

Gene-by-father's income interactions shape educational attainment

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- Evidence for $G \times E$ interactions for educational attainment (Belsky et al., 2018, Barcellos, Carvalho & Turley, 2018; Papageorge & Thom, 2018).
- Both genetic endowments and childhood socioeconomic status (SES) shape educational attainment
- Genetic endowments and childhood SES are substitutes for high-school education, complements for two years of college or more (Papageorge & Thom, 2018).

Contributions and relevance

- Much attention to improving measurement of G (For EA: Rietveld et al. (2013) → Okbay et al (2016) → Lee et al (2018))
- Good measurement of SES also imperative to identify $G \times \text{SES}$ interactions
- Childhood SES is a crudely measured environment, assessed through subjective, self-reported survey questions (i.e. "Was your family well off financial, above average, or poor?").
 - Difficult to interpret effects of such variables out-of-sample.
 - Measurement error when retrospectively assessed in surveys with older adults, such as the Health and Retirement Study (HRS).
- **Solution:** combine different, more objective variables in the HRS to construct a continuous measure of childhood financial SES.
- How? Use US Census data to estimate a model that can predict wages out of sample. Use this model to predict income of fathers of HRS respondents.

Father's income as a better predictor of educational attainment in HRS

	(1)	(2)	(3)	(4)	(5)	(6)
Years of education						
Father's income	1.607*** (0.0447)					
Above median income		1.457*** (0.0518)				
Family well off			1.055*** (0.0624)			
Father never unemployed				0.558*** (0.0661)		
Years of education, father					0.269*** (0.00662)	
Years of education, mother						0.307*** (0.00826)
Constant	-2.772*** (0.454)	12.94*** (0.0330)	12.72*** (0.0552)	13.10*** (0.0594)	10.71*** (0.0735)	10.20*** (0.0939)
N	8576	8576	8477	8535	8576	8368
Incremental R^2	0.141	0.0888	0.0326	0.00829	0.165	0.147

Standard errors in parentheses

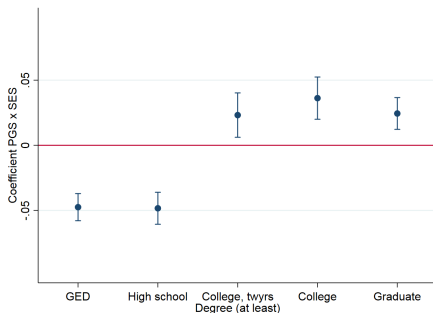
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Findings on gene by father's income interplay

- We use father's income to explore the interplay between genetic endowments and parental economic resources during childhood for educational attainment.
- At the mean, a one std. deviation decrease in the PGS for education decreases the probability of obtaining a high school degree by 6.6 percentage points.
 - A 42% increase in father's income (\$12,490) fully compensates for the decreased PGS.
 - Similar amounts for other educational degrees: GED: 43%, Two years of college: 45%, College: 47%, Graduate school: 46%.

Findings on $G \times$ father's income interactions

We provide evidence for $G \times$ father's income interactions: substitutes at high-school level, complements at two years of college or above. More precisely measured than in (Papageorge & Thom, 2018) due to increased explanatory power of SES measurement.



Coefficient on the interaction between the PGS for education and father's income. 95% confidence intervals shown.

Future directions

- The new, continuous measure of childhood SES varies by geography, time, and demographic characteristics.
- This allows for causal estimates of $G \times$ father's income estimates in education by exploiting a Bartik-style shift-share IV strategy (Bartik 1991, Broxterman & Larsson, 2019).
- The Bartik instrument uses local industry shares and national growth rates of real wages to arrive at a measure of local economic conditions that is driven by national economic trends, and is therefore plausibly exogenous.
- Results pending