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Working Paper

Educational Gender Gaps

IZA Discussion Papers, No. 13630

Provided in Cooperation with:

IZA – Institute of Labor Economics

Suggested Citation: Lundberg, Shelly (2020) : Educational Gender Gaps, IZA Discussion Papers, No. 13630, Institute of Labor Economics (IZA), Bonn

This Version is available at:

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DISCUSSION PAPER SERIES

IZA DP No. 13630

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ISSN: 2365-9793

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ABSTRACT

Educational Gender Gaps*

Cross-country studies reveal two consistent gender gaps in education—underachievement in school by boys and low rates of participation in STEM studies by girls. Recent economics research has shown the importance of social influences on women’s STEM avoidance, but male low achievement has been less-studied and tends to be attributed to behavior problems and deficient non-cognitive skills. I revisit the determinants of the gender gap in U.S. educational attainment with a relatively-advantaged sample of young men and women and find that school behavior and measured skills are not very important drivers of gender differences, particularly in the transition to college. Educational aspirations, on the other hand, are strongly predictive of educational gaps and the gender difference in aspirations cannot be explained, even with rich adolescent data that includes parental expectations and school achievement indicators. These results suggest that gender identity concerns may influence (and damage) the educational prospects of boys as well as girls through norms of masculinity that discourage academic achievement.

JEL Classification: I20, J12, J16

Keywords: education, gender identity, school achievement, gender, aspirations, college graduation

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* This paper is based on the Association Lecture presented at the Southern Economic Association Annual Meeting in Fort Lauderdale FL on November 24, 2019. My thanks to Ziteng Lei for research assistance, and to many colleagues for comments on this and related work.

I. Introduction:

A recent OECD study highlights two gender gaps in educational achievement worldwide: general underperformance and early school exit by boys and avoidance of, and lack of confidence in, studies in math and science by girls (OECD, 2015). Based on a survey of 15 year-olds from 64 countries as part of the PISA assessment, the study documents a remarkably consistent pattern across countries—boys are less likely than girls to attain basic proficiency in core subjects, report investing less time and effort on schoolwork, and express more negative attitudes to school, while girls report lower levels of self-efficacy in and greater anxiety about math. These achievement and attitude gaps presage later gaps in educational attainment and field of study, with boys less likely in most OECD countries to enroll in and complete tertiary education than girls, and girls less likely to study in STEM fields. The implications of these gender differences in education for labor market outcomes are also significant: lower enrollment of young women in more lucrative fields of study contributes to the gender wage gap that remains after controlling for years of education, and the lagging educational growth of young men during a period of increasing returns to human capital has hampered their income growth as well, with negative implications for family formation and family stability (Lundberg, Pollak, and Stearns, 2017).

Economic research on educational gender gaps has focused on the sources of and possible remedies for STEM avoidance by women (including the underrepresentation of women among college economics majors). A number of recent studies have shown, with plausible strategies for identifying causal impacts, that girls' attitudes towards, and willingness to study, quantitative and scientific subjects are affected by the social influence of family, peers, and role models on their perceived competence in math and beliefs about gender-appropriate behavior. This may explain why many gender gaps in performance and attitudes, such as the male advantage in math and higher levels of female risk aversion, emerge only in adolescence as gender identity concerns intensify (Fahle and Reardon, 2018; Andreoni, Di Girolamo, List, Mackevicius, and Samek, 2019). There has been less research in economics on the educational underperformance of boys, and much of it is descriptive, pointing to behavioral problems more prevalent among boys as evidence of a deficit in non-

cognitive skills that increases the costs of persisting in formal education (Goldin, Katz, and Kuziemko, 2006; Becker, Hubbard, and Murphy, 2010).

In this paper, I focus on the gender gap in educational attainment and in particular the role of family and child characteristics during adolescence in explaining adult education levels and educational progression for a recent cohort of young American men and women. I find that an extensive set of pre-determined variables, including parental resources and educational expectations for the child, relationship quality and the scope of parent-child activities, and measures of the child's physical, cognitive, and non-cognitive abilities explains little of the gender gap in high school completion, college enrollment, or college graduation by young adulthood.

I then turn to a set of indicators that can reasonably be considered jointly determined with educational progress and in which there are also large gender differences—school behavior problems and educational aspirations. Surprisingly, including these measures in “kitchen sink” education regressions can account for less than half of the gender gap in college graduation in this sample, and only 30 percent of the gap in college enrollment. School behavior, which has been identified as an indicator of non-cognitive skills and a likely source of male educational disadvantage, is a significant but relatively unimportant predictor of these outcomes. The most important factor in explaining gender differences in the transition to college is the large gap between the educational aspirations of girls and boys, which in turn cannot be explained by child and parent characteristics, even when school achievement indicators such as grades are included in the model.

These results suggest that male behavior problems, in addition to being endogenous with respect to other drivers of educational success, may be less important determinants of the educational gender gap than had been believed. Instead, the developing gender identity of adolescent boys, which often leads to negative attitudes to school and non-compliance with authority, may play a crucial role in driving both male school underperformance and low educational aspirations. The importance of gender norms has been analyzed in a substantial literature in other social sciences, and should receive more attention in economics as well. More work is needed to establish the development and impact of gender identities in educational progression, and will have important implications for the design of programs that address the educational disadvantages of boys.

II. Boys and girls in school

The OECD study of gender equality in education shows that, in general, girls receive higher PISA test scores in reading and often, though there is more variation in this achievement gap, lower test scores in math. Boys are consistently less likely than girls to report that school is important and enjoyable, and this translates into lower levels of effort and poorer grades. In most countries girls, on the other hand, report higher levels of anxiety about, and lower confidence in their ability to perform well in, math and science classes. The gender gap in math anxiety varies considerably across countries and, at the country level, is predictive of actual gaps in test performance (OECD 2015, p. 78). The cross-country analysis emphasizes gender differences in interests, enjoyment, and attitudes towards school and learning rather than differences in ability, since any inherent gender gaps are unlikely to vary across countries.

The gender gaps in math performance and low female participation in STEM fields have received a great deal of scholarly attention.¹ Several studies find a link between math test score gaps and aggregate cultural attitudes: girls in more gender-equal countries perform relatively better compared to boys (Guiso, Monte, Sapienza, and Zingales, 2008; Hyde and Mertz, 2009).² Nollenberger, Rodríguez-Planas, and Sevilla (2016) apply an “epidemiological” approach to this question by examining the math performance of second-generation immigrants in the United States. They find that the gender equality index of parents’ country of ancestry predicts gender gaps in math PISA scores of U.S.-born children, with a presumed path through parent or community cultural beliefs about

¹ One recurring story about the underrepresentation of women in STEM careers is that it can be explained by greater variability in male mathematical ability such that men are more likely than women to perform above a threshold than women. It is likely that too much ink has been spilled on this question, since math test scores are achievement measures that can be affected by social forces rather than indicators of innate ability, but the evidence supporting greater male variance as a driver of male dominance of STEM fields is also very limited. A meta-analysis of 242 studies published between 1990 and 2007 by Lindberg, Hyde, and Peterson (2010) finds that adolescent girls have now reached parity with boys in average math performance and that, though there is considerable variation in estimates of the male/female ratio of variances in test performance, the average across studies is only 1.07. Pope and Sydnor (2010) examine regional variation in math test score distributions and find that in U.S. regions in which there is disproportionate representation of boys among high performers in math and science, there is also an over-concentration of girls at top of reading tests. This suggests that regions vary in levels of school gender stereotyping rather than in distributions of innate abilities.

² In contrast, a cross-country study by Charles and Bradley (2009) finds that female representation in engineering and math/science fields in higher education tends to be decreasing in national income, a pattern they attribute to the development of self-expressive value systems in postindustrial societies.

appropriate roles for women. Another pattern that suggests the importance of social influences is the age trajectory of the math test score gap—it is small or non-existent in the early grades, but grows as students approach high school (Fahle and Reardon, 2018; Fryer and Levitt, 2010).

The recent economics literature includes several studies showing, with plausible causal identification, more direct evidence of the importance of social factors and gender norms on the gender gap in STEM education. The influence of family, peers, and role models on women’s perceived competence in math, school achievement, and choices of educational and professional paths appears to be substantial. The importance of parents, and particularly fathers, on women’s career paths is demonstrated by Oguzoglu and Ozbeklik (2016), who establish a link between fathers in a STEM occupation and daughters choice of a STEM major in college that is substantially weaker if they have brothers. Cools, Fernandez, and Patacchini (2019) find that greater exposure to "high-achieving" boys, as proxied by their parents' education, has a negative effect on girls’ science and math grades and decreases the likelihood that girls go on to complete a bachelor's degree, while exposure to high-achieving girls has positive effects. The mechanism appears to be peer effects on girls’ self-confidence, aspirations, and risky behavior (including having a child before age 18). Eble and Hu (2019) show that randomly assigned variation in the proportion of a child’s middle school classmates whose parents believe that boys are better than girls at learning math affects children’s perceived difficulty of math, aspirations, and math performance to the detriment of girls.

Role models in the classroom may also be important. Porter and Serra (2020) conducted a field experiment in which students enrolled in introductory economics classes were exposed to successful and charismatic women who majored in economics at the same university. The intervention significantly impacted female students’ enrolment in further economics classes, increasing their likelihood of majoring in economics by 8 percentage points without affecting boys. Studies of the impact of teacher gender on student performance have been conducted in many different classroom environments, from primary school to college, and reach varying conclusions. Many find positive effects of teacher-student gender matching, particularly for girls and particularly in math and other STEM classes. Teacher gender may matter directly, through role model effects (Paredes, 2014),

indirectly through differential teacher expectations for or treatment of male and female students (Sansome, 2017), or both (Gong et al., 2018). In contrast, there is limited evidence that male teachers boost the relative achievement of boys (Carrington, Tymms, and Merrell, 2008).³

In contrast to the wealth of recent studies in economics on the drivers of women's underrepresentation in STEM fields, there are few studies of the other gender gap—the lower educational attainment of boys—that go beyond the descriptive. Most of the attention has focused on the relative costs of and benefits to higher education for men and women, with little attention paid to the impact of culture or norms.⁴ Comparing the returns to education for men and women is difficult, since these returns are multidimensional and include not just improved earnings and more stable employment, but also marriage market returns and potential improvements in children's human capital and wellbeing. Some studies find a gender gap in benefits to education, such as a higher college wage premium for women than for men (Dougherty, 2005) but others have concluded that there is little consistent evidence of higher overall returns for women (Becker et al., 2010).⁵ Instead, a consensus seems to be emerging that the principal source of the college gap lies in gender differences in the nonpecuniary costs of educational persistence. These cost differences are reflected in a persistent female advantage in school performance at all levels and are due, some argue, to lower levels of non-cognitive skills among boys (Goldin et al., 2006; Becker et al., 2010).

An extensive literature in education and the social sciences has documented gender differences in the academic and behavioral outcomes of boys and girls in elementary and secondary school (Buchmann, DiPrete, and McDaniel, 2008). These gender gaps are not new phenomena: girls have consistently outperformed boys in grades and are less likely to get in trouble at school (Duckworth and Seligman, 2006). Gender gaps in assessments of social and behavioral skills develop early—girls begin school more organized and attentive

³ There is also a large literature on the impact of single-sex schools on student achievement. Single-sex schools are usually associated with positive outcomes, but only a few studies are able to control for bias due to student selection into schools. For a review of the literature and recent evidence of broad positive effects of single-sex education using a policy experiment in Trinidad and Tobago, see Jackson (2019).

⁴ Some of the STEM studies included boys as well as girls (eg. Cools et al., 2019) but found no peer effects on their achievement.

⁵ Charles and Luoh (2003) modify the returns to education by including uncertainty, and conclude that the relative changes in the expected dispersion of college wages for men and women can explain the divergence in college attendance in recent decades.

and less disruptive than boys, and this advantage grows with age. These early behavioral gaps, in turn, appear to explain much of the gender differential in early elementary academic outcomes (DiPrete and Jennings, 2012) and are predictive of later behavior problems and school achievement (Owens, 2016).

The link between gender differences in behavior and grades in school is straightforward—increased effort and compliance with school authorities are likely to have consequences for grades—but the argument has also been advanced that this “behavioral advantage” of girls may be responsible, at least in part, for their higher rates of college graduation (Fahle and Reardon, 2018). The underlying assumption here is that observed gender differences in school behavior and academic performance are signals of stable gaps between the non-cognitive skills of boys and girls, such that they are likely to affect success in higher education as well (Becker et al., 2010; Goldin et al., 2006). One hypothesis about how these persistent non-cognitive skill gaps emerge is that the skill development of boys is inherently more vulnerable to disadvantage, and dimensions of disadvantage such as father absence, than that of girls (Autor and Wasserman, 2013; Bertrand and Pan, 2013; Autor, Figlio, Karbownik, Roth, and Wasserman, 2019).⁶ Though such excess male sensitivity to disadvantage is apparent in terms of grades and disruptive behavior in grade school, however, it does not persist to affect college graduation or other adult economic outcomes (Brenøe and Lundberg, 2017; Lei and Lundberg, 2020).

One fundamental difficulty with the non-cognitive skills explanation for the gender gap in college graduation is that our standard measures for these skills are observed or reported behaviors which, though they may indeed reflect skills such as self-control or personality traits, will also depend on incentives, beliefs, and situational factors. Kautz, Heckman, Diris, ter Weel, and Borghans (2015) argue in favor of using task performance as a measure of non-cognitive skills, while attempting to control for other factors that influence performance, such as effort. Given the identification problems inherent in this measurement exercise, it is problematic to use behaviors to compare skill levels of children facing very different environments, such as high- and low-income families (Lundberg,

⁶ Others have analyzed parental investments, finding evidence that parent teaching activities favor girls at very young ages (Baker and Milligan, 2016).

2018). The underlying cause of a possible gender gap in non-cognitive skills is also unclear, though some studies allude to the different developmental trajectories of boys and girls (Goldin et al, 2006).

An alternative to a biological explanation for gender gaps in school behavior is a cultural explanation developed at length by DiPrete and Buchmann (2013a) and based on a large literature in sociology, both quantitative and ethnographic, on gender norms in schools. They show that adolescent boys cultivate a masculine self-image that may involve a rejection of school values, and that this “oppositional culture” may be particularly relevant for boys with absent or low-education fathers. Other scholars have noted that though, for girls, hard work and conscientiousness in school is seen as desirable (Connell and Messerschmidt, 2005), such behavior is inconsistent with a “cool” masculinity characterized by dominance, strength, and “effortless achievement” (Epstein, 1998; Archer, Pratt, and Phillips, 2001). Hsin (2018) provides an interesting case in an analysis of the achievement trajectories of white and Asian-American schoolchildren. White boys underperform white girls as early as kindergarten, but Asian-American boys don’t begin to fall behind girls in school achievement until adolescence. Hsin argues that the pro-school behavior of younger Asian-American boys is supported at home by model-minority stereotypes, parents’ immigrant experience and high expectations, and by more fluid concepts of masculinity that are consistent with school achievement. In adolescence, peer culture becomes more important and boys begin to “turn away from family and community to establish autonomy,” particularly in schools with male-centric sports cultures.⁷ If norms of masculine identity are responsible for male underperformance in school, then we expect to see gender differences not just in behavior, but also in educational goals and attitudes.

In the rest of the paper, I use longitudinal data on a recent cohort of young men and women to assess these alternative explanations for the educational gender gap in terms of how much can be explained by adolescent measures of skills, behavior problems, and a comprehensive set of student, family, and school characteristics. Since many of these factors cannot be considered exogenous with respect to the student’s success in navigating

⁷ Another illustration of the significance of adolescence in the development of gender differences in school can be found in the outcome of a Finnish school reform that delayed tracking from age 10-11 to 15-16, which reduced the probability that boys, relative to girls, would choose the academic track and continue to tertiary education (Pekkarinen, 2008).

through the educational system, the analysis is not causal, but it is reasonable to think that their explanatory power of behavioral measures will be biased upwards by confounding. I find that standard candidates for explaining the attainment gender gap leave a large unexplained difference in adult education levels, and that differences in educational aspirations, which appear to be strongly linked to student gender per se, are surprisingly important. Recognizing that aspirations are social constructs opens the door to a broader consideration of the role of gender norms and gender identities in driving these disparities.

III. Data

The National Longitudinal Study of Adolescent to Adult Health (Add Health) has collected a rich array of longitudinal data on the social, economic, psychological and physical well-being of young men and women from adolescence through young adulthood.⁸ The Add Health study began in 1994-95 with a nationally-representative school-based survey of more than 90,000 students in grades 7 through 12. The students were born between 1976 and 1984 and attended one of 132 schools in the sampling frame. About 20,000 respondents were followed in subsequent surveys, and the last complete survey (Wave IV) was conducted in 2007-08 when the respondents were between 24 and 32 years of age. Two sets of variables are used in this study: contemporaneous measures of child and family characteristics and of school outcomes from the parent and adolescent surveys in Wave I, and educational attainment, including college graduation, from Wave IV.

This analysis is limited to a subsample of Add Health respondents that is more homogeneous than the full sample and is relatively advantaged—white, non-Hispanic men and women who were living with both biological or adoptive parents as adolescents in the Wave I survey.⁹ Intersectionality is likely to be important in the forces generating

⁸ This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (<http://www.cpc.unc.edu/addhealth>). No direct support was received from grant P01-HD31921 for this analysis.

⁹ I also restrict the sample to observations with non-missing values for most key explanatory variables, leaving a sample of 2198 women and 2139 men (see Table A1). Since family income is missing for about 10 percent of the sample, I include a dummy for missing family income in all models. Parent-reported disability and the

education gender gaps—the role of gender in driving educational aspirations and school achievement can depend on factors such as school disciplinary environment and family immigration status that vary by race and ethnicity. The restriction to two-parent households allows us to assess the role of fathers and the father-child relationship and reduces variance in levels of economic adversity—which has been advanced as particularly disadvantaging for boys. Even for this subsample, there is a substantial gender gap in educational attainment—49 percent of the girls graduate from college compared to 38 percent of the boys.

1. Wave IV: Educational Attainment and Educational Progression

Educational attainment is measured in the Wave IV survey of Add Health, collected when most respondents are between 25 and 31 years of age. Most, though not all, will have completed their final level of formal schooling at this point. I focus on four outcomes: the attainment of a 4-year college degree, and three indicators of educational progression—high school graduation, the probability of enrolling in college conditional on high school graduation, and the probability of completing college conditional on attending.

Figure 1 shows the proportions of men and women who have achieved each level of educational attainment by Wave IV. Men are much more likely than women to have stopped at high school graduation, while women in this sample are much more likely to be college graduates.

cognitive ability indicator are missing for 1-3 percent of the sample, and I also include a missing dummy for these variables.

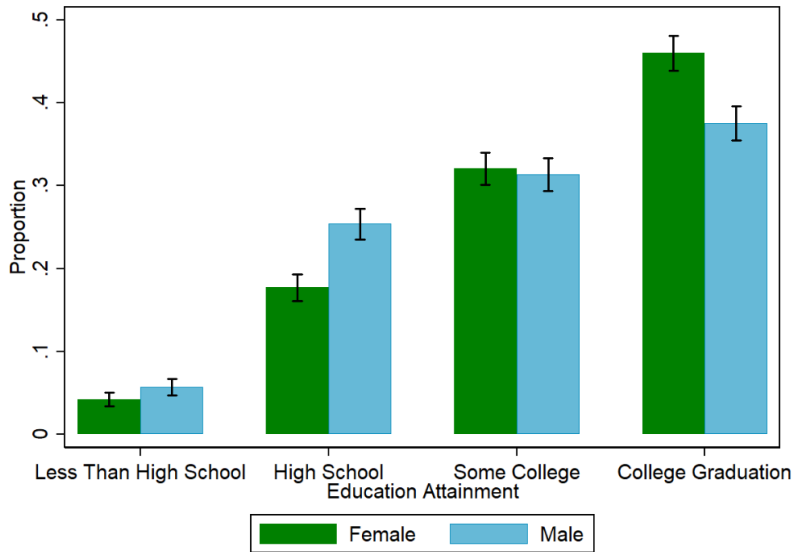


Figure 1: Educational Attainment by Wave IV

The gender gap in educational attainment is not limited to more disadvantaged households, but is present at all levels of family SES in this subsample. Figure 2 shows rates of college graduation for men and women by SES quintile.¹⁰

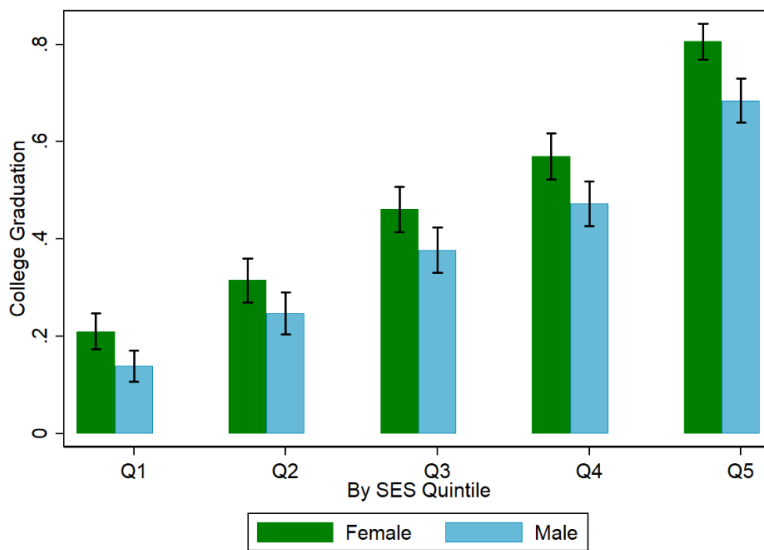


Figure 2: College Graduation by SES quintile

¹⁰ The SES index is based on father's education, mother's education, and family income, and is constructed using factor analysis.

2. Wave I: Family Resources and Child Skills

Educational attainment and progress through formal schooling will depend on many factors, but two important determinants are parental investments in their child's education and the child's human capital endowment. In the presence of credit constraints, the parents' resources will limit their investments in the child, and all models control for mother's education, father's education, and family income (Taubman, 1989). Parental education, in addition to being a proxy for lifetime resources, is likely to be correlated with the child's endowment and also to affect the returns to parental time with the child (Chevalier, Harmon, O'Sullivan and Walker, 2013). Parental education is defined with dummy variables for high school completion, some college, and 4-year college graduation or more.

The combination of the parent and child questionnaires permits an extensive description of the relationship between the respondent and both parents. Three factors we can measure are likely to be important for a child's school achievement—the general quality and conflict level of the parent-child relationship, the parents' expectations regarding the child's educational future, and activities shared by parent and child. As children get older, their own actions become increasingly important in the development of their human capital, relative to the actions of their parents (Del Boca, Monfardini, and Nicoletti, 2017). Parents have a variety of tools available to them to encourage study and hard work in school, but the quality of their relationship with their children is likely to be an important determinant of their effectiveness, particularly as children become adolescents (as well as being a potential outcome of the child's compliance). The parent survey (in most cases completed by the mother) included five questions about whether the parent gets along with the child, trusts him/her, understands him/her well, make decisions together, and whether the child interferes with the parent's activities. These are combined using factor analysis into a standardized relationship quality index.

The parent is also asked whether he/she will be very, somewhat, or not at all disappointed if the child does not graduate from college. This measure is not very highly correlated with the adolescent's own reports of how disappointed he/she thinks the mother or father will be if they do not graduate from college, and all three measures are included in the model. As can be seen in Table A1, parent reports, both of relationship quality and

educational expectations, are not significantly different for parents of boys and girls, despite the actual future gap in attainment. Girls, however, are more likely to think that parents will be disappointed if they do not graduate from college than boys. These expectations do tend to be strongly positively correlated with educational outcomes.

To capture possible differences in parental investments in sons and daughters, I use child reports of recent activities with both mother and father. The respondent is asked whether, in the past four weeks, their mother (father) has engaged in any of a series of ten positive activities, including shopping, attending a movie, sporting event, etc., or talking to them about school, personal problems, or social activities. Positive responses are summed for each parent, yielding two indicators between 0 and 10. The responses are distinctly gendered, with sons reporting that fathers engage in more activities with them than mothers, and daughters reporting much more varied interactions with mothers than do sons.

Of course, none of these indicators of parent-child relationships and interactions can be considered exogenous with respect to contemporaneous school outcomes and adolescent behavior, and so to later educational attainment. Difficulties in school may very well be reflected in strained relationships with parents and consequent negative interactions. Bad grades are likely to reduce parents' expectations about college attendance. However, they do give a multi-dimensional snapshot of parental influences on their children before the end of high school.

School achievement will also depend upon dimensions of child ability or human capital—I include indicators of cognitive skills, non-cognitive skills, and health in the education models.¹¹ Add Health includes one measure of cognitive ability—an abridged version of the Peabody Picture Vocabulary Test (PPVT) administered in Wave I. The models also include a parent-reported indicator of whether the child has a specific learning disability, the adolescent's own assessment of their general physical health (poor to excellent) in Wave I, and the interviewer's assessment of how physically mature the respondent is compared to other youth the same age. There are significant differences

¹¹ Also included in the family variables are indicators for whether the adolescent is a first child, an only child, and a control for birth cohort. Previous models included more controls for the respondent's siblings, including gender and birth order, but these were never important factors.

between the gender means of each of these measures: boys have a higher prevalence of learning disabilities, higher PPVT scores, better self-reported health, and lower interviewer-reported maturity (Table A1).

Much of the economic discussion of male underperformance in education has concentrated on the non-cognitive skill deficits of school-aged boys. Usually, reports of behavior problems or school disciplinary actions are used as proxies for these underlying skills. I will treat school behaviors as school outcomes in the next section, along with grades and educational aspirations, and instead use the adolescents' self-assessments about their own behavioral tendencies and emotions as non-cognitive skill measures. The response to "When making decisions, you usually go with your 'gut feeling' without thinking too much about the consequences of each alternative" is used as a measure of impulsivity.¹² Other Wave I self-reports can be used to construct standard psychological indices of self-esteem and depression. Table A1 shows that there are substantial gender differences in these reports—boys are more impulsive and have higher self-esteem than girls, and report much lower levels of depression.¹³

3. Wave I: School Outcomes

We can expect the observed behavior, achievement, and aspirations of the students who are surveyed in Wave I of the Add Health Study to be informative as to their success in the educational process so far and to be strongly predictive of eventual educational attainment. As such, we can think of them as signals of how the educational gender gap is emerging as children progress through school—and the gender differences here are profound. The differences between boys and girls in behavior and grades are well-known—the differences in educational aspirations less so.

School Problems and Attitudes Towards School: Students were asked about problems they experience in school, including trouble getting along with teachers and other students, trouble getting homework done and trouble paying attention in class (coded 0-4 from

¹² This impulsivity measure is strongly correlated with school suspensions, with interviewer reports of respondent impatience, and later criminal behavior (Lundberg, 2018).

¹³ Becker et al. (2010) base their explanation of the growing education gender gap on a purported higher male variance of non-cognitive skills. In Add Health skill measures, no such pattern in the variances emerges.

“never” to “every day”), how many times they have been absent without an excuse, and whether they have ever received an out-of-school suspension. Factor analysis was used to aggregate these measures into a standardized school problems index. Similarly, five questions about happiness, fairness, and perceived safety in school are used to construct a school attitudes index. The school suspension dummy is also included in most models separately. The mean of the school problem index is one-third of a standard deviation higher for boys than girls, and 24 percent of them report being suspended from school, compared to 9 percent of girls. The school attitudes index, however, does not differ by student gender.

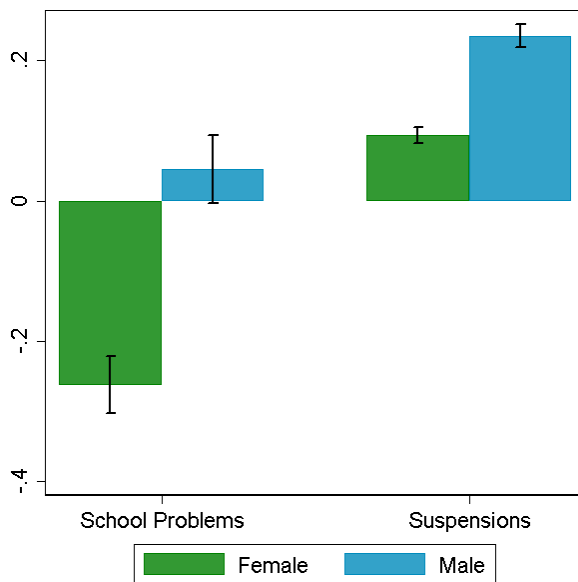


Figure 3: Index of School Problems and Proportion Reporting Ever Suspended from School

Grades and Aspirations: Students reported their math and English grades in the most recent grading period. As usual, the girls in this sample report higher grades in both math and English, though the grade gap is much smaller in math.

Educational aspirations in Wave I are based on student responses (on a 5-point scale) regarding how much they want to attend college, and how likely they think it is that they will attend college. In general, the students in this sample are very ambitious—most responses to both questions are either 4 or 5. However, there is a large gender gap: boys are on average 0.3 points less likely to expect to attend college and 0.2 points less likely to

want to attend and this gap, as can be seen in Figure 4, is present at the top of the SES scale, though it is more pronounced at the bottom. Rampino and Taylor (2013) also find a substantial gender gap in the educational aspirations of 11 to 15 year olds in the British Household Panel Survey.

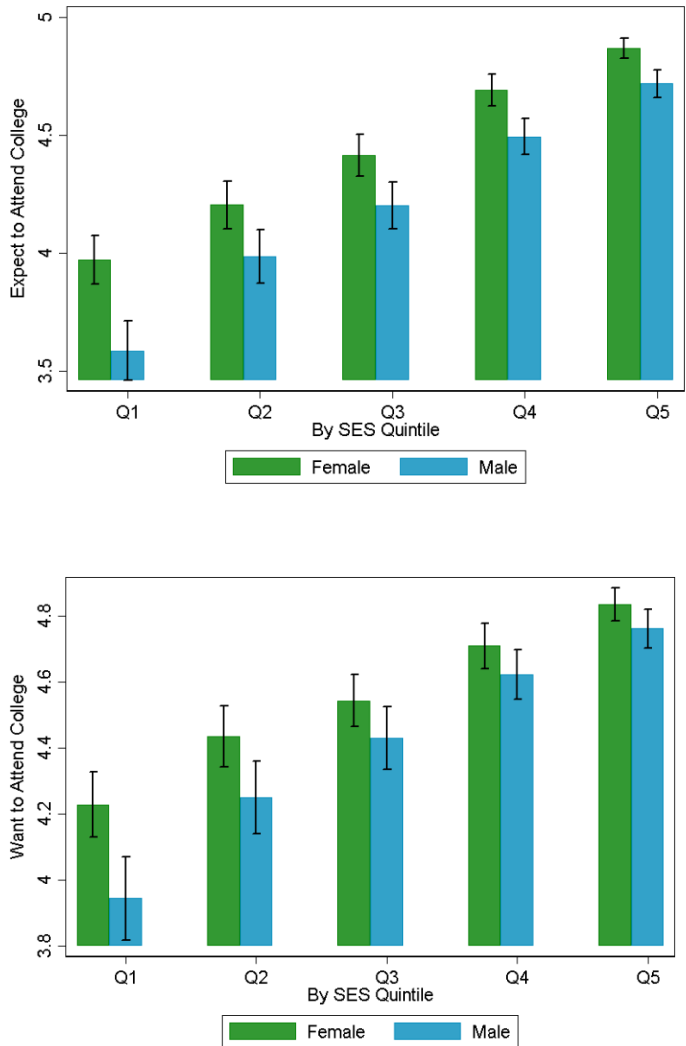


Figure 4: Educational Aspirations by SES Quintile

IV. Explaining the gender gap in education

A. Do Family Environment and Child Skills Explain the Gender Gap in Education?

I begin by regressing the four key educational outcomes—college graduation and three educational progression measures—on Wave I family and child characteristics that, if not exogenous, can be regarded as plausibly pre-determined with respect to educational success in adolescence and young adulthood. The control variables discussed in the previous section can be divided into three groups:

1. Family resources and environment: Mother's education, father's education, family income, the parent-child relationship quality index, reports by both parents and the adolescent about parental expectations regarding college attendance, maternal and paternal activities with the adolescent, indicators for first child and only child, and for the child's birth cohort.

2. Ability: Parent-reported indicator of a specific learning disability, vocabulary test score, self-reported health status, and interviewer report of physical maturity.

3. Non-cognitive skills: Impulsivity, depression index, self-esteem index.

Figure 5 shows, for all four educational outcomes, whisker graphs with the coefficient and standard error of the male dummy with and without the full set of control variables. Figure 5a shows that, for the full subsample, the family, ability, and non-cognitive skill variables explain essentially none of the gender gap in any of the education and educational progression outcomes. Figures 5b and 5c replicate this analysis for respondents in households with SES values above the mean (5b) and below the mean (5c). We can see here that the stage in the education process that contributes most to the eventual gender gap in attainment is different for the more advantaged youth (finishing a 4-year college, conditional on attending college) and the less-advantaged (beginning college after high school), but the result that pre-determined control variables fail to explain the gap is consistent. In some sense, it is not surprising that the family variables explain little, since the gender differences in the mean value of most controls is small, but there are substantial gender gaps in non-cognitive skills and in the prevalence of learning disabilities that fail to explain any of the gender gap.

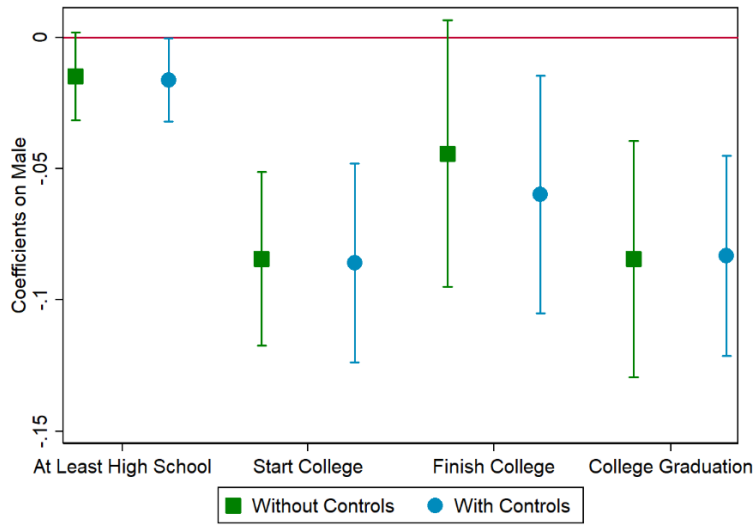


Figure 5a: Coefficient and Confidence Interval for Male Dummy in Education Models—Full Subsample

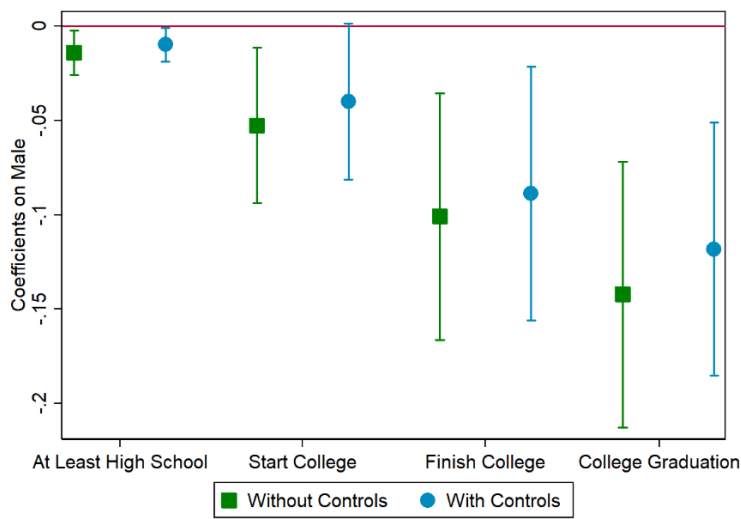


Figure 5b: Coefficient and Confidence Interval for Male Dummy in Education Models—High SES Subsample

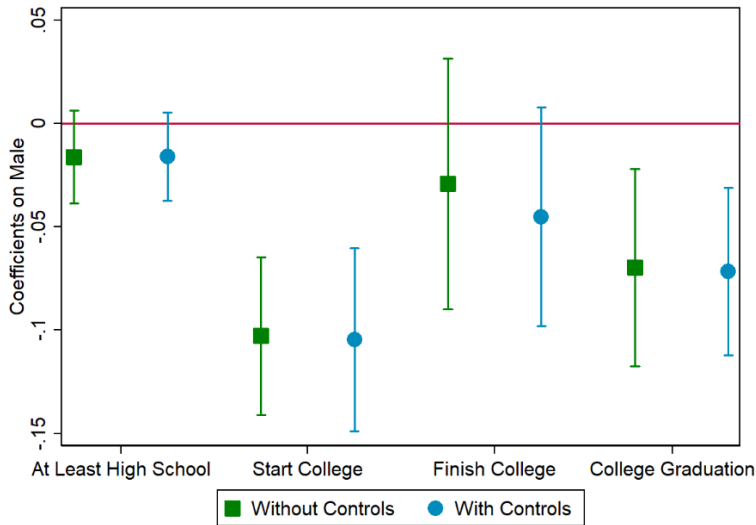


Figure 5c: Coefficient and Confidence Interval for Male Dummy in Education Models—Low SES Subsample

B. School Behavior and Aspirations

As we have seen, there are very substantial differences between the school outcomes in Wave I of adolescent boys and girls—girls have higher grades, particularly in English but also in math, fewer reported school problems and a much lower prevalence of school suspensions, and higher educational aspirations. Girls are much more likely to report that they both want and expect to attend college than are similar boys. These outcomes can be regarded as jointly determined: defiant behavior that leads to school suspensions is likely to be accompanied by low academic effort that results in poor grades and reduced expectations of attending college. However, since school disciplinary records and reports of externalizing behavior are often used as indicators of non-cognitive skills and skill deficits have been highlighted in the literature as a driver of the educational gender gap, there is a case for including these behavior measures in the education models to see if they can “explain” the gap.

The concept of aspirations as a driver of choices is a recent import to economics, initially based on the work of the anthropologist Appadurai (2004). In the theoretical model of Genicot and Ray (2017), aspirations are socially determined and they can affect

investment incentives either positively or negatively, depending upon whether the gap between aspirations (effectively, a reference point in wealth or income) and achievement is small enough to encourage effort, or large enough to frustrate.¹⁴ There is increasing evidence that economic and educational aspirations are strongly predictive of outcomes and some studies find the non-monotonic impact predicted by Genicot and Ray (Khoo and Ainley, 2005; Favara, 2017; Janzen, Magnan, Sharma, and Thompson, 2017).

Social identity is likely to shape the comparison group that drives aspirations, and much of the economics literature has focused on gender inequality in traditional societies as a frame for analyzing aspirations (Mukherjee, 2015). Notably, Beaman, Duflo, Pande, and Topalova (2012) find that a law that reserved leadership positions for women in randomly selected village councils in India altered the career aspirations of adolescent girls through role model effects and increased their educational attainment, erasing the gender gap.¹⁵ In contrast, the gender gap in both aspirations and education in this Add Health subsample favors girls rather than boys.

Figure 6 illustrates the results of adding first school behavior and then educational aspirations to the previous educational attainment and progression models—focusing on college graduation and the probability of continuing to college after high school. The dark bars show the raw gender gap and the others illustrate the portion that is explained by each set of variables using a Kitagawa/Blinder/Oaxaca decomposition.¹⁶ Model 1 includes only the basic control variables, and so is equivalent to the results in Figure 5. Model 2 includes school behavior and attitudes, and Model 3 adds educational aspirations.

Only 30 percent of the gender gap in college graduation is explained by Model 2, with gender differences in school behavior the most predictive factors. Model 3 shows that a sizable additional (and essentially independent) fraction of the gap explained by aspiration differences, but the proportion of the gap in college graduation explained by the model remains below 50 percent. The results for the conditional probability of beginning college

¹⁴ Much of the recent economics literature on aspirations has focused on its possible role in generating poverty traps in low-income countries. In a 2013 lecture, Esther Duflo emphasizes that hope is a capability and that low aspirations can discourage investments (Duflo, 2013).

¹⁵ Rizzica (2020), on the other hand, finds that a policy in the UK intended to raise the aspirations of disadvantaged students had negligible impacts on college enrollment.

¹⁶ The decomposition method generally known as Blinder-Oaxaca was originally developed by Evelyn Kitagawa (1955).

are even more stark. Model 2 explains only 12 percent of the gender gap in college starts, and Model 3 explains about one-third, with the gender gap in educational aspirations the most important factor by far. School behavior (or the non-cognitive skills that these reflect) are not at all important for the transition to college, while aspirations are. This is consistent with a process in which disruptive behavior has more impact at lower levels of education/earlier ages, while the move to tertiary programs is more dependent on goal-setting. College graduation is a cumulative outcome that clearly depends on both.

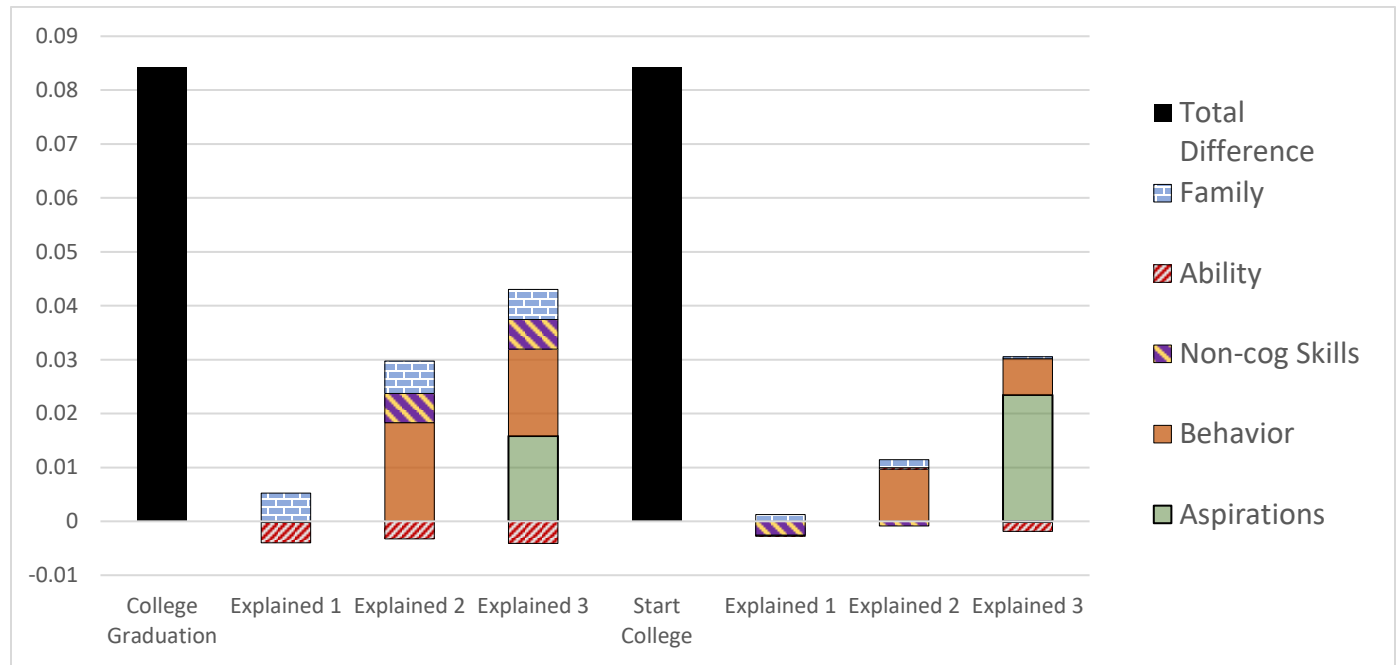


Figure 6: Gender Gaps in College Graduation and Starting College, Explained and Unexplained.

C. Explaining the Gender Gap in Aspirations

We have seen that the lower educational aspirations of boys are strongly predictive of their lower educational attainment, even after controlling for many other family and adolescent characteristics, including school behavior, disciplinary outcomes, and non-cognitive skills. Since we have, as always, only limited proxies for skills, is it possible that the gender difference in aspirations is simply a consequence of a skill gap, with boys recognizing that their underperformance in school will limit their realistic educational goals? Figure 7 shows the results of a “kitchen sink” regression in which we include all of

the previous Wave I control variables as well as math and English grades. In general, students who perform well in secondary school are more likely to progress to college, and so it would be reasonable to think that the pronounced differences in school achievement between boys and girls might explain the difference in their contemporaneous desires and expectations regarding higher education. However, they do not.

Less than half of the gender gap in wanting to attend college and one-third of the difference in expectations can be “explained” by the model, which includes grades, school behavior, parental expectations, attitudes to school, cognitive ability, and other variables, many of them undoubtedly correlated with unobserved traits that affect educational ambitions. Reported aspirations are not simply reflective of school achievement and the gender difference appears to be explained by—gender. At least, there must be unobservable variables that are strongly correlated with gender, drive educational aspirations, and are not picked up by other indicators of school achievement and behavior. This finding focuses our attention on where these differences in desires and expectations between otherwise similar boys and girls might come from.

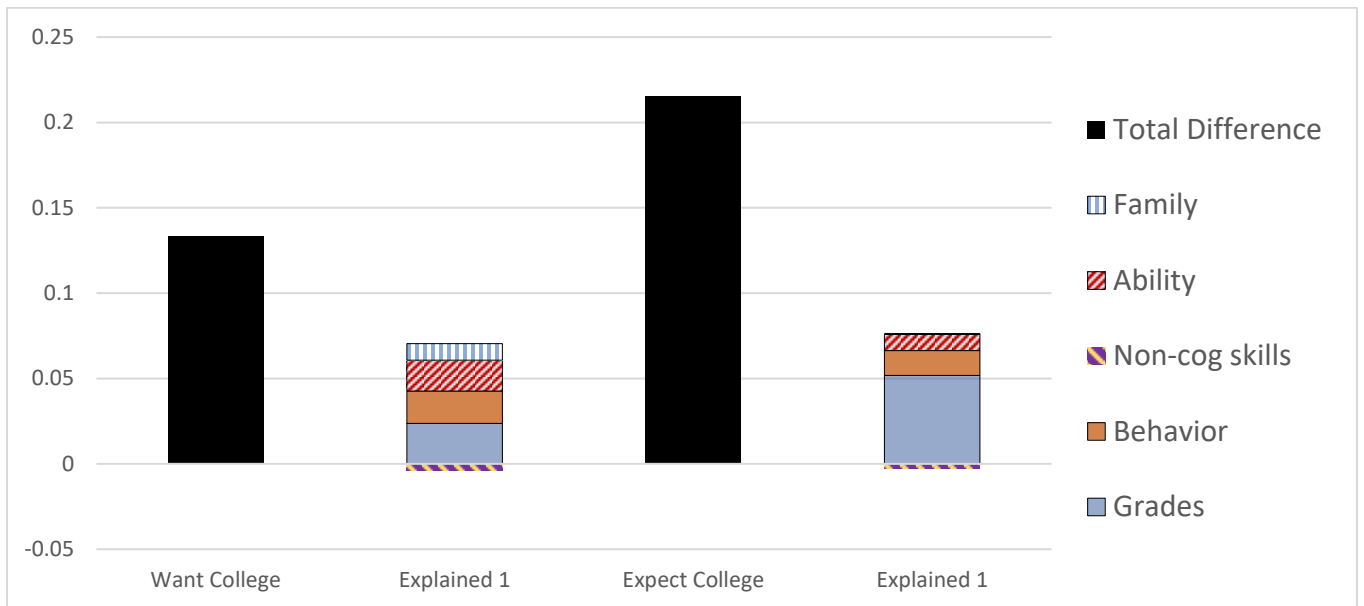


Figure 7: Gender Gaps in Educational Aspirations, Explained and Unexplained

V. Identity, Aspirations, and Gender Gaps.

Gender differences in educational aspirations—in these data, adolescent reports of their desire to attend college and their expectation that they will do so—appear central to the question of why boys are more likely than girls to drop out of school early and fail to attend or complete college. In the model of Genicot and Ray, aspirations depend upon an individual’s social environment and their observation of the outcomes of ‘similar’ or ‘attainable’ individuals. In that sense, aspirations are closely tied to notions of social identity. As introduced by Akerlof and Kranton, identity is of economic significance when individuals have self-images or assigned categories that influence their behavior. Behavior that deviates from expected behavior for someone in your identity category decreases utility, causing “anxiety and discomfort in self and others” (Akerlof and Kranton, 2000).

Gender is a fundamental human category with strong social norms about appropriate behavior in essentially all societies, and schools are social institutions in which gender identities are highly relevant, particularly as students approach adolescence.¹⁷ Akerlof and Kranton (2002) emphasize that schools are social institutions in which peer interaction is important and in which group identities are enforced and have important implications for achievement.

For girls, female identity appears to both help and hamper educational success. On one hand, feminine socialization emphasizes compliance with demands and conflict avoidance, tendencies which are well-suited to demands of formal education. The application of focused attention to and consistent effort in schoolwork, shown in the OECD study on gender equality in education as more characteristic of female students, is compatible with a social identity as a “good girl.” On the other hand, the importance of cultural attitudes regarding gender equality and the social influence of parents, peers, and role models for girls’ willingness to study math and science fields reflects norms in which STEM studies are unfeminine, as many recent studies have shown.

¹⁷ Recent work has emphasized the importance of gender identity for explaining patterns of behavior in the work lives of women in a family context (Bertrand, 2011). Women who earn more than their husbands are in violation of identity norms for both men and women in households, and this outcome is associated, according to Bertrand, Kamenica, Pan (2015), with reduced marital satisfaction and a higher probability of divorce.

In other fields, this insight into the relevance of gender identity for educational outcomes has been extended to male behavior as well, as we have seen with the sociological studies, such as DiPrete and Buchmann, tying adolescent gender norms to school achievement. If developing a masculine identity involves a denigration of hard work and conscientiousness and encourages autonomy and risk-taking, this will stimulate more oppositional behavior in an environment such as formal schooling that strongly discourages it.¹⁸ Peers are important actors in this process: the notion that groups who feel under threat reinforce identity by penalizing members who deviate is central to the concept of identity. Fryer and Torelli (2010) note, in the context of racial school achievement gaps, that group cohesion may be enhanced by opposition/indifference to school demands. The desire to conform to social norms in ways that enhance identity and promote group solidarity that drive girls to be compliant with school demands drives many boys to rebel against them.

One observable aspect of male rebellion against the demands of school in the service of masculine identity appears to a reported lack of interest in pursuing higher education. Our measures of educational aspirations in the Add Health sample are starkly different for male and female students, even controlling for grades and school behavior. There is also weak evidence in these data that this aspirational gender gap increases with age, and is somewhat more likely to fall for male students between the Wave I survey and the Wave II survey one year later. It is not easy to assess the degree to which the want/expect questions elicit actual plans for future study, but they are strongly predictive. It is clear that they are closely linked to preparatory actions in high school: Fortin, Oreopoulos, and Phipps (2015) find that much of the gender gap in high school achievement can be attributed to the gender difference in educational expectations, particularly those linked to career plans that include a graduate degree.

The strength of the norms that promote gender differences in school behavior will vary over time, across societies, and between social groups as we have seen with female participation in STEM fields, and exploiting such variation is likely to enhance our understanding of the educational challenges of boys. Several sociological studies have done

¹⁸ Schools may be an unusually discouraging environment for aggressive and oppositional behavior. Papageorge, Ronda & Zheng (2019) find that externalizing behavior, though it reduces the educational attainment of men, increases their earnings.

this. Hsin's analysis of the different school trajectories of Asian-American boys shows that the tradeoff between the costs and benefits of school compliance/resistance varies for boys in different cultural groups. Legewie and DiPrete (2012) use variation in class SES composition in Berlin schools, where this is arguably random, and show that high-SES classroom differentially favor the academic achievement of boys. Yavorsky and Buchmann (2019), exploiting behavior variation that is unlikely to be exogenous, show that adolescent boys with less gender-typical behavior patterns tend to have higher GPAs. Robust identification of these connections presents empirical difficulties, but the success in establishing the social influences on women's study of STEM fields suggests optimism regarding future progress in understanding the education gender gap.

IV. Conclusions

The substantial gender gap in educational attainment for recent cohorts of men and women cannot be explained by differences in observable parental investments, measurable skills, or behaviors that may reflect skills, even in rich data such as that provided by the Add Health Study and even in a relatively homogeneous sample of young adults. The achievement gap in school reflects, not just a skills deficit, but also an aspirations gap between of boys and girls. This gender gap in aspirations, in turn, cannot be explained as simply a rationalization of gaps in school performance, disciplinary interventions, or parental expectations and seems to reflect an independent influence on educational outcomes that is fundamentally linked to gender.

An explanation for this gender gap in educational aspirations consistent with the findings of recent work in economics on women and STEM and a broader literature in the social sciences is that social and cultural forces linked to gender identity are important drivers of educational goals and performance. A peer-driven search for masculine identity drives some boys towards risk-taking and non-compliance with school demands that hampers school achievement, relative to girls. Aspirations are linked to social identities—what you want and expect depends on who you think you are—and profound differences in the norms defining masculinity and femininity create a gender gap in educational trajectories. What this implies is that the “behavioral deficit” that leads to lower grades

and disciplinary issues for boys is important, but treating this as evidence of a hard-wired skill gap rather than an outcome of a gendered adolescent quest for social identity may be misleading for those designing interventions to boost boys' educational attainment.¹⁹

Other fields in the social sciences and public health have extensive literatures devoted to the development of masculine and feminine identities and the behavioral implications of perceived threats to gendered identities. In social psychology in particular, the concept of fragile or precarious masculinity, in which manhood (unlike womanhood) is seen as a social state that requires continual proof and validation, has been deployed to explain gendered patterns of aggression, risk-taking, medical care usage, and political attitudes (Bosson and Vandello, 2011; Courtenay, 2000; Parent, Kalenkoski, and Cardella, 2018; DiMuccio & Knowles, 2020). Economics, in contrast, tends to treat male behavior as the default from which women diverge in many domains—in this case, male adolescence, in the current case, is simply “adolescence.” This viewpoint may be, to some extent, a reflection of the demographic composition of economics, but a broader willingness to examine masculinity directly will open new avenues for research and for interventions.

¹⁹ Or, as DiPrete and Buchmann (2013b) put it “...boys' underperformance in school has more to do with society's norms about masculinity than with anatomy, hormones or brain structure.”

References

- Akerlof, George A., and Rachel E. Kranton. "Economics and identity." *The Quarterly Journal of Economics* 115, no. 3 (2000): 715-753.
- Akerlof, George A., and Rachel E. Kranton. "Identity and schooling: Some lessons for the economics of education." *Journal of Economic Literature* 40, no. 4 (2002): 1167-1201.
- Andreoni, James, Amalia Di Girolamo, John A. List, Claire Mackevicius, and Anya Samek. "Risk preferences of children and adolescents in relation to gender, cognitive skills, soft skills, and executive functions." *Journal of Economic Behavior & Organization* (2019).
- Appadurai, Arjun. "The capacity to aspire." *Culture and Public Action* (2004): 59-84.
- Archer, Louise, Simon D. Pratt, and David Phillips. "Working-class men's constructions of masculinity and negotiations of (non) participation in higher education." *Gender and Education* 13, no. 4 (2001): 431-449.
- Autor, David, and Melanie Wasserman. "Wayward Sons: The Emerging Gender Gap in Labor Markets and Education." *Third Way Report* 20013 (2013).
- Autor, David, David Figlio, Krzysztof Karbownik, Jeffrey Roth, and Melanie Wasserman. "Family disadvantage and the gender gap in behavioral and educational outcomes." *American Economic Journal: Applied Economics* 11, no. 3 (2019): 338-81.
- Baker, Michael, and Kevin Milligan. "Boy-girl differences in parental time investments: Evidence from three countries." *Journal of Human Capital* 10, no. 4 (2016): 399-441.
- Beaman, Lori, Esther Duflo, Rohini Pande, and Petia Topalova. "Female leadership raises aspirations and educational attainment for girls: A policy experiment in India." *Science* 335, no. 6068 (2012): 582-586.
- Becker, Gary S., William HJ Hubbard, and Kevin M. Murphy. "Explaining the Worldwide Boom in Higher Education of Women." *Journal of Human Capital* 4, no. 3 (2010): 203-241.
- Bertrand, Marianne. "New perspectives on gender." In *Handbook of labor economics*, vol. 4, pp. 1543-1590. Elsevier, 2011.
- Bertrand, Marianne, Emir Kamenica, and Jessica Pan. "Gender identity and relative income within households." *The Quarterly Journal of Economics* 130, no. 2 (2015): 571-614.
- Bertrand, Marianne, and Jessica Pan. "The Trouble with Boys: Social Influences and the Gender Gap in Disruptive Behavior." *American Economic Journal: Applied Economics* 5, no. 1 (2013): 32-64.
- Bosson, Jennifer K., and Joseph A. Vandello. "Precarious manhood and its links to action and aggression." *Current Directions in Psychological Science* 20, no. 2 (2011): 82-86.

Brenøe, Anne Ardila, and Shelly Lundberg. "Gender gaps in the effects of childhood family environment: Do they persist into adulthood?" *European Economic Review* 109 (2018): 42-62.

Buchmann, Claudia, Thomas A. DiPrete, and Anne McDaniel. "Gender Inequalities in Education." *Annual Review of Sociology* 34 (2008): 319-337.

Carrington, Bruce, Peter Tymms, and Christine Merrell. "Role models, school improvement and the 'gender gap'—do men bring out the best in boys and women the best in girls?." *British Educational Research Journal* 34, no. 3 (2008): 315-327.

Charles, Kerwin Kofi, and Ming-Ching Luoh. "Gender differences in completed schooling." *Review of Economics and Statistics* 85, no. 3 (2003): 559-577.

Charles, Maria, and Karen Bradley. "Indulging our gendered selves? Sex segregation by field of study in 44 countries." *American Journal of Sociology* 114, no. 4 (2009): 924-976.

Chevalier, Arnaud, Colm Harmon, Vincent O'Sullivan, and Ian Walker. "The impact of parental income and education on the schooling of their children." *IZA Journal of Labor Economics* 2, no. 1 (2013): 8.

Connell, Robert W., and James W. Messerschmidt. "Hegemonic masculinity: Rethinking the concept." *Gender & Society* 19, no. 6 (2005): 829-859.

Cools, Angela, Raquel Fernández, and Eleonora Patacchini. *Girls, boys, and high achievers*. No. w25763. National Bureau of Economic Research, 2019.

Courtenay, Will H. "Engendering health: A social constructionist examination of men's health beliefs and behaviors." *Psychology of men & masculinity* 1, no. 1 (2000): 4.

Del Boca, Daniela, Chiara Monfardini, and Cheti Nicoletti. "Parental and child time investments and the cognitive development of adolescents." *Journal of Labor Economics* 35, no. 2 (2017): 565-608.

DiMuccio, Sarah H., and Eric D. Knowles. "The political significance of fragile masculinity." *Current Opinion in Behavioral Sciences* 34 (2020): 25-28.

DiPrete, Thomas A., and Claudia Buchmann. *The Rise of Women: The Growing Gender Gap in Education and What it Means for American Schools: The Growing Gender Gap in Education and What it Means for American Schools*. Russell Sage Foundation, 2013a.

DiPrete, Thomas A., and Claudia Buchmann. "The Rise of Women: The Growing Gender Gap in Education and What It Means for American Schools." Briefing Paper, Council on Contemporary Families, March 13, 2013b. http://www.contemporaryfamilies.org/wp-content/uploads/2013/10/2013_Briefing_DiPrete_The-rise-of-women.docx

- DiPrete, Thomas A., and Jennifer L. Jennings. "Social and Behavioral Skills and the Gender Gap in Early Educational Achievement." *Social Science Research* 41, no. 1 (2012): 1-15.
- Dougherty, Christopher. "Why are the Returns to Schooling Higher for Women than for Men?" *Journal of Human Resources* 40, no. 4 (2005): 969-988.
- Duckworth, Angela Lee, and Martin EP Seligman. "Self-discipline Gives Girls the Edge: Gender in Self-discipline, Grades, and Achievement Test Scores." *Journal of Educational Psychology* 98, no. 1 (2006): 198-208.
- Duflo, Esther. "Hope, Aspirations, and the Design of the Fight Against Poverty." Arrow Lecture, McCoy Family Center for Ethics in Society, Stanford University, October 2, 2013. <https://ethicsinsociety.stanford.edu/events/esther-duflo-hope-aspirations-and-design-fight-against-poverty>
- Eble, Alex, and Feng Hu. "The sins of the parents: Persistence of gender bias across generations and the gender gap in math performance." *CDEP-CGEG Working Paper* 53 (2018).
- Epstein, Debbie. 1998. "Real Boys Don't Work: Underachievement, Masculinity and the Harassment of Sissies." Pp. 96–108 in *Failing Boys? Issues in Gender and Achievement*, edited by D. Epstein, J. Elwood, V. Hey, and J. Maw. Buckingham, UK: Open University Press.
- Fahle, Erin M., and Sean F Reardon. "Education." *State of the Union 2018: The Poverty and Inequality Report*, Pathways Magazine, Stanford Center on Poverty and Inequality (2018).
- Favara, Marta. "Do dreams come true? Aspirations and educational attainments of Ethiopian boys and girls." *Journal of African Economies* 26, no. 5 (2017): 561-583.
- Fortin, Nicole M., Philip Oreopoulos, and Shelley Phipps. "Leaving Boys Behind Gender Disparities in High Academic Achievement." *Journal of Human Resources* 50, no. 3 (2015): 549-579.
- Fryer Jr, Roland G., and Steven D. Levitt. "An empirical analysis of the gender gap in mathematics." *American Economic Journal: Applied Economics* 2, no. 2 (2010): 210-40.
- Fryer Jr, Roland G., and Paul Torelli. "An empirical analysis of 'acting white'." *Journal of Public Economics* 94, no. 5-6 (2010): 380-396.
- Genicot, Garance, and Debraj Ray. "Aspirations and inequality." *Econometrica* 85, no. 2 (2017): 489-519.

- Goldin, Claudia, Lawrence F. Katz, and Ilyana Kuziemko. "The Homecoming of American College Women: The Reversal of the College Gender Gap." *Journal of Economic Perspectives* 20, no. 4 (2006): 133-156.
- Gong, Jie, Yi Lu, and Hong Song. "The effect of teacher gender on students' academic and noncognitive outcomes." *Journal of Labor Economics* 36, no. 3 (2018): 743-778.
- Guiso, Luigi, Ferdinando Monte, Paola Sapienza, and Luigi Zingales. "Culture, gender, and math." *Science* 320, no. 5880 (2008): 1164-1165.
- Hsin, Amy. "Hegemonic Gender Norms and the Gender Gap in Achievement: The Case of Asian Americans." *Sociological Science* 5 (2018): 752-774.
- Hyde, Janet S., and Janet E. Mertz. "Gender, culture, and mathematics performance." *Proceedings of the National Academy of Sciences* 106, no. 22 (2009): 8801-8807.
- Jackson, C. Kirabo. "Can Introducing Single-Sex Education into Low-Performing Schools Improve Academics, Arrests, and Teen Motherhood?" *Journal of Human Resources* (2019): 0618-9558R2.
- Janzen, Sarah A., Nicholas Magnan, Sudhindra Sharma, and William M. Thompson. "Aspirations failure and formation in rural Nepal." *Journal of Economic Behavior & Organization* 139 (2017): 1-25.
- Kautz, Tim, James J. Heckman, Ron Diris, Bas Ter Weel, and Lex Borghans. *Fostering and measuring skills: Improving cognitive and non-cognitive skills to promote lifetime success*. No. w20749. National Bureau of Economic Research, 2014.
- Khoo, Siek Toon, and John Ainley. "Attitudes, intentions and participation." *Longitudinal Surveys of Australian Youth Research Reports* (2005): https://research.acer.edu.au/lsay_research/45.
- Kitagawa, Evelyn M. "Components of a difference between two rates." *Journal of the American Statistical Association* 50, no. 272 (1955): 1168-1194.
- Legewie, Joscha, and Thomas A. DiPrete. "School context and the gender gap in educational achievement." *American Sociological Review* 77, no. 3 (2012): 463-485.
- Lei, Ziteng and Shelly Lundberg. "Vulnerable Boys: Short-term and Long-term Gender Differences in the Impacts of Adolescent Disadvantage." Forthcoming in *Journal of Economic Behavior and Organization*. (IZA Discussion Paper 12944, February 2020.)
- Lindberg, Sara M., Janet Shibley Hyde, and Jennifer L. Petersen. "New trends in gender and mathematics performance: A meta-analysis". *Psychological Bulletin* 136, no. 6 (2010):1123–1135.

- Lundberg, Shelly. "Non-cognitive skills as human capital." In *Education, Skills, and Technical Change. Implications for Future US GDP Growth* (2018).
- Lundberg, Shelly, Robert A. Pollak, and Jenna Stearns. "Family inequality: Diverging patterns in marriage, cohabitation, and childbearing." *Journal of Economic Perspectives* 30, no. 2 (2016): 79-102.
- Mukherjee, Priya. "The effects of social identity on aspirations and learning outcomes: a field experiment in rural India." International Growth Center working paper S-35120-INC-7 (2017).
- Nollenberger, Natalia, Nria Rodrguez-Planas, and Almudena Sevilla. 2016. "The Math Gender Gap: The Role of Culture." *American Economic Review*, 106 (5): 257-61.
- OECD (2015), *The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence*. PISA, OECD Publishing. <http://dx.doi.org/10.1787/9789264229945-en>
- Oguzoglu, U., and S. Ozbeklik. "Like Father, Like Daughter (Unless There Is a Son): Parental Occupational Investment and STEM Field Choice in College." IZA Discussion Paper #10052, 2016.
- Owens, Jayanti. "Early childhood behavior problems and the gender gap in educational attainment in the United States." *Sociology of Education* 89, no. 3 (2016): 236-258.
- Papageorge, Nicholas W., Victor Ronda, and Yu Zheng. *The economic value of breaking bad: Misbehavior, schooling and the labor market*. No. w25602. National Bureau of Economic Research, 2019.
- Paredes,Valentina. "A teacher like me or a student like me? Role model versus teacher bias effect." *Economics of Education Review* 39 (2014): 38-49.
- Parent, Mike C., Charlene M. Kalenkoski, and Eric Cardella. "Risky business: Precarious manhood and investment portfolio decisions." *Psychology of Men & Masculinity* 19, no. 2 (2018): 195.
- Pekkarinen, Tuomas. "Gender differences in educational attainment: Evidence on the role of tracking from a Finnish quasi-experiment." *Scandinavian Journal of Economics* 110, no. 4 (2008): 807-825.
- Pope, Devin G., and Justin R. Sydnor. "Geographic variation in the gender differences in test scores." *Journal of Economic Perspectives* 24, no. 2 (2010): 95-108.
- Porter, Catherine, and Danila Serra. "Gender differences in the choice of major: The importance of female role models." *American Economic Journal: Applied Economics* (2019).
- Rampino, Tina, and Mark P. Taylor. *Gender differences in educational aspirations and attitudes*. No. 2013-15. ISER Working Paper Series, 2013.

Rizzica, Lucia. "Raising aspirations and higher education: evidence from the UK's Widening Participation policy." *Bank of Italy Temi di Discussione (Working Paper) No 1188* (2018).

Sansone, Dario. "Why does teacher gender matter?" *Economics of Education Review* 61 (2017): 9-18.

Taubman, Paul. "Role of parental income in educational attainment." *American Economic Review* 79, no. 2 (1989): 57-61.

Yavorsky, Jill E., and Claudia Buchmann. "Gender Typicality and Academic Achievement among American High School Students." *Sociological Science* 6 (2019): 661-683.

Table A1: Summary statistics, White Non-Hispanic sample, Add Health Wave I

	(1) Female Mean(sd)	(2) Male Mean(sd)	(3) Female–Male Mean(sd)
<u>Education and Educational Progression - Wave IV</u>			
College Graduate	0.489 (0.500)	0.378 (0.485)	0.111 (0.015)
High School Graduate	0.969 (0.173)	0.942 (0.233)	0.027 (0.006)
Start College (cond. on high school graduation)	0.813 (0.390)	0.736 (0.441)	0.078 (0.013)
Finish College (cond. on start college)	0.621 (0.485)	0.546 (0.498)	0.075 (0.017)
<u>Family Resources and Environment – Wave I</u>			
Mother High School	0.433 (0.496)	0.429 (0.495)	0.004 (0.015)
Mother Some College	0.184 (0.388)	0.204 (0.403)	-0.020 (0.012)
Mother College Graduate	0.296 (0.456)	0.296 (0.457)	-0.000 (0.014)
Father High School	0.288 (0.453)	0.284 (0.451)	0.004 (0.014)
Father Some College	0.258 (0.438)	0.293 (0.455)	-0.034 (0.014)
Father College Graduate	0.352 (0.478)	0.335 (0.472)	0.017 (0.014)
Family Income	61.801 (60.216)	58.008 (48.483)	3.793 (1.753)
SES Index	0.307 (1.177)	0.324 (1.158)	-0.017 (0.035)
First-born	0.356 (0.479)	0.372 (0.483)	-0.016 (0.015)
Only Child	0.111 (0.314)	0.107 (0.309)	0.004 (0.009)
Age in 2008	28.748 (1.713)	29.034 (1.703)	-0.286 (0.052)
Disappointed if child doesn't attend college (parent-reported)	2.225 (0.689)	2.195 (0.714)	0.030 (0.021)
Relationship Quality Index	-0.122 (1.133)	-0.104 (1.129)	-0.019 (0.034)
Mother disappointed if no college (child-reported)	4.025 (1.179)	3.928 (1.249)	0.097 (0.037)
Father disappointed if no college (child-reported)	4.074 (1.178)	3.948 (1.274)	0.127 (0.037)
Activities with mother	4.115 (1.834)	3.439 (2.131)	0.677 (0.060)
Activities with father	2.861	3.092	-0.231

	(1.704)	(2.465)	(0.064)
<u>Child Ability – Wave I</u>			
Learning Disability (parent-reported)	0.075 (0.264)	0.148 (0.356)	-0.073 (0.010)
Peabody Vocabulary Test (standardized)	-0.015 (1.010)	0.072 (0.962)	-0.088 (0.031)
Health Status (self-reported)	3.919 (0.843)	4.057 (0.832)	-0.138 (0.025)
Physical maturity (interviewer report)	3.451 (0.828)	3.335 (0.801)	0.116 (0.025)
<u>Psychological characteristics/Non-cognitive skills – Wave I</u>			
Impulsivity	0.279 (0.449)	0.386 (0.487)	-0.106 (0.014)
Depression Index	-0.064 (1.014)	-0.270 (0.849)	0.205 (0.028)
Self-esteem Index	-0.151 (1.150)	0.245 (1.021)	-0.396 (0.033)
<u>School Outcomes – Wave I</u>			
School Problems Index	-0.270 (1.022)	0.077 (1.165)	-0.347 (0.033)
Attitudes to School Index	-0.120 (1.106)	-0.131 (1.065)	0.011 (0.033)
Ever Suspended from School	0.093 (0.290)	0.238 (0.426)	-0.145 (0.011)
English Grade	3.190 (0.859)	2.799 (0.967)	0.391 (0.028)
Math Grade	2.935 (0.995)	2.811 (1.034)	0.123 (0.032)
<u>Aspirations – Wave I</u>			
Want to Attend College	4.582 (0.903)	4.366 (1.128)	0.216 (0.031)
Expect to Attend College	4.466 (0.973)	4.151 (1.170)	0.315 (0.033)
Observations	2198	2139	4337