Opportunity Begets Merit: Mobility and Heritability in Education

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Abstract

Sociologists and other social scientists have studied how educational privilege is transmitted across generations, often with the implicit understanding that the channels of transmission are mainly environmental in origin. In contrast, studies in behavior genetics compare outcomes for siblings with a varying degree of genetic resemblance and typically assign an important role to genetic factors. In this study we unite genetically and sociologically informed designs by drawing on two recent global efforts that synthesize estimates from each. We test, and find support for, the hypothesis that in high-inequality regimes where schooling is strongly transmitted from parent to child, the environmental channel is relatively more important. Conversely, in egalitarian systems where family background is less pronounced, genetic factors gain in explanatory power. Far from suggesting a trade-off between the objectives of mitigating the impact of family background and rewarding innate endowment, our results indicate that these objectives go hand in hand.

The idea of equality of opportunity is deeply ingrained in liberal democracies. In contemporary society, no institution is more central to the allocation of recognition and reward than education. Understandably, then, education occupies a main stage in political debates about fairness and opportunity. While most people agree that some principle of merit should govern the distribution of educational attainment, they differ in their opinion about how much inherited advantage is consistent with it [1].

On one side of the debate are those who claim that a meritocratic system inevitably necessitates some—perhaps high—degree of intergenerational inheritance of status. This

view is best captured in an infamous syllogism that can be paraphrased from Herrnstein [2] as follows. If (*i*) differences in natural abilities are inherited, and (*ii*) educational success requires those abilities, then (*iii*) educational attainment will be based to some extent on inherited differences among people. On this view, a level of intergenerational inheritance such as exists in the present-day US is a symptom of, not an affront to, meritocracy, and further reductions in the impact of family background would have to occur at the expense of it.

On the other side are those who hold that increased selection on merit follows as a corollary of policies that promote mobility. This view is well captured in the sociological dictum that when opportunities for schooling expand, stratification systems come to reward socially valuable traits over inherited privilege—often referred to as a shift from "ascription" to "achievement" [3]. Much research supports the view that in modern, post-industrial societies with extensive welfare states, parental background plays a lesser role for attained status [4, 5]. However, this literature has only insufficiently addressed *mechanisms* underlying the waning influence of the family.

Until now, social science has not been well placed to adjudicate between these views because it requires answering questions of two different kinds. First, in which societies is the impact of family background stronger? Second, in which is innate endowment more important? The first question has been addressed by social scientists, while behavioral geneticists have been occupied with the latter. These camps have often worked in silos and only sparingly exchanged insights. But with the accumulation of data on both sides, the time is ripe to bring the two perspectives to bear on each other.

To bridge this gap in the literature, we draw on two recent, global efforts from social science and behavior genetics. The Global Database on Intergenerational Mobility (GDIM) recently unveiled by the World Bank [6, 7] provides estimates of intergenerational mobility using comparable data and methodology for representative samples covering 96% of the world's population. This allows us to answer the first question of

where family background matters more. As a summary measure, we focus on the simple correlation (r) in years of schooling from parent to child, selecting the parent with the highest education. This parameter measures the strength of inheritance, and hence its inverse is seen as a measure of social mobility.

To shed light on the second question about the importance of innate endowments, we merged GDIM with the most comprehensive collection of behavior genetics estimates for educational attainment to date. Compiled by Branigan et al. [8], this meta-analysis compiles 34 estimates from fifteen behavior genetics studies, stratified by country, sex and birth cohort, including over 50,000 twins. We merged each estimate based on these characteristics to the closest matching birthyear in GDIM. Following this procedure, and eliminating a number of double hits with preference for the most representative estimate, we were able to match 27 of 34 estimates.[1]

In its canonical form, the behavior genetics design compares correlations in a trait for fraternal and genetically identical twin pairs. Assuming, among other things, no assortative mating and that the environments shared by one twin type is no more alike than that of the other, twice the difference between the two correlations is an estimate of the population variance accounted for by genetic differences, so-called heritability (h^2). By subtracting this figure from the total correlation in outcomes between identical twins, an estimate of the influence of shared environment (or c^2) is obtained [8].

Whilst both h^2 and c^2 represent family background influences in the twin model, the interpretation of each component is different. c^2 may indicate to what extent investments of parents and other nurturing factors lead to educational success of their offspring. In contrast, h^2 measures to what extent individual differences in educational attainment are a result of the genetic lottery. The latter measure, it has been argued, may approximate the degree of meritocracy in a society, since genetic differences likely encode—at least partly—differences in abilities [9, 10].

[1] GDIM coverage begins in 1940 which led us to drop a cohort of Norwegian twins born pre-WWII. For 1950s US cohorts, several twin estimates were available and we retained Midlife in the United States (MIDUS) which is population representative. Negative variance components were recoded to zero.

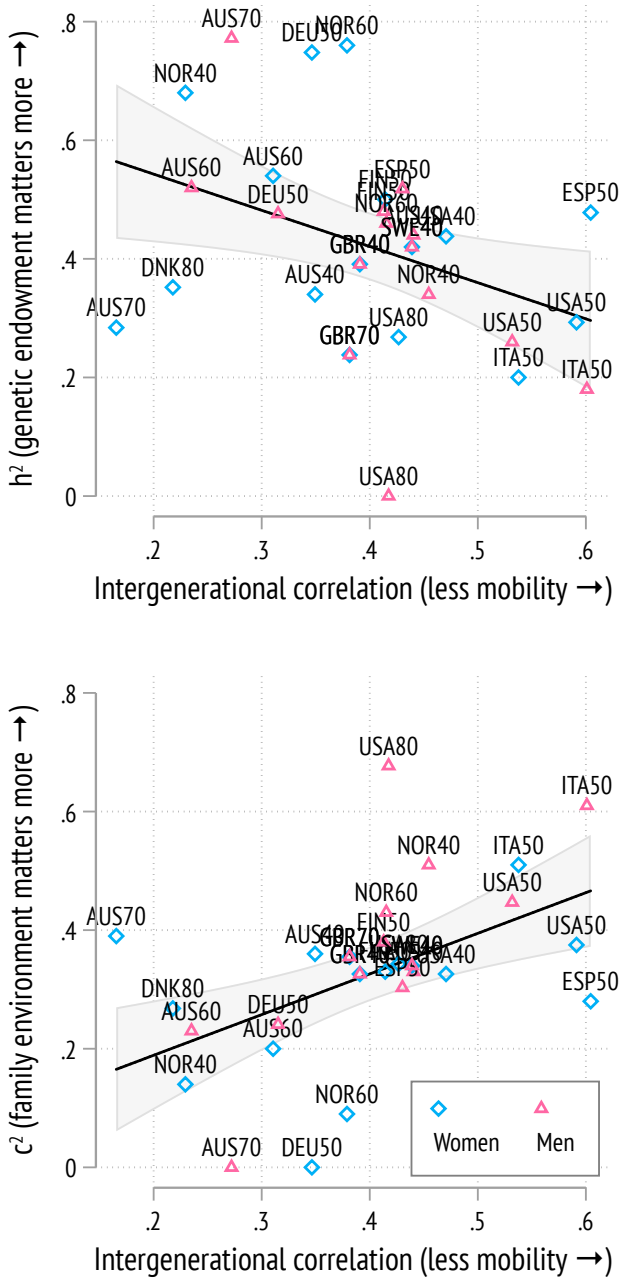

Figure 1: Determinants of educational attainment: intergenerational correlation, horizontal axis, and genetic variance components (heritability and environmentability), vertical axes. The superimposed lines show the least-squares line of best fit with 90% confidence intervals indicated by shaded areas. In cohorts where the intergenerational (parent-to-child) correlation in years of schooling is higher, the explanatory power of genetic endowment (heritability) is weaker, while that of family environment is stronger. Marker labels encode the country and approximate birth year of each cohort.

The geographic coverage in Branigan et al. [8] is limited, spanning only 10 Western European and Anglo-Saxon countries. Nevertheless, combined with cohort variation, there is considerable differentiation in policy contexts and, thereby, intergenerational mobility. Consistent with literature on income persistence [5], the lowest levels of mobility are recorded in the US and Southern Europe. Conversely, Scandinavian countries together with Australia are more effective at promoting mobility. In line with previous research, there is also a trend toward increased educational mobility in more recent cohorts [4,7]. Existing work links these well-known findings to the size of the welfare state, including access to high quality public education and health care [4,5,11]. Less is known about how genetic contributions to education might vary in tandem—the question that we address.

Our key result appears in Figure 1 which plots the genetic variance components on the vertical axes against the parent-to-child correlation in schooling on the horizontal axis. While there is a fair degree of scatter around the line of best fit, the results clearly emerge as most consistent with the sociological view: in societies with high rates of intergenerational mobility, genetic influences on educational attainment are more pronounced (top panel; $b = -.610$, s.e. .293, two-tailed $p < 0.05$). The flip side is that with more rigidity from one generation to the next, the influence of family environment looms larger (bottom panel; $b = .686$, s.e. .235, two-tailed $p < 0.01$). Based on these results, we would think that there is no inherent tension between the goals of neutralizing the impact of family background and fostering innate endowment.

These findings speak directly to recent research which shows, using molecular genetic data, that individual genetic endowment contributes substantially to social mobility in contemporary societies, not just inheritance [9]. One caveat to our finding is that it applies to the relatively homogenous sample of liberal democracies analyzed here. Not every policy that breaks the intergenerational link may achieve the aim of rewarding talent and hard work, as is illustrated by the historical case of Soviet rule [10]. Nevertheless,

there is sound theoretical reason to believe that the policy mix represented by countries at the more egalitarian end of our spectrum not only promotes mobility, but also allows the naturally gifted to rise. For example, the so-called Scarr–Rowe hypothesis states that an impoverished family environment will suppress the influence of genes on individual differences. A recent meta-analysis of intelligence [12] found that this phenomenon is more pronounced in the US than in Europe and Australia, which directly supports our interpretation and offers a possible explanation for our results.

The assumptions and limitations of behavior genetics are well known and have led some skeptics to dismiss it as uninformative for policy purposes [13, 14]. Others have argued that if interpreted with caution, such decompositions can help shed light on the distribution of opportunities within a society. Our results side with this view, and suggest room for a fruitful integration between genetically and sociologically informed designs. There is scope for much more work in this vein in years to come which, together with the ongoing molecular genetics revolution [15], will contribute to the evidence base informing debate about the healthy functioning of democratic societies.

References

[1] Christopher Jencks and Laura Tach. Would equal opportunity mean more mobility? *Mobility and inequality: Frontiers of research from sociology and economics*, pages 23–58, 2006.

[2] Richard Herrnstein. Iq. *The Atlantic*, 228(3):44–64, 1971.

[3] Seymour Martin Lipset and Reinhard Bendix. *Social mobility in industrial societies*. University of California Press Berkeley, 1959.

[4] Richard Breen, Ruud Luijkx, Walter Müller, and Reinhard Pollak. Nonpersistent inequality in educational attainment: Evidence from eight european countries. *American Journal of Sociology*, 114(5):1475–1521, 2009.

[5] Miles Corak. Income inequality, equality of opportunity, and intergenerational mobility. *Journal of Economic Perspectives*, 27(3):79–102, 2013.

[6] GDIM. Global database on intergenerational mobility, 2018.

[7] Ambar Narayan, Roy Van der Weide, Alexandru Cojocaru, Christoph Lakner, Silvia Redaelli, Daniel Gerszon Mahler, Rakesh Gupta N Ramasubbaiah, and Stefan Thewissen. *Fair Progress?: Economic Mobility across Generations around the World*. The World Bank, 2018.

[8] Amelia R Branigan, Kenneth J McCallum, and Jeremy Freese. Variation in the heritability of educational attainment: An international meta-analysis. *Social Forces*, pages 109–140, 2013.

[9] Daniel W Belsky, Benjamin W Domingue, Robbee Wedow, Louise Arseneault, Jason D Boardman, Avshalom Caspi, Dalton Conley, Jason M Fletcher, Jeremy Freese, Pamela Herd, et al. Genetic analysis of social-class mobility in five longitudinal studies. *Proceedings of the National Academy of Sciences*, forthcom.

[10] Kaili Rimfeld, Eva Krapohl, Maciej Trzaskowski, Jonathan RI Coleman, Saskia Selzam, Philip S Dale, Tonu Esko, Andres Metspalu, and Robert Plomin. Genetic influence on social outcomes during and after the soviet era in estonia. *Nature human behaviour*, 2:269–275, 2018.

[11] Sandra E Black and Paul J Devereux. Recent developments in intergenerational mobility. *Handbook of Labor Economics*, 4B:1487–1541, 2011.

[12] Elliot M Tucker-Drob and Timothy C Bates. Large cross-national differences in gene $\times$ socioeconomic status interaction on intelligence. *Psychological science*, 27(2):138–149, 2016.

[13] Arthur S Goldberger. Heritability. *Economica*, 46(184):327–347, 1979.

[14] Christopher Jencks. Heredity, environment, and public policy reconsidered. *American Sociological Review*, 45(5):723–736, 1980.

[15] Dalton Conley and Jason Fletcher. *The Genome Factor: What the social genomics revolution reveals about ourselves, our history, and the future*. Princeton University Press, 2017.