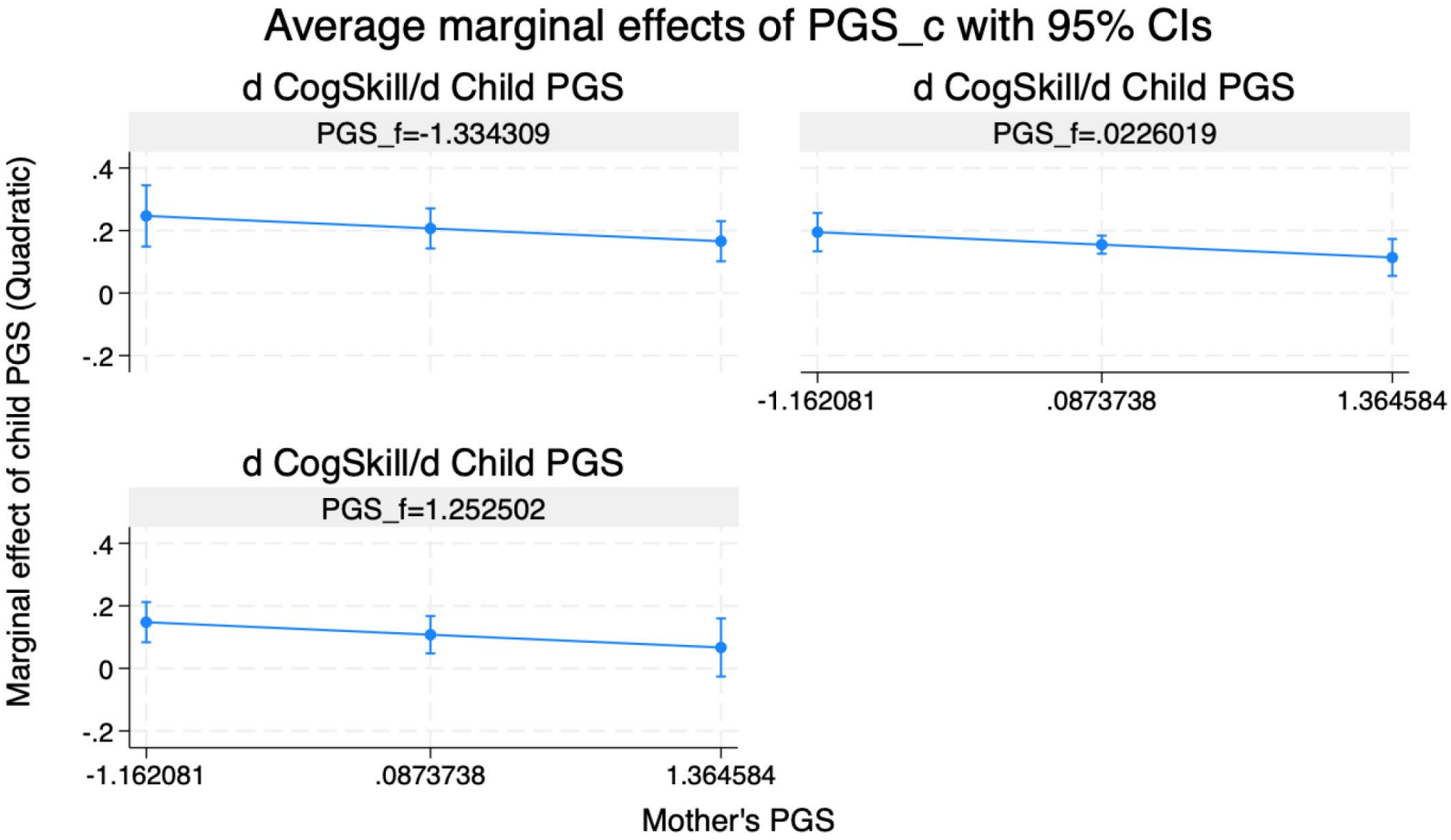
	(1) 3,5	(2) 7,11	(3) 14,17
Child's PGS	0.0697***	0.0518**	0.0530**
	(0.0266)	(0.0241)	(0.0226)
Mother's PGS	-0.00826	0.0124	0.0259
	(0.0226)	(0.0210)	(0.0199)
Father's PGS	-0.0123	-0.00277	0.0152
	(0.0216)	(0.0204)	(0.0192)
Observations	4948	5024	4684
R^2	0.006	0.105	0.019

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

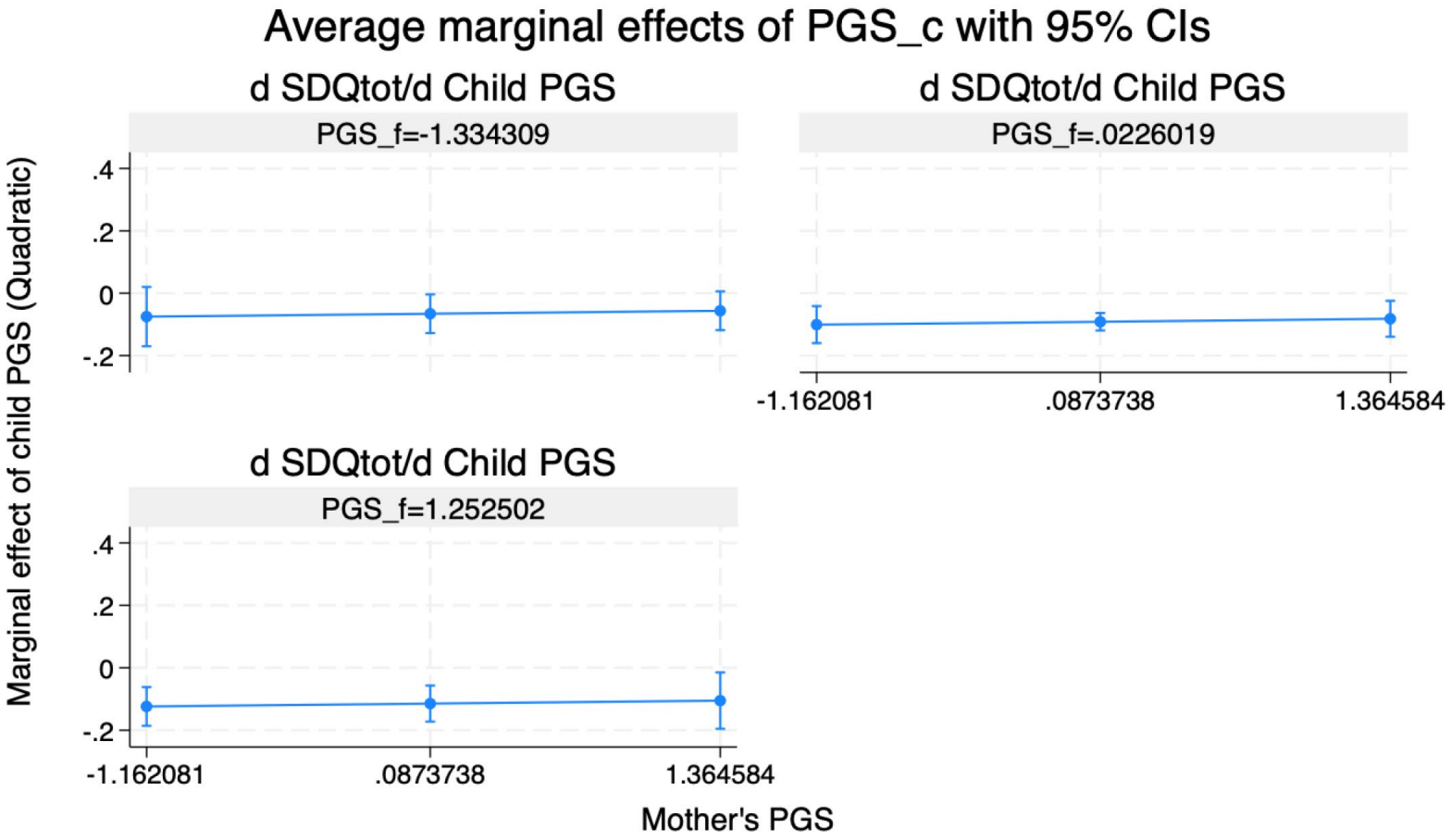
More Flexible Models (allow for gene-environment interactions)

- Allow child and parent PGS to interact
  - Impacts of child PGS on cognition are lower when parents have higher PGS



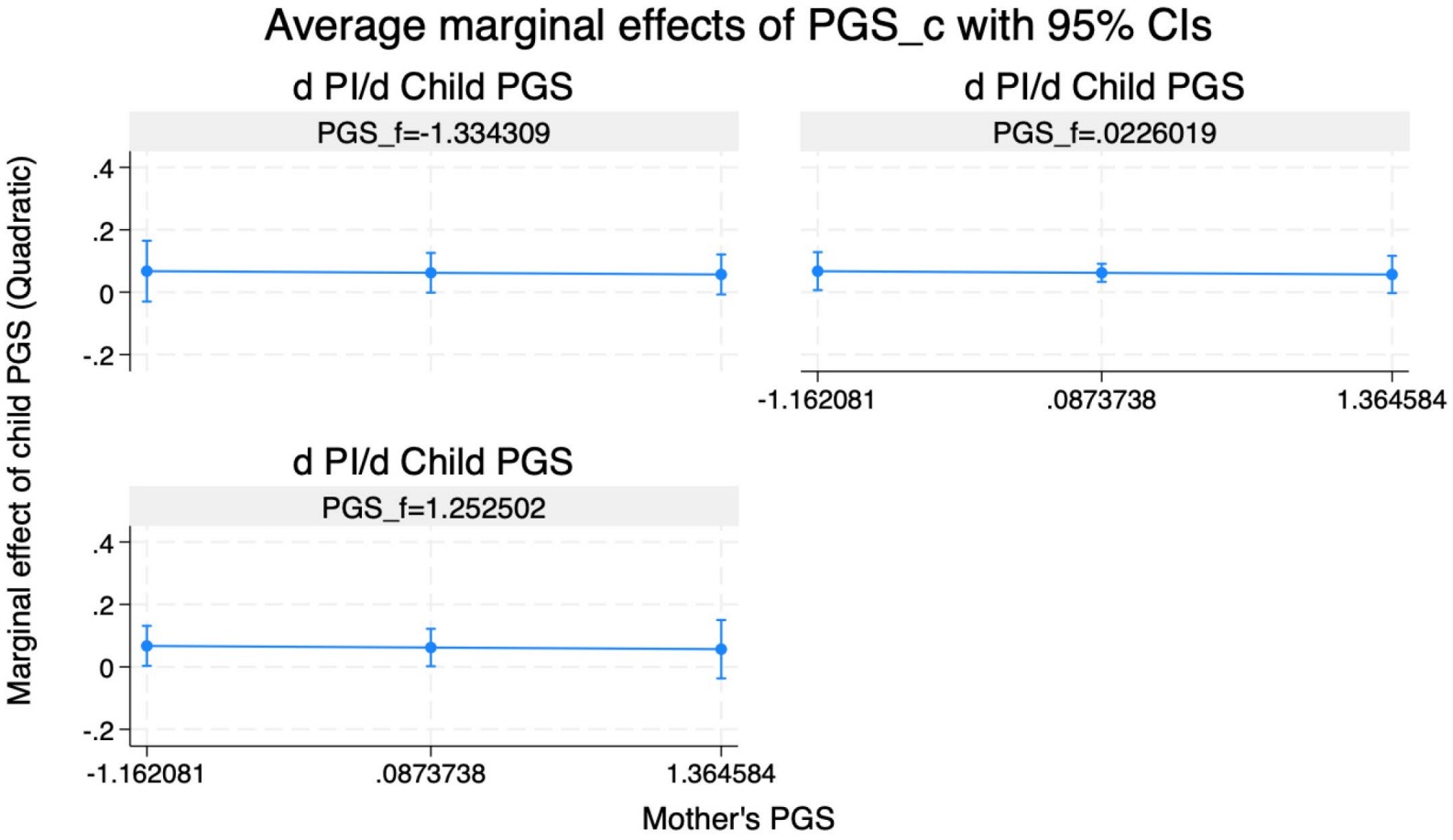
More Flexible Models (allow for gene-environment interactions)

- Allow child and parent PGS to interact
  - Impacts of child PGS on SDQ are similar when parents have higher PGS



More Flexible Models (allow for gene-environment interactions)

- Allow child and parent PGS to interact
  - Impacts of child PGS on parental investments are similar when parents have higher PGS



Parental Responses to Child Endowments - Siblings

Table: Pooled results, all waves

	(1) PI	(2) PI	(3) PI	(4) PI
Child's PGS	0.0894***	0.0656***	0.0542***	0.0529***
	(0.0119)	(0.0167)	(0.0159)	(0.0166)
Have siblings=0 × Child's PGS	-0.107***	-0.106***	-0.105***	-0.0964**
	(0.0280)	(0.0280)	(0.0280)	(0.0380)
Mother's PGS		0.0234*	-0.00780	0.00531
		(0.0132)	(0.0131)	(0.0142)
Father's PGS		0.0190	-0.00642	-0.0167
		(0.0130)	(0.0127)	(0.0138)
Observations	17186	17186	17186	17186
R^2	0.011	0.011	0.028	0.030

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Parental Responses to Child Endowments - Siblings

Table: Results by wave, waves 1 to 7

	(1) PI	(2) PI	(3) PI	(4) PI	(5) PI	(6) PI	(7) PI
Child's PGS	0.023	0.068**	0.093***	0.062**	0.080***	0.028	0.093***
	(0.032)	(0.033)	(0.031)	(0.030)	(0.030)	(0.030)	(0.033)
Have siblings=0 × Child's PGS	-0.034	-0.060	-0.110	-0.159	-0.161**	-0.221***	-0.268***
	(0.040)	(0.051)	(0.068)	(0.097)	(0.069)	(0.070)	(0.103)
Mother's PGS	0.031	-0.012	0.002	0.007	0.138***	0.030	-0.039
	(0.025)	(0.026)	(0.025)	(0.025)	(0.025)	(0.025)	(0.028)
Father's PGS	0.034	-0.003	0.008	-0.010	0.093***	0.032	-0.034
	(0.025)	(0.026)	(0.024)	(0.026)	(0.024)	(0.024)	(0.028)
lin_com	-0.010	0.009	-0.018	-0.097	-0.081	-0.193***	-0.175*
	(0.039)	(0.050)	(0.067)	(0.095)	(0.070)	(0.070)	(0.101)
Observations	2531	2441	2506	2487	2537	2570	2114
R^2	0.004	0.011	0.016	0.010	0.068	0.014	0.007

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Parental Responses to Child Endowments - Siblings

Table: Pooled results, all waves

	(1) PI	(2) PI	(3) PI	(4) PI
Child's PGS	-0.0182	-0.0413	-0.0497*	-0.0413
	(0.0256)	(0.0279)	(0.0278)	(0.0347)
1 sibling × Child's PGS	0.0849***	0.0839***	0.0871***	0.0863**
	(0.0285)	(0.0285)	(0.0286)	(0.0393)
2 siblings × Child's PGS	0.121***	0.119***	0.117***	0.0853*
	(0.0339)	(0.0339)	(0.0334)	(0.0451)
3+ siblings × Child's PGS	0.139***	0.138***	0.129***	0.118**
	(0.0426)	(0.0427)	(0.0423)	(0.0598)
Mother's PGS		0.0207	-0.00748	-0.0783***
		(0.0130)	(0.0130)	(0.0283)
Father's PGS		0.0226*	-0.000652	0.0483
		(0.0130)	(0.0127)	(0.0299)
PGS if 1 sibling	0.0666***	0.0426**	0.0374**	0.0451**
	(0.0137)	(0.0179)	(0.0174)	(0.0203)
PGS if 2 siblings	0.1028***	0.0779***	0.0673***	0.0440
	(0.0222)	(0.0248)	(0.0238)	(0.0294)
PGS if 3+ siblings	0.1203***	0.0964***	0.0794**	0.0765
	(0.0341)	(0.0365)	(0.0354)	(0.0482)
p-value: 1 = 2 = 3+ siblings	0.176	0.182	0.305	0.820
Observations	17186	17186	17186	17186
R^2	0.023	0.023	0.035	0.037

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Parental Responses to Child Endowments - Siblings

Table: Pooled results with child FE, all waves

	(1) PI	(2) PI	(3) PI	(4) PI
Child's PGS				
1 sibling × Child's PGS	0.0833**	0.0833**	0.0836**	0.115**
	(0.0325)	(0.0325)	(0.0325)	(0.0475)
2 siblings × Child's PGS	0.160***	0.160***	0.159***	0.162***
	(0.0421)	(0.0421)	(0.0419)	(0.0623)
3+ siblings × Child's PGS	0.258***	0.258***	0.256***	0.221**
	(0.0686)	(0.0686)	(0.0687)	(0.0945)
Mother's PGS				
Father's PGS				
PGS if 1 sibling	0.0833**	0.0833**	0.0836**	0.1155**
	(0.0325)	(0.0325)	(0.0325)	(0.0475)
PGS if 2 siblings	0.1599***	0.1599***	0.1585***	0.1624***
	(0.0421)	(0.0421)	(0.0419)	(0.0623)
PGS if 3+ siblings	0.2579***	0.2579***	0.2558***	0.2212**
	(0.0686)	(0.0686)	(0.0687)	(0.0945)
p-value: $1 = 2 = 3+$ siblings	0.008	0.008	0.009	0.433
Children	2571	2571	2571	2571
Children moving from 0 to more	880	880	880	880

Why?

- Do parents learn about endowments from observing siblings?
- Do tighter resources lead to stronger responses to endowments?
- ...

Parental Responses to Child Endowments – Beliefs and Siblings

	(1) P(very likely)	(2) P(very likely)	(3) P(very likely)	(4) P(very likely)
Child's PGS	0.045***	0.045***	-0.017	-0.020
	(0.011)	(0.011)	(0.030)	(0.031)
Prior skills	0.100***	0.112***	0.100***	0.119***
	(0.006)	(0.021)	(0.006)	(0.021)
1 sibling × Prior skills		-0.011		-0.018
		(0.022)		(0.023)
2 siblings × Prior skills		-0.015		-0.027
		(0.023)		(0.024)
3+ siblings × Prior skills		-0.015		-0.021
		(0.026)		(0.027)
1 sibling × Child's PGS			0.061*	0.063**
			(0.031)	(0.032)
2 siblings × Child's PGS			0.079**	0.084**
			(0.032)	(0.033)
3+ siblings × Child's PGS			0.060*	0.063*
			(0.035)	(0.035)
Skills if 1 sibling		0.1009***		0.1013***
		(0.0083)		(0.0084)
Skills if 2 siblings		0.0970***		0.0923***
		(0.0104)		(0.0107)
Skills if 3+ siblings		0.0973***		0.0985***
		(0.0155)		(0.0161)
PGS if 1 sibling			0.0436***	0.0432***
			(0.0130)	(0.0131)
PGS if 2 siblings			0.0621***	0.0639***
			(0.0149)	(0.0152)
PGS if 3+ siblings			0.0426**	0.0429**
			(0.0195)	(0.0201)
Mean outcome	0.421	0.421	0.421	0.421
N	7028	7028	7028	7028
R^2	0.155	0.155	0.156	0.156

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Parental Responses to Child Endowments – Skills and Siblings

Table: Pooled results with family FE, all waves

	(1) CogSkills	(2) CogSkills	(3) CogSkills	(4) CogSkills
Child's PGS				
1 sibling × Child's PGS	0.211***	0.211***	0.208***	0.200***
	(0.0314)	(0.0314)	(0.0314)	(0.0470)
2 siblings × Child's PGS	0.347***	0.347***	0.343***	0.369***
	(0.0445)	(0.0445)	(0.0444)	(0.0673)
3+ siblings × Child's PGS	0.489***	0.489***	0.484***	0.441***
	(0.0664)	(0.0664)	(0.0670)	(0.0883)
Mother's PGS				
Father's PGS				
PGS if 1 sibling	0.2107***	0.2107***	0.2085***	0.2002***
	(0.0314)	(0.0314)	(0.0314)	(0.0470)
PGS if 2 siblings	0.3465***	0.3465***	0.3428***	0.3690***
	(0.0445)	(0.0445)	(0.0444)	(0.0673)
PGS if 3+ siblings	0.4894***	0.4894***	0.4838***	0.4414***
	(0.0664)	(0.0664)	(0.0670)	(0.0883)
p-value: $1 = 2 = 3+$ siblings	0.000	0.000	0.000	0.002
Children	2571	2571	2571	2571
Children moving from 0 to more	886	886	886	886

Parental Responses to Child Endowments – Income (FE)

Table: Pooled results, all waves

	(1) CogSkills	(2) CogSkills	(3) CogSkills	(4) CogSkills
Income Q2	0.0331	0.0331	0.0430	0.0477
	(0.0303)	(0.0303)	(0.0321)	(0.0326)
Income Q3	0.0281	0.0281	0.0372	0.0452
	(0.0347)	(0.0347)	(0.0364)	(0.0368)
Income Q4	0.0402	0.0402	0.0341	0.0409
	(0.0378)	(0.0378)	(0.0403)	(0.0406)
Income Q5	-0.000983	-0.000983	-0.0157	-0.0125
	(0.0463)	(0.0463)	(0.0488)	(0.0493)
Income Q2 × Child's PGS	-0.0310	-0.0310	-0.0315	-0.0519
	(0.0310)	(0.0310)	(0.0310)	(0.0430)
Income Q3 × Child's PGS	0.0241	0.0241	0.0215	-0.0159
	(0.0335)	(0.0335)	(0.0335)	(0.0486)
Income Q4 × Child's PGS	-0.0304	-0.0304	-0.0330	-0.0756
	(0.0382)	(0.0382)	(0.0382)	(0.0527)
Income Q5 × Child's PGS	0.0123	0.0123	0.0103	-0.0466
	(0.0465)	(0.0465)	(0.0465)	(0.0624)
Observations	14019	14019	14019	14019
R^2	0.371	0.371	0.372	0.372

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Non-linearity? – Cognitive Skills

Table: Pooled results, all waves

	(1) CogSkills	(2) CogSkills	(3) CogSkills
Child's PGS Q2	0.135***	0.0906**	0.0849**
	(0.0363)	(0.0372)	(0.0348)
Child's PGS Q3	0.274***	0.206***	0.179***
	(0.0353)	(0.0383)	(0.0364)
Child's PGS Q4	0.312***	0.210***	0.185***
	(0.0357)	(0.0418)	(0.0396)
Child's PGS Q5	0.512***	0.364***	0.320***
	(0.0355)	(0.0486)	(0.0456)
Mother's PGS		0.0610***	0.0149
		(0.0137)	(0.0134)
Father's PGS		0.0354**	-0.00442
		(0.0143)	(0.0137)
Observations	16814	16814	16814
R^2	0.030	0.033	0.065

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Non-linearity? – Behaviours

	(1) SDQ Total	(2) SDQ Total	(3) SDQ Total
Child's PGS Q2	-0.166***	-0.120**	-0.109**
	(0.0551)	(0.0567)	(0.0544)
Child's PGS Q3	-0.260***	-0.188***	-0.153***
	(0.0535)	(0.0574)	(0.0555)
Child's PGS Q4	-0.269***	-0.165***	-0.134**
	(0.0555)	(0.0622)	(0.0601)
Child's PGS Q5	-0.474***	-0.323***	-0.272***
	(0.0507)	(0.0698)	(0.0674)
Mother's PGS		-0.0502***	-0.00209
		(0.0191)	(0.0193)
Father's PGS		-0.0475**	-0.00494
		(0.0206)	(0.0206)
Observations	9855	9855	9855
R^2	0.024	0.027	0.071

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Non-linearity? – Parental Expectations

	(1) P(very likely) (11)	(2) P(very likely) (14)	(3) P(very likely) (17)
PGS Q2	0.032	0.070**	0.041
	(0.028)	(0.030)	(0.033)
PGS Q3	0.048	0.100***	0.100***
	(0.030)	(0.032)	(0.034)
PGS Q4	0.067**	0.138***	0.152***
	(0.034)	(0.035)	(0.038)
PGS Q5	0.121***	0.197***	0.204***
	(0.039)	(0.040)	(0.043)
Mother's PGS	0.029**	0.015	0.020
	(0.011)	(0.012)	(0.013)
Father's PGS	0.008	0.001	0.041***
	(0.011)	(0.011)	(0.013)
Mean outcome	0.360	0.457	0.445
N	2527	2565	2113
R^2	0.106	0.103	0.144

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Non-linearity? – Parental Investments

Table: Pooled results, all waves

	(1) PI	(2) PI	(3) PI
Child's PGS Q2	0.0768**	0.0537	0.0451
	(0.0350)	(0.0356)	(0.0341)
Child's PGS Q3	0.162***	0.125***	0.104***
	(0.0337)	(0.0360)	(0.0346)
Child's PGS Q4	0.186***	0.133***	0.112***
	(0.0347)	(0.0396)	(0.0375)
Child's PGS Q5	0.209***	0.133***	0.0994**
	(0.0340)	(0.0449)	(0.0426)
Mother's PGS		0.0284**	-0.00428
		(0.0128)	(0.0127)
Father's PGS		0.0216*	-0.00474
		(0.0127)	(0.0124)
Observations	17186	17186	17186
R^2	0.006	0.007	0.025

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

PGS Cognition

	(1) Cog. Skills	(2) Cog. Skills	(3) Cog. Skills	(4) Cog. Skills
Cognition PGS child	0.177***	0.126***	0.115***	0.0763***
	(0.0138)	(0.0195)	(0.0182)	(0.0200)
Cognition PGS mother		0.0330**	-0.0103	-0.00770
		(0.0168)	(0.0160)	(0.0171)
Cognition PGS father		0.0632***	0.0234	0.0418**
		(0.0176)	(0.0164)	(0.0179)
Child's PGS				0.0999***
				(0.0210)
Mother's PGS				-0.000715
				(0.0175)
Father's PGS				-0.0456**
				(0.0180)
Observations	9927	9		
R^2	0.031	0.		

	(1) SDQ Total	(2) SDQ Total	(3) SDQ Total	(4) SDQ Total
Cognition PGS child	-0.0741***	-0.0511**	-0.0424**	-0.0123
	(0.0156)	(0.0218)	(0.0209)	(0.0227)
Cognition PGS mother		-0.0236	0.0111	0.00894
		(0.0188)	(0.0184)	(0.0200)
Cognition PGS father		-0.0199	0.0116	0.0134
		(0.0188)	(0.0182)	(0.0198)
Child's PGS				-0.0791***
				(0.0236)
Mother's PGS				0.00239
				(0.0203)
Father's PGS				-0.00411
				(0.0209)
Observations	9855	9855	9855	
R^2	0.007	0.065	0.071	

	(1) PI	(2) PI	(3) PI	(4) PI
Cognition PGS child	0.0441***	0.00850	0.000952	-0.0226
	(0.0141)	(0.0204)	(0.0195)	(0.0208)
Cognition PGS mother		0.0347**	0.00140	0.00900
		(0.0169)	(0.0163)	(0.0177)
Cognition PGS father		0.0326*	0.00461	0.0132
		(0.0167)	(0.0160)	(0.0175)
Child's PGS				0.0599***
				(0.0203)
Mother's PGS				-0.0173
				(0.0180)
Father's PGS				-0.0208
				(0.0172)
Observations	10284	10284	10284	10284
R^2	0.002	0.003	0.042	0.044

PGS ADHD

	(1) Cog. Skills	(2) Cog. Skills	(3) Cog. Skills	(4) Cog. Skills
ADHD PGS child	-0.0763***	-0.0623***	-0.0471***	-0.0223
	(0.0144)	(0.0191)	(0.0175)	(0.0176)
ADHD PGS mother		-0.0178	0.0108	0.00829
		(0.0173)	(0.0162)	(0.0164)
ADHD PGS father		-0.0103	0.0165	0.0106
		(0.0170)	(0.0157)	(0.0157)
Child's PGS				0.126***
				(0.0196)
Mother's PGS				-0.00314
				(0.0169)
Father's PGS				-0.0268
				(0.0170)
Observations	9927	9		
R^2	0.006	0		

	(1) SDQ Total	(2) SDQ Total	(3) SDQ Total	(4) SDQ Total
ADHD PGS child	0.0822***	0.0721***	0.0591***	0.0436**
	(0.0157)	(0.0216)	(0.0205)	(0.0208)
ADHD PGS mother		0.00593	-0.0142	-0.0123
		(0.0184)	(0.0175)	(0.0178)
ADHD PGS father		0.0148	-0.00316	-0.00201
		(0.0179)	(0.0171)	(0.0175)
Child's PGS				-0.0763***
				(0.0219)
Mother's PGS				0.00423
				(0.0190)
Father's PGS				0.00248
				(0.0195)
	9855	9855	9855	9855
	0.008	0.066	0.072	

	(1) PI	(2) PI	(3) PI	(4) PI
ADHD PGS child	-0.0309**	-0.00107	0.00984	0.0201
	(0.0141)	(0.0193)	(0.0182)	(0.0184)
ADHD PGS mother		-0.0330**	-0.0132	-0.0168
		(0.0166)	(0.0158)	(0.0160)
ADHD PGS father		-0.0268	-0.00966	-0.0133
		(0.0167)	(0.0159)	(0.0162)
Child's PGS				0.0547***
				(0.0193)
Mother's PGS				-0.0168
				(0.0167)
Father's PGS				-0.0176
				(0.0159)
Observations	10284	10284	10284	10284
R^2	0.001	0.002	0.042	0.044

PGS Income

	(1) Cog. Skills	(2) Cog. Skills	(3) Cog. Skills	(4) Cog. Skills
Income PGS child	0.178***	0.119***	0.108***	0.0508**
	(0.0140)	(0.0199)	(0.0187)	(0.0238)
Income PGS mother		0.0563***	-0.00283	-0.00267
		(0.0168)	(0.0163)	(0.0209)
Income PGS father		0.0530***	0.00271	0.0264
		(0.0168)	(0.0160)	(0.0197)
Child's PGS				0.0962***
				(0.0247)
Mother's PGS				-0.000636
				(0.0211)
Father's PGS				-0.0434**
				(0.0207)
Observations	9927			
R^2	0.031			

	(1) SDQ Total	(2) SDQ Total	(3) SDQ Total	(4) SDQ Total
Income PGS child	-0.120***	-0.0585***	-0.0496**	0.00166
	(0.0150)	(0.0216)	(0.0206)	(0.0271)
Income PGS mother		-0.0603***	-0.0169	-0.0304
		(0.0181)	(0.0179)	(0.0231)
Income PGS father		-0.0539***	-0.0168	-0.0263
		(0.0191)	(0.0187)	(0.0226)
Child's PGS				-0.0838***
				(0.0285)
Mother's PGS				0.0240
				(0.0240)
Father's PGS				0.0173
				(0.0234)
	9855	9855	9855	
	0.022	0.069	0.071	

	(1) PI	(2) PI	(3) PI	(4) PI
Income PGS child	0.0815***	0.0348*	0.0270	-0.00566
	(0.0135)	(0.0196)	(0.0186)	(0.0241)
Income PGS mother		0.0426***	-0.000884	0.0114
		(0.0161)	(0.0158)	(0.0205)
Income PGS father		0.0446***	0.00892	0.0272
		(0.0161)	(0.0155)	(0.0196)
Child's PGS				0.0534**
				(0.0247)
Mother's PGS				-0.0203
				(0.0213)
Father's PGS				-0.0317
				(0.0198)
Observations	10284	10284	10284	10284
R^2	0.007	0.009	0.043	0.044

Summary

- Parental investments reinforce child genetic endowments
  - Especially strong at the bottom of the distribution of endowments
- True mainly for children who have siblings
  - Especially those with a lot of siblings
    - Larger impacts of PGS after accounting for family fixed effects
  - Gene environment interactions
    - Larger impact of genes on cognition (but not behaviour) for children with siblings, possibly through investments
- Mainly through the education PGS
- More work on what models explain our result