Leaving Boys Behind: Gender Disparities in High Academic Achievement[1]

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Abstract

Using three decades of data from the "Monitoring the Future" cross-sectional surveys, this paper shows that, from the 1980s to the 2000s, the mode of girls' high school GPA distribution has shifted from "B" to "A", essentially "leaving boys behind" as the mode of boys' GPA distribution stayed at "B". In a reweighted OB decomposition of achievement at each GPA level, we find that gender differences in post-secondary expectations, controlling for school ability, and as early as 8th grade are the most important factor accounting for this trend. Increases in the growing proportion of girls who aim for a post-graduate degree are sufficient to account for the increase over time in the proportion of girls earning "A's". The larger relative share of boys obtaining "C" and C+" can be accounted for by a higher frequency of school misbehavior and a higher proportion of boys aiming for a two-year college degree.

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1. Introduction

Women now far outnumber men among recent college graduates in most industrialized countries (OECD, 2008). As Goldin, Katz, and Kuziemko (2006) observe, the puzzle is : "Why have women overtaken men in terms of college completion instead of simply catching up to them?" The growing female dominance in educational attainment raises new questions about gender disparities arising throughout school-ages.[2] Girls have long obtained better grades, on average, in high school than boys.[3] As shown in Figure 1a, the average gender gap in GPA among high school seniors (scaled out of 4 points) hovers steadily around 0.2 between 1976 and 2009.[4] Because historically these achievements never translated into higher levels of educational attainment or better labor market outcomes for women relative to men, earlier research has concentrated on explaining the remaining gaps in women's performance, particularly in mathematics (e.g. Guiso et al., 2008; Bedard and Cho, 2010, Niederle and Vesterlund, 2010). Conversely, the relative underperformance of males, especially in reading, has attracted little attention until recently (LoGerfo, Nichols, and Chaplin, 2006). Interest in the academic performance gap favoring women is changing for a number of reasons[5]. There are now numerous books and articles in the popular press discussing the relative underperformance and under motivation of boys, and their late entry into adulthood.[6]

The first goal of this paper is to document changes in gender disparities in the academic performance of high school students (12^{th}, 10^{th}, and 8^{th} graders) over the last three decades using survey data from the "Monitoring the Future" (MTF) project.[7] We find that an increasing proportion of students are earning A grades, arguably allowed by the progressive disaffection

[2] According to OECD (2008), the average share of the student population in tertiary education in OECD countries accounted for by women reached 55% in 2005. Only four countries are likely not to achieve at least parity between men and women by 2015: Korea, Turkey, Japan and Switzerland.
[3] This is observed in other countries as well. See Machin and McNally (2005) for Britain, Lai (2010) for China.
[4] The gender gap in GPA from the MTF match (within standard errors) the numbers from the NAEP High School Transcript Study for 1990, 2000, 2005 and 2009, also reported in NCES (2004), as well as the numbers reported in Cho (2007) for 1984 from the HS&B survey.
[5] The more difficult job prospects of men with a post-secondary education and feared labor shortages in some professional specialties that attract few women, such as orthopedic surgeons, are mentioned, as well as repercussions for the marriage prospects of college-educated women (Blank, 2011), and concerns among boys' parents about a "failure to launch" (Bell, Burtless, Gornick and Smeeding, 2007).
[6] See among others, Tyre (2008), Gurian and Stevens (2007), Sax (2008). By contrast, popular books in the 1990s were concerned about girls being disadvantaged by school system (e.g. Sadker and Sadker, 1994; AAUW,1992).
[7] To the best of our knowledge, Jacob and Wilder (2012) is the only other contemporaneous paper using the MTF to study educational expectations. They study on the impact of these expectations on college going.

with "grading on the curve".[8] As shown in Figure 1b, the percentage of 12th grade students reporting in the MTF that they earn A's (93-100%) almost doubled, from 8.5% in the 1980s to 16.6 % in the 2000s, and the difference between the proportion female and the proportion male in this category also doubled from 3.2% to 5.4%.[9] From the 1990s to the 2000s, the female advantage in the proportion of 10th and 8th graders earning A's also increased, from 3.6% to 4.8% and from 4.9% to 5.5%, respectively. What accounts for this growing gender disparity in high grades in high school? The second aim of the paper is to identify the relative importance of four potential sets of determining factors that changed differently by gender over time. These include plans for the future, — likely driven by changes in the labor market—, non-cognitive skills, the family environment, and working while in school.[10]

The post-secondary aspirations and expectations of high school students, as well as their choice of high school program (from vocational to academic) to enact these career plans, are among the most important set of factors that changed over the last three decades. While returns to college have increased more for men than for women over the last three decades[11], Figure 2a shows that just the opposite happened to expectations about "definitively" attending a graduate or professional school after college, which have risen faster for women than for men. Among seniors, boys' expectations were slightly higher than girls' from 1976 to 1983, but thereafter a gap in favor of girls began to emerge, widening in the 1990s, and reaching 9% before the Great Recession. Figure 2b presents the share female among students who say that they "will definitively go to a four year college", a question asked at the three grade levels. Among seniors, the share female was around 50% up to the early 1980s, overshot actual enrollment rates by a few percentage points in the 1990s to stabilize around 57% in the 2000s.[12] Interestingly, the gender gap in expectations to attend a four year college is shown to emerge as early as grade 8, when it hovers around 55%. Goldin and Katz (2002) have argued that the 1970s "Pill Revolution" was crucial in allowing young women to formulate plans for higher education

[8] To be clear, the erosion of grading on the curve is not seen as "causing" an increasing proportion of girls to earn A's, rather the absence of constraints on the proportion of students earnings A implies that we do not have to be preoccupied by potential general equilibrium effects that such constraints would imply.
[9] In the MTF, an A grade corresponds to a percentile grade in the 93-100% range. The exact years are 1976 to 1988 for the 1980s, and 2000 to 2009 for the 2000s for 12th graders, and 1991-1999 for the 1990s for 10th and 8th graders.
[10] See Buchmann, DiPrete, and McDaniel (2008) for an encompassing literature review of these determining factors.
[11] This is a well-known stylized fact (see Fortin, 2006, among others) illustrated in Appendix Figure A1a.
[12] Note that given the higher percentage of boys who drop out of school, the share female in the sample of 12th graders ranges from 51% in earlier years to 52% in later years. The above female share has thus moved from a 1% deficit to 5% surplus.

without the fear of interruptions for family reasons. We argue that in subsequent decades, the ongoing progress of women in the professions has continued to fuel young women's career plans involving graduate and professional schools. At the same time, with the advent of computerization and other office technologies, in the 2000s clerical work seems to have lost much of its appeal for young women. The proportion of girls anticipating to be working in a clerical job at age 30 plummeted from 1 in 5 in the 1980s to less than 1 in 40 in the 2000s.[13]

Our set of expectation variables includes a full range of career plans for life after high school, including serving in the army, attending a vocational, a two-year college, a four-year college and even aiming for graduate or professional school. These distinctions will prove critical to understand the lower GPA of boys. As explained below, the expectation variables are thought to subsume the effects of gender difference in the returns to college (Jacob, 2002; Cho, 2007) or the anticipated dispersion regarding those returns (Charles and Luoh, 2003). As pointed out by Manski (2004), when using expectations data, it is important to clarify the assumptions held about the information used to form of their expectations. In the context of educational expectations, whether youths condition these expectations on returns to college, ability or financial constraints could lead to different interpretations of the results. Fortunately, the MTF surveys also include data on educational aspirations and subjective assessments of school ability which allows us to condition, at least partially, for some potentially endogenous effects, and to present bounds on the effects of educational expectations with and without these controls. As Fisher (1958) observed in the case of lung cancer, "We must recognize here the possibility of one real cause for the increase in lung cancer. .. But the only good comparison we can make in respect of time-change is that between men and women." (p. 166). Similarly, we have to rely on changes in gender differences over time as a unique "quasi-experiment" to help disentangle the relationship between educational expectations and achievement.

The data do not allow us to consider the effect of teaching styles (Algan, Cahuc, and Shleifer, 2010) or of the teachers' gender (Dee, 2005, 2006), which have attracted recent attention. To the extent that teaching styles may be linked the teacher's gender, CPS data shows that the proportion female (ranging from 55% to 59%) among secondary school teachers has changed very little over the time period considered. Moreover, some studies (Kramarz, Machin,

[13] See Table A1. Table A2 which displays the labor market outcomes of young people (25-39 years old) over the 35 year period, shows the actual proportion of young women employed in clerical work has also dropped significantly, but not as dramatically as desired occupations.

and Ouazad, 2008; Bertrand and Pan, 2011) suggest that these effects are smaller in magnitude than those of student ability or family background variables, which we include in our analysis. We do however include information on the type of high school program (academic, vocational, general, etc.) attended, which consistent with Dustmann (2004) and Checchi and Flabbi (2007), are associated with different GPA distributions.[14] Following the wave of interest in the impact of non-cognitive traits, we account for school misbehavior, smoking, and alcohol binging.[15] It is interesting to note that the gender gap in smoking, which had closed in the 1970s and early 1980s, has reopened more recently, and that school misbehavior, which has decreased over time for boys, has reduced - the gender gap in reprehensible behavior.[16]

The other sets of factors that we consider are the family environment and working during school. As first observed by Ben-Porath and Welch (1976) boys and girls are raised in somewhat different family environments. Our study also shows significant differences in family composition. Families with girls are, on average, larger (in line with Angrist and Evans, 1998), have less educated parents, more working mothers, and more fathers not living in the same household, as documented by Dahl and Moretti (2008).[17] These last two gender gaps in family characteristics are increasing over time. These time trends would seem to disadvantage girls, suggesting that high achieving girls are actually "swimming upstream" perhaps reacting to more difficult circumstances. Another changing factor is the closing of the gender gap in labor force participation during high school coming from a decline in the labor force participation of boys, from 85% in the 1980s to the 76% in the 2000s, when about three-quarters of both boys and girls had some sort of paid employment during school.[18] To the extent that negative effects of working during school are expected for a wide range of high school students (Tyler, 2003; Rothstein, 2007), the time trends should prevent boys from falling behind in high school grades. On the other hand, working during school in entry level jobs could play a role in motivating

[14] Similar information on the type of high school program (academic, general, vocational, etc.) in which students are enrolled is also asked in the NLS72 and NELS-88, for example.
[15] We include information on smoking and alcohol binging. For 10^{th} and 8^{th}, we also use information on the frequency of being sent to the principal or to detention for bad behavior in the last year. Among 12^{th} graders, that information was collected only for a small subset of students.
[16] See Figures A1b and A1c.
[17] As shown in Figure A1d. See Lundberg and Rose (2002) on the gendered effects of children on fathers' labor supply and wages.
[18] However as shown below, boys continue to work longer hours and earn more money.

students to pursue higher education and may thus have different effects across the GPA distribution.

As with most studies of changes in gender differentials, we construct counterfactual states of the world based on the observed responses and respective endowments of males and females. We then apply a reweighted decomposition methodologies (Fortin, Lemieux, and Firpo, 2011) aimed at separating endowment effects from response effects under the assumption that the distribution of unobservables conditioning on observables is independent of gender. We focus on an analysis of changes over time in the distribution of GPA because gender differences in average GPA have not changed over the past thirty years, while the gender ratio of students admitted to college, those with high GPA, has changed substantially. In so doing, we also contribute a distributional understanding to increases in average GPA over time.[19]

The paper is organized as follows. Section 2 presents the simple threshold model of academic achievement that motivates the estimation procedure. Section 3 introduces the MTF surveys and presents some descriptive statistics about gender disparities in academic achievement and in the explanatory factors, as well as changes over time therein. The decomposition methodology is explained in Section 4. Section 5 presents the decomposition results and discusses their interpretation. Finally, section 6 concludes.

1. A Simple "Threshold" Model of High School Performance

We begin by presenting a simple behavioral threshold model of academic performance where the changing aspirations and expectations for the future of girls would lead them to capture a larger proportion of high grades. The focus on the gender gap in top grades follows from the findings of previous studies (Jacob, 2002; Goldin, Katz, and Kuziemko, 2006; Cho, 2007; Conger and Long, 2010) showing that the lower college admission rates of men can in large part be accounted for by their lower high school performance.[20] We note that better high school performance explains "how" more girls are admitted to college but not "why".

[19] By contrast, grade inflation should refer to changes in the price of grades (e.g decrease in study time). Because they compress the grade distribution, rising grades are different from rising nominal prices. The term "grade inflation" may be an imperfect analogy.

[20] The higher average grades of girls are at times equated with their higher average non-cognitive abilities (Jacob, 2002; Becker, Hubbard, and Murphy, 2010).

Over the last three decades there has been sustained effort (Manski and Wise, 1983; Manski, 1993; Dominitz, Manski, and Fischhoff, 2001; Manski, 2004) to understand the formation of students' expectations and to ascertain the importance of these expectations in their decision to enroll in college. Recent studies (Stange, 2008; Zafar, 2011; Jacob and Wilder, 2012) set in longitudinal settings have focused on learning and beliefs updating, trying to address on the first part of the puzzle. Not having access to the longitudinal MTF data, we bypass the first issue of expectations formation assuming that the majority of students, by the time they leave elementary school, have fashioned some expectations about college-going. Indeed, decisions to enroll in a college preparatory high school program, to move to a neighborhood with a better high school, and to apply to a magnet school have to be made early in a pupil's life. We rely instead on changes over time across gender in the educational expectations of students in order to evaluate the importance of these expectations for the high academic achievement that opens the door to college-going and to graduate school attendance. We argue that these changes are different by gender for reasons exogenous to the early education process; rather they are rooted in changes in the labor market opportunities for women.[21]

These considerations lead us to propose a "threshold" model of academic achievement where educational expectations, formed in elementary school and likely influenced by parental desires, play a prominent role in determining, given a level of aptitude, in an individual's choice of optimal GPA. Models of high school performance in economics are usually set as derivatives of the Mincerian human capital investment model where individuals choose their level of schooling to maximize their life-cycle earnings. Here we want think of decisions taken earlier in life when labor market outcomes are not as concrete or narrow as returns to college, but would come out as the answer to the typical question: "What do you want to do when you grow up?"[22]

At this stage, parents are likely still involved in the education of their children, perhaps actively assisting them with homework, helping them set goals, and manage their time. The model thus borrows from the model of intergenerational transmission of income status (Becker and Tomes, 1979), the idea that the other generation's utility, the parents in this case, enters the

[21] A caveat here is the disproportionate increase in ADHD among boys (Elder and Lubotsky, 2009; Chen, Fortin, Oreopoulos and Phipps, 2011). But in our data, we actually see a decrease over time in school misbehavior

[22] For example, DiPrete and Buchmann (2006) suggest that gender differences in college enrollment may arise because women's marriage market possibilities and social status may be enhanced by college going over and above the simple returns to college.

decision maker's objective function. The parents' utility from their offspring's educational expectations depends on their own characteristics, such as their own level of education, as well as on the school ability or aptitude of each child. Over the last three decades, exogenous changes in the opportunities for women in the labor market have led many parents to have higher educational expectations for their daughters. As shown in Chen, Fortin, Phipps, and Oreopoulos (2011), in the 2000s, parents of primary school students had higher educational expectations for their daughters than for their sons. Frenette and Zeman (2007) find that parental expectations that their child will attain the highest level of education accounts for a notable share of gender differences in university attendance. Further the role of parental expectations could explain why first generation immigrant boys suffer less from the boys' underachievement problem.[23]

As with signaling models of educational choices (Spence, 1973), we want to allow for the fact that, given a level of aptitude or ability, an individual may find it optimal to aim for the minimum GPA needed to reach a career or educational goal. Implicit in our framework is the fact that basic school ability is revealed quite early in the pupil's schooling experience .There is indeed an emerging consensus in the psychology literature that students form reliable perceptions of their academic competency around 5th grade (Herbert and Stipek, 2005).[24] This contrasts with learning models (Stange, 2008) where academic ability for college is revealed slowly over time and where individuals revised their schooling decisions. We think that both models provide an adequate representation of the behavior of some subsets of individuals and for different levels of skills. The updating of educational expectations is perhaps more salient among college/university students who face more fateful choices about which major to pursue or whether or not to continue their studies (Zafar, 2011) than among high school students for whom the salient choice is whether or not to drop out (once they reach minimum school leaving age). Despite updating by some individuals, results in Stange (2008) and Jacob and Wilder (2012) support the idea that the majority of individuals are actually successful at enacting their early educational plans. Jacob and Wilder (2012) report that only 35% of high school students update their

[23] Wilson, Burgess and Briggs (2011) have also suggested aspiration-based explanations to account for ethnic differences in academic performance. See also Zafar (2011).
[24] This is consistent with the high school tracking taking place in many European countries around the ages of 10 and 11 (Dustmann, 2004; Checchi and Flabbi, 2007).

educational expectations from grade 8 to grade 10; from grade 10 to 12, that percentage is only 25%. Importantly, because we use cross-sectional data, the model is set in a static framework.[25]

We assume that a pupil comes to secondary school with a basic aptitude for school (A_i) that was largely revealed during elementary school and with plans for future education likely influenced by parental desires, and aims for a GPA (G_i) in the range $R_j(G_i) = I[l_j \leq G_i \leq u_j]$, where I is the indicator function, that will allow him/her to pursue further schooling/career plans ($S_j j = 1, \dots, J$). As illustrated in Figure 3, the simple functional form for $R_j(G_i)$ with multiple thresholds assumes with probability one that a student with a GPA in the indicated range will be able to pursue her educational plans.[26] The student chooses a level of effort and target GPA to maximize her utility from schooling plans minus costs, $C(G_i)$, plus an intergenerational utility component,

$$Max_{\{G,E\}}\, U_i\{S_j - C(G_i)\} + \alpha U_i^p(S_j, A_i),$$
$$\text{subject to } S_j(G_i) = I\left[l_j \leq G_i \leq u_j\right], \qquad j = 1, \dots, J$$
$$C(G_i) = f(E_i, A_i).$$

The component $U_i^p(S_j, A_i)$ represents the utility to the parents of having an offspring of ability A_i in reach of educational level S_j, and α is the weight placed by the student on parental utility. This last parameter is potentially important is assessing gender differences, as psychologists argue that girls place more importance on pleasing adults than boys. Assuming separability of schooling plans and costs, however, parental utility merely acts to scale the rewards of a schooling plan. The effect of parents' other characteristics might have similar rescaling effects on the cost function.[27]

Importantly, the cost of getting a particular grade, $C(G_i) = f(E_i, A_i)$, is decreasing non-linearly with ability, $\frac{\partial f(E_i, A_i)}{\partial A_i} < 0$, and $\frac{\partial^2 f(E_i, A_i)}{\partial A_i} > 0$. The cost of academic achievement is increasing with effort, but there may be some complex non-linear interactions between effort and ability, possibly different by gender, that we do not attempt to model directly here, but leave for

[25] We do not exclude the possibility that some students revise their plans, but because we do not have access to the MTF longitudinal data, we cannot explore this avenue.
[26] In reality, the discontinuities do not need to be as sharp as illustrated in Figure 3.
[27] The role of teachers in this model would be similar to that of parents in lowering the cost of academic achievement and enhancing its benefits by motivating students to succeed.

future research.[28] The mapping $R_j(G_i)$ of GPA into educational plans may include a more complex step function than the one above, where there are different probabilities of attaining educational choice S_j by GPA level.[29] What is important in leading some students to optimally choose lower levels of GPA are the thresholds in access to educational choice by GPA, as shown in Figure 3.

In Figure 3, the utility of three educational choices for student *i*, $U_i(S_j) = w_i * I[l_j \leq G_i]$, are displayed as simple step functions, for *j*=two-year college ($w_i = 4, l_{2-yr} = 2$), four-year college ($w_i = 7.5, l_{4-yr} = 3$), and graduate school ($w_i = 10, l_{grad} = 4$). The cost functions illustrated in Figure 3, subsume in their functional forms the level of effort needed for high, medium and low ability students to achieve that higher GPAs, showing that it is more costly for lower ability students to obtain high GPAs. Thus the choices of GPA, $G_i^*(A_i, S_j)$, which maximizes the utility net of achievement cost for each ability level, are the lower bound of each educational choice. That is, the low ability student will target a GPA of 2 to access two-year colleges, the medium ability a GPA of 3 to access four-year colleges, and the high ability student a GPA of 4 aiming to attend graduate school. Letting $G_i^{max}(A_i) = G_i^*(A_i, S_J)$ be the highest grade that a student, with a given level of ability A_i, can attain when the student has the highest educational aspirations $j = J$ (e.g. graduate school), then a student's optimal choice of GPA may reflect potential educational under-achievement $G_i^*(A_i, S_k) < G_i^{max}(A_i)$. The model helps rationalize the relative underperformance of boys as the consequence of career choices that require lower levels of educational attainment. This potential educational underachievement may be of concern when students' educational aspirations are limited by lack of information, borrowing constraints, time impatience, or other intertemporal optimization errors.[30] This model contrasts with both the early childhood development (ECD) branch and education production function (EPF) branch of the literature on cognitive achievement in children (Todd and Wolpin, 2003), where the goal is to maximize achievement under some cost constraints.

[28] Bishop (2006) argues that there are different studying and homework cultures by gender, something like "smart boys get high marks without showing effort" or 'it is not cool for boys to work hard to get top grades". Finnie et al. (2011) reports sizeable gender differences among 15 year old in positive answers to the question "Friends think its okay to work hard at school" in the Canadian Youth in Transition Survey (YITS).

[29] The role of teachers in this model would be similar to that of parents in lowering the cost of academic achievement and enhancing its benefits by motivating students to succeed.

[30] Lundberg (2012) finds that among low SES adolescents in the Add Health survey, lower "openness" to experience is associated with lower propensity to attend college.

In this study of gender gaps in academic achievement, we seek to identify how the distribution of student characteristics maps into the distribution of GPAs differently by gender, taking into account different educational expectations, controlling for student ability, students' aspirations, labor market work, and for the family environment. We are primarily interested in how changes over time in these determinants help account for changes over time in gender differentials in academic achievement. For each of the three time periods, we estimate the following academic achievement equation,

$$Prob[G_i = c] = h_g^c(S_i, A_i, L_i; X_i, X_i^p), \qquad c = 1, \dots, 9\ , \tag{1}$$

where $S_i$denotes the educational expectations and A_i denotes the student' school ability, ideally measured in elementary school. We combine the high school program, the schooling expectations and aspirations to measure S_i. The student's school ability, A_i is proxied using a contemporaneous subjective measure of school ability, available for 12th grade students.[31] For 8th and 10th grade students, we measure ability by how often he or she found school "too hard" in the last year, in addition to a measure of past grade retention. We include an indirect measure of effort, following the tradition in labor economics of deriving non-market time, here study time, as the difference between total time (T) and labor market time (L_i): $E_i = T - L_i$. To account for the impact of non-cognitive skills, we include measures of cigarette smoking and alcohol binging, which may relate to time impatience, and a measure of school misbehavior for 8th and 10th graders. Exogenous characteristics of student X_i, including race and living in a SMSA as well as an extended set of family characteristics, X_i^p, thought to be pre-determined variables, are included in the specification.[32]

We estimate a different linear probability model by gender for each level of GPA, which carries some advantages and disadvantages. The advantages of using a linear probability model are that we do not have to rely on the assumptions of normality of residuals. By comparison with an ordered probit model, this model allows the educational responses to be different by level of

[31] Educational aspirations and subjective school ability measures are available only for the 12th graders. Clearly, lagged measures would have been preferred.

[32] These family environment characteristics include living in the same household as the father, the mother, and siblings (separate questions), the number of siblings, whether the mother had a paid job while growing up (not at all, some of the time, most of the time, all the time), the level of education (6 levels) of the father and of the mother.

GPA. Given that the detailed decomposition of the gender differentials requires linear educational responses, this estimation procedure gives us coefficients that can readily be used.[33]

3. Data and Descriptive Statistics

The data used are from the "Monitoring the Future" project which has been measuring behaviors, attitudes, and values of American secondary school students for more than thirty-five years. These data have been collected by the Institute for Social Research, University of Michigan mainly to monitor substance abuse every year from 1976 onwards for 12th graders, and from 1991 onwards for students in Grades 8 and 10. Given higher male drop-out rates (Heckman and Lafontaine, 2008), our sample of 12th graders is only 48% to 49% male. Thus our sample is likely comprised of a positively selected sample of boys, likely leading us to understate any gender gap favorable to girls by comparison to a wider sample of boys. It is thus useful to compare high school seniors with high school sophomores and 8th graders, who remain subject to minimum age school leaving laws. Because of the focus on drug use, those who use illicit drugs as seniors are oversampled, we are thus careful to use the sample weights provided to remove any bias resulting from that oversampling. We use the cross-sectional surveys, which comprise 10,000 to 16,000 observations per grade per year for the core questions, resulting in close to half-a-million observations over the entire period.[34] Many more attitudes and behavioral questions are asked of students answering one of 6 modules.[35] We focus here on the core sample because of the larger sample sizes available, which allow us to perform the breakdown by gender and GPA.

Most variables from the MTF are coded categorically. For variables with non-ordinal categories (e.g. type of high school program), we simply use categorical dummies. For ordinal variables that do not have a metric but are available in n categories (e.g. likeness of attending a

[33] By comparison with a multinomial logit, there is no need to compute the marginal effects at the mean of characteristics, which may not correspond to a representative student for some GPA levels. Among the disadvantages is the fact that the predicted probabilities are not bounded between 0 and 1. In practice, we will find some under-predictions (<0), but the predicted probabilities over GPA levels sum to 1.

[34] There exists a practically inaccessible longitudinal component, which surveys a small subset of the students (Bachman et al., 2002).

[35] The surveys contain a host of non-cognitive variables but they are asked only of a subset of students. Acknowledging that some psychologists (e.g. Duckworth and Seligman, 2006; Hicks, Johnson, Iacono and McGue, 2008) have argued that self-control and self-discipline give girls the "edge", and these issues are at the center of the ADHD debate (Elder and Lubotsky, 2009), we attempt to capture a similar notion with the "alcohol binging" variable, which is present in the core sample.

4-year college, subjective school ability), we generally use the following formula to rescale the index from 0 to 1: Category $k = 1 - (n - k + 1)/(n + 1)$, when $k = n$ is highest category to be recoded into 1. This recoding presumes equal distance between the categories. For the decomposition analysis, these variables are further normalized to have a zero mean over the entire sample of boys and girls.

Our dependent variable is the self-reported school grade which is elicited from the following question: "Core 20: Which of the following best describes your average grade so far in high school? D (69 or below), C- (70-72), C (73-76) , C+ (77-79), B- (80-82), B (83-86) , B+ (87-89), A- (90-92), A (93-100)."[36] Obviously, grades from administrative data are preferable to self-reported grades because students with different characteristics may misreport their grades differently.[37] But we find that the self-reported grades from the MTF are very reliable.[38] When we compare the average grades of 12th graders from the MTF to those of the NAEP High School Transcript Surveys (HSTS), we find that the gender differences, as well as the grade inflation, do match within standard errors, even though the scales used are somewhat different.[39] Note that this report finds, as Goldin, Katz, and Kuziemko (2006) also reported, that girls are increasingly taking more challenging math and science courses.

Also note that there are other questions in the MTF survey of seniors asked before this one directed at getting subjective assessments of school ability (Core 16) and intelligence (Core 17) , which would allow students, who are so inclined, to boast about their abilities. The question on subjective school ability asks: "Core 16: Compared with others your age throughout the country how do you rate yourself on school ability? Far below average, below average, slightly below average, average, slightly above average, above average, far above average." On average both genders rate their subjective school ability equally high, but boys rate themselves more favorably on intelligence than girls do.[40] We note that the raw correlation between subjective

[36] Following standard institutional practice, the self-reported grades in the 9 categories are translated in the numbers: A (93-100) 4.0, A- (90-92) 3.7, B+ (87-89) 3.3, B (83-86) 3.0, B- (80-82) 2.7, C+ (77-79) 2.3, C (73-76) 2, C- (70-72), 1.7, D (69 or below) 1, where 2.3 and 2.7 and so on, are the rounded versions of 2.333 and 2.666.
[37] See Balsaa, Giuliano, and French (2011) on grade misreporting by alcohol-binging students.
[38] The wording of the question on self-reported grades in terms of an upward scale is similar to commonly used questions about self-reported income where individuals are asked to declare in which income bracket their income falls and may be less prone to error than simple declarative questions.
[39] The HSTS scale has 5 categories, which include a zero: A(90–100) 4.0, B(80–89) 3.0 , C(70–79) 2.0, D(60–69) 1.0, F (less than 60) 0.0.
[40] The question on intelligence asks on the same six points scale: "Core 17: How intelligent do you think you are compared with others your age?" See Figures A2a and A2b.

school ability and self-reported grades is only 58% among seniors. Following the results of Stinebricker and Stinebricker (2008) who find that college students are generally overconfident about their school ability when they enter college, we will assume that students use their own assessment of school ability when forming educational expectations, and use this measure, where available, to control for school ability.

Table 1 begins by reporting a simple difference-in-difference analysis of the changes over time and by gender in self-reported grades and in expectations about attending graduate or professional school of 12th graders. To facilitate the exposition, we regroup our data into three time periods of 10-12 years, 1976-1988, 1989-1999 and 2000-2009, rather than the four decades. Figure 1, Panel A of Table 1 shows little change over time in the significant female advantage of about 0.2 (on a 4 point scale) in average grades, if anything boys have made small gains (0.010-0.011) in relative grades. Panel B shows that the stability in average grades masks a significant increase in the female advantage in the proportion of students with the highest grades (A (93-100) students), which represents the pool of students who can be confident of being admitted to graduate school if they continue to succeed in their undergraduate studies. Panel C shows an even greater and significant increase of the female advantage in expectations of attending graduate school. Indeed from the 1980s to 1990s, the proportion of women expecting to attend graduate school more than doubled from 10% to 21%, while the proportion of men increased only by half, from 10% to 15%. The fact that the increase in the gender differential in expectations to attend graduate school was more sizeable (5.3 percentage points) from the 1980s to the 1990s, when women' progress in the labor market was sharpest, than from the 1990s to the 2000s (2.6 percentage points) are in line with our conjecture that gender differences in plans for the future fuel gender differences in high academic achievement. Panel D provides additional descriptive evidence showing that the girls' higher educational expectations are driven by career choices that require graduate studies. In the smaller sample of seniors who answered module 4, the proportion of girls thinking that, at age 30, they will work as a professional with a doctoral degree (or equivalent) has grown by 11.5 percentage points from the 1980s to the 1990s, while the equivalent proportion of boys has grown only by 3.3 percentage points .[41] Moreover, when

[41] It is interesting to note that they were no significant increases from the 1990s to the 2000s in those proportions. The questionnaire explicitly lists a few of occupations, lawyer, physician, dentist, scientist, college professor, among those requiring a doctoral degree. Note that the following occupations, engineer, architect, and accountant are listed in the professional occupations without doctoral degree, possibly accounting for gender differences. Appendix Table

asked how likely it is that they will get to do that type of work, 77.3% of girls vs. 71.2% of boys state that it is as least "very likely".[42]

A more complete picture of changes in academic achievement is presented in Figure 4 which displays histograms, corresponding to the actual data, overlaid with a kernel density of the self-reported grades of girls and boys in 12th grade. The figures clearly show a progressive disaffection over the past thirty years with "grading on a curve" with the alternative "competency grading" gaining in importance.[43] In the 1980s, the mode and median of the grades distribution roughly coincided in the B range. By the 2000s, the mode of the girls' grade distribution had moved from B to A, while the mode of the boys' grade distribution stayed at B.[44] This is what we call "leaving boys behind" although the proportion of boys in the A range has increased over time; the gender gap in the proportion of students at the very top of the GPA distribution has increased. Figures 5a and 5b report the same data for 10th and 8th graders for two time periods, 1991-1999 and 2000-2009. Here the girls' advantage appears even more dramatic.

Figure 6 displays the female/male difference in the percentage of seniors in each GPA level for each of the three decades of interest. The lines in the figure show the raw differences for the observations with non-missing information; each corresponding bar previews our decomposition results, which we discuss in section 5 below. In Figure 6, the largest gender gap favorable to girls is in the percentage of students with A's which has increased from 3.7% to 6.0 % from the 1980s to the 2000s. The largest gender gap favorable to boys is in the percent of students with C+'s, which has decreased from 4.4% to 3.2%. Gender gaps for 10th graders and 8th graders are displayed in Figures 7a and 7b, which show an even greater female advantage in top grades.

The means of our core variables for seniors are reported in Table 2 for each of the three time periods of interest.[45] The first 9 rows of the table report the exact numbers behind Figure 4a. The next two rows display the average school grade index and the students' own evaluation of

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A-1 reports the complete answers to the question by gender and time period. It shows a sharp decline in clerical office work as an intended occupation for girls, not matched by as great a decline in craftsman and protective services as intended occupations for boys, over the three decades.

[42] The various choices are "not very likely, somewhat likely, fairly likely, very likely, certain, already doing it".

[43] "Grading on a curve" means grading relatively to classmates, whereas "competency grading" means that if a student's work deserves an A for example, the student should get an A irrespective of the number of classmates getting A's.

[44] Similar gender differences can be found in the administrative grades available in the Add Health data for example.

[45] The statistics are computed on observations with no missing variables. This reduces the sample sizes by comparison with Table 1. Descriptive statistics for 10th and 8th graders are available upon request.

their school ability. It shows that despite having lower grades, boys rate their own school ability higher than girls, although differences are not always statistically significant.[46] This would lend some support to the motto of effective gender-specific teaching: "build the girls up, break the boys down" (Sax, 2007). Similar male overconfidence has been reported among college students by Stinebricker and Stinebricker (2009). They argued that even when boys are admitted to college, because of their overall lower performance, they are less likely to succeed in spite of their overconfidence.[47]

Demographic characteristics are presented next. They show that the sample is composed of 8% black boys versus10-11 % black girls; this largely reflects the differential drop-out rates by gender among Blacks. Among 8th graders, the sample is composed of 11 % black boys vs. 12 % black girls.[48] The subsequent rows tabulate cigarette smoking and alcohol binging (how frequently did one had more than 5 drinks over the last two weeks) recoded into 4 categories. Although smoking has fluctuated somewhat differently by gender over time, boys are still more likely than girls to report these risky behaviors.

As noted above, girls tend to live in families that on the surface might be less likely to foster high academic achievement. For example, although family size has decreased over time, by comparison to boys, girls are raised in larger families.[49] In the 2000s, 37% of girls vs. 33% of boys report living in families with 3 or more children. Similarly, 4% more girls than boys report not living in the same household as their father, 3% more girls than boys report that their mother works all the time and about 3% more boys than girls report than their father or mother has completed college.[50] The proportions of mothers and fathers in the various educational attainment classes provide an additional way to assess the representativeness of the sample and they do in fact correspond to proportions reported elsewhere.

The means of paid work, hours of work and wages, reported next in Table 2, show that the gender gap in paid work participation has closed over time, but boys continue to work longer

[46] Girls in 1976-1988 and boys in 2000-2009 having similar average GPA of 3, but the boys' school ability index of 0.664 is significantly greater than the girls 0.651.
[47] Although grades by topic are not reported in the MTF, numerous studies (especially those using the National Education Longitudinal Study) show that boys continue to maintain an advantage in math test scores (but not in math grades), especially at the high end of the distribution. The boys' overconfidence may be built on these scores.
[48] Descriptive statistics for 10th and 8th graders are available upon request, as well as analyses that focus only on non-Black students.
[49] See Angrist and Evans (1998).
[50] We note that the gender gaps in family characteristics are similar in the sample without Blacks.

hours and get higher pay. About 3% more boys than girls work more that 30 hours a week during school and 7% more boys than girls earn at least $126 per week for that employment.[51] Next, the types of high school programs in which seniors are enrolled inform us about gender differences in the students' educational plans for the future. The numbers show that the gap in favor of girls in the proportion of students enrolled in an academic program has grown; while about 3 % more girls than boys were enrolled in an academic program in the 1980s, that proportion increased to 7% in the 2000s, with 59% of girls vs. 52% of boys enrolled in an academic program. Conversely the gap in favor of girls in the proportion students attending a general high school has reversed. While 31% of girls vs. 30% of boys attended in general high school in the 1980s, in the 2000s, 30% of girls vs. 33% of boys attended a general high school. Among 8th graders, already 4% more girls than boys report being enrolled in a college preparatory program, although a large proportion of students (43% of both boys and girls) are not clear about their type of high school program.

Among 12th graders, two types of questions regarding post-secondary plans are asked. A first question asks about expectations: "Core 21: How likely (definitively won't, probably won't, probably will, definitively will) is it that you will do each of the following things after high school? a) Attend a technical or vocational school, b) Serve in the armed forces, c) graduate from a two-year college, d) graduate from college (four-year program), e) attend graduate or professional school after college?" A second question asks about aspirations: "Core 22: Suppose you could do just what you'd like and nothing stood in your way. How many of the following things would you WANT to do?" with the five options above being supplemented by none of the above. Among 8th and 10th graders, only the expectations questions are asked. Among 12th graders in particular, the expectations question raises issues of endogeneity with respect to GPA. Some students with low GPA may simply be aiming for a two-year college because of their anticipated career choices; others may have low expectations of graduating from a four-year college because of their GPA. The aspirations question attempts to circumvent that problem with the preamble if "nothing stood in your way". Controlling for subjective school ability (Core 16 above) and aspirations (Core 22) is thus central to alleviate concerns of cognitive dissonance. Among 8th and 10th graders, the issue of endogeneity of educational expectations is presumably

[51] The categorical data on hours and pay does not allow us to compute a gender pay gap per se.

less severe as there is more time to adjust one's level of effort. For these students, we control for two retrospective measures of school ability (grade retention and whether school was often hard), as well as school misbehavior.[52]

Interestingly, Table 2 shows that in the 1980s, although seniors of both genders had similar expectations about graduating from college and attending graduate school, girls already had aspirations close to 2% higher than boys. By the 2000s, the gender differences had become sizeable; the expectations index for both college and graduate school was 8% higher for girls than boys.[53] Gender differences in aspirations for college and graduate school are respectively 8% and 11% in favor of girls. Also in line with higher drop out rate among boys, is the fact that 6% of boys vs. 3% of girls have declared no post-secondary aspirations.

4. Reweighted Decomposition Methodology

We follow the literature on gender wage differentials in applying an Oaxaca-Blinder type of decomposition, but we extend the decomposition to the overall distribution of grades and follow the approach of Fortin, Lemieux, and Firpo (2011) to analyze the impact of gender differences in the educational response functions. We now give a short summary of the formulas behind this modified decomposition. With the standard Oaxaca-Blinder decomposition, the researcher seeks to determine what portion of the gender gap in grades is attributable to differences in the characteristics of boys and girls and what portion is attributable to gender differences in the educational responses to these characteristics. Traditionally, this latter portion has been called the "unexplained" part. Here, owing to reweighting we argue that it corresponds to gender differences in the structural function $h_g^c(S_i, A_i, L_i; X_i, X_i^p)$ of equation (1). With the detailed decomposition, we apportion parts of the aggregate decomposition to particular explanatory factors and responses to determine which of these explanatory factors are relatively more important.

[52] More precisely, responses to the grade retention question "Have you ever had to repeat a grade in school?" are available as a binary variable. The responses to the two questions: "Now thinking back over the past year in school, how often did you…find the school work too hard to understand?" "…get sent to the office, or have to stay after school, because you misbehaved?" were coded on a 5 points scale.

[53] Comparing seniors in 1972 from the NLS72, in 1980 from the H&B, in 1992 from the NELS88, and in 2004 from the ELS2002, Ingels and Dalton (2008) also find that in 2004, more girls than boys expected to pursue graduate studies, whereas it was the opposite in 1972.

The classic OB methodology is based on the construction of a counterfactual state of world. Assuming that grades (G) can be modeled as a linear (in the parameters) function of characteristics (X) that is different for girls ($F = 1$) and boys ($F = 0$)

$$\mathbb{E}(G|X, F = 1) = \mathbb{E}(X|F = 1)\beta_1 \text{ and } \mathbb{E}(G|X, F = 0) = \mathbb{E}(X|F = 0)\beta_0,$$

under the zero conditional mean assumption, $\mathbb{E}(\varepsilon|X, F) = 0$. The OB counterfactual, $\mathbb{E}(G^{OB}) = \mathbb{E}(X|F = 1)\beta_0$, asks "What would boys' grades be if they had the same characteristics as girls?" using the coefficients estimated on the sample of boys, thus incorporating different family resources among other things. As shown in Fortin, Lemieux, and Firpo (2011), with reweighting we can construct a counterfactual that more precisely isolate the educational responses. This counterfactual uses the coefficients estimated using the grades outcomes of boys, but the characteristics of the sample of boys reweighted to be like girls.

More precisely, we reweight the sample of boys so that the distribution of their characteristics (X) is similar to that of girls, using the following reweighting function

$$\Psi(X) = [(Prob(X \mid F = 1))/(Prob(X \mid F = 0))]$$
$$= [(Prob(F = 1 \mid X))/(Prob(F = 0 \mid X))] \cdot [Prob(F = 0)/Prob(F = 1)].$$

Then, the counterfactual coefficients β_o^1 are estimated on the sample of boys reweighted to look like girls $\{X_0, \Psi(X_0)\}$. The difference $(\beta_1 - \beta_o^1)$ reflects the true gender gap in educational responses, and the counterfactual means are computed as $\bar{X}_0^1 = \sum\{i : F = 0\} \Psi(X_i) \cdot X_i$. The reweighted decomposition uses the predicted grades, $(X_0|F = 1)\beta_o^1$, from the reweighted sample as counterfactuals,

$$\Delta_{O,R}^{\mu} = \mathbb{E}(X|F = 1)\beta_1 - \mathbb{E}(X_0|F = 1)\beta_o^1 + \mathbb{E}(X_0|F = 1)\beta_o^1 - \mathbb{E}(X|F = 0)\beta_0$$
$$= \Delta_{E,R}^{\mu} + \Delta_{X,R}^{\mu}$$

to obtain an aggregate decomposition as the sum of an educational response effect, $\Delta_{E,R}^{\mu}$, and a composition effect, $\Delta_{X,R}^{\mu}$. Inasmuch as grade dummies can be averaged out, this decomposition relies on the additional assumptions of common support and ignorability ($F \perp \varepsilon|X$), that is, conditioning of observables, unobservables are assumed to be the same across gender.

Each term of the reweighted decomposition can be further broken down into the "pure" effect and a residual term. The composition effect, $\Delta_{X,R}^{\mu}$, is written as the sum of a pure composition effect, $\Delta_{X,p}^{\mu}$, and a specification error, $\Delta_{X,e}^{\mu}$,

$$\Delta^{\mu}_{X,R} = \mathbb{E}(X_0|F=1)\beta^1_o - \mathbb{E}(X|F=0)\beta_0 + \mathbb{E}(X_0|F=1)\beta_0 - \mathbb{E}(X_0|F=1)\beta_0$$
$$= [\mathbb{E}(X_0|F=1) - \mathbb{E}(X|F=0)]\beta_0 + \mathbb{E}(X_0|F=1)(\beta^1_o - \beta_0)$$
$$= \quad \Delta^{\mu}_{X,p} \quad + \quad \Delta^{\mu}_{X,e}.$$

Similarly, the educational response term, $\Delta^{\mu}_{E,R}$, can be written as the sum of a pure response effect $\Delta^{\mu}_{E,p}$ plus a reweighting error $\Delta^{\mu}_{E,p}$,

$$\Delta^{\mu}_{E,R} = \mathbb{E}(X|F=1)\beta_1 - \mathbb{E}(X_0|F=1)]\beta^1_o - \mathbb{E}(X|F=1)\beta^1_o + \mathbb{E}(X|F=1)\beta^1_o$$
$$= \mathbb{E}(X|F=1)(\beta_1 - \beta^1_o) \; + \; [\mathbb{E}(X|F=1) - \mathbb{E}(X_0|F=1)]\beta^1_o$$
$$= \quad \Delta^{\mu}_{E,p} \quad + \quad \Delta^{\mu}_{E,e} \quad .$$

The specification error $\Delta^{\mu}_{X,e} = \mathbb{E}(X_0|F=1)(\beta^1_o - \beta_0)$ corresponds to the difference in the composition effects estimated by reweighting and by using simple regressions, where $\mathbb{E}(X_0|F=1)$ is the mean of the reweighted sample. The reweighting error $\Delta^{\mu}_{E,e} = [\mathbb{E}(X|F=1) - \mathbb{E}(X_0|F=1)]\beta^1_o$ goes to zero in a large sample.

Because of the linearity of these expressions, the detailed decomposition or the apportionment of the composition and educational response effects to each explanatory variable is straightforward. In practice, this detailed reweighted decomposition can be obtained by running two Oaxaca-Blinder decompositions: OB1) use with sample of girls ($F=1$) and the reweighted sample of boys looking like girls to get the pure wage structure effect, OB2) uses with sample of boys ($F=0$) and the reweighted sample of boys looking like girls to get the pure composition effect.

5. Empirical Results

Before going on to the decomposition results, it is useful to show which of our explanatory variables are more significant and how the educational responses differ by gender. As explained earlier, we estimate models corresponding to equation (1) separately by gender, and for the reweighted sample, for each of the nine GPA levels and for each of the three time periods to compute the decomposition results, for each grade level and specification (2 for grade 12 students) for a total of 324 GPA regressions. To conserve space we report the detailed estimated coefficients only for seniors in the 2000s and only for the two GPA levels where the

gender achievement gaps were largest, that is for the A and C+ grades, and only for boys (not reweighted) and girls.[54]

5.1 Determinants of Top and Below Average GPA

Tables 3a and 3b report the estimated coefficients of the explanatory variables listed in Table 2. In Table 3a, the dependent variable is equal to 100 if the student gets an A, and 0 otherwise, so that the coefficients indicate the added probability of getting an A associated with the explanatory variables. In Table 3b, we estimate the covariates of getting exactly a C+. To illustrate the impact of controlling for subjective student ability, we present the estimated coefficients from two specifications. Specification 1 includes educational expectations, assuming that students take their abilities and other limitations into account when formulating their expectations, while Specification 2 explicitly controls for subjective school ability and for educational aspirations formed without possible limitations resulting from ability or other constraints.[55] To the extent that teachers' assessments and study effort stand between one's subjective school ability assessment and one's actual grade, the coefficients of subjective student ability on GPA should be different from 100, and they are. Interestingly, for the A grade, the estimates turn out to be quite different -- 44.5 (s.e. 0.827) for boys and 70.1 (s.e. 0.975) for girls.

As shown in Table 3a and 3b, we find that the explanatory power of expectations is reduced when we control for student ability and student aspirations, yet educational expectations remain among the most significant explanatory variables. Getting an A is very significantly positively associated with wanting and expecting to attend graduate school, especially for boys, and negatively associated with expecting to go to a two-year college. Note that expecting to go to college is so widespread that it has little explanatory power. Conversely, consistent with the threshold model of section 2, the probability of getting a C+ is most strongly positively associated with expecting to go to a two-year college, which dominates expectations of alternative post-secondary schooling choices, especially for boys.[56] Similar effects are found for the type of high school program, much of the impact of the variable is captured by school ability

[54] The other estimated coefficients are available upon request. The coefficients estimated on the reweighted sample are generally close to the ones estimated on the sample of boys.
[55] Estimates from models that exclude expectations altogether are presented in Appendix Table A3.
[56] This interesting new finding would be masked if the dependent variable was getting at least C+. In this case, expecting to go to a four-year college dominates.

going from Specification 1 to Specification 2, although it does remain a significant variable with effects in the 2% to 4% range. The types of high school program, thought to be part of a student's plans for the future, do however show significant differences across genders. Girls are more likely to get an A, and less likely to get a C+ in academic high school programs than boys.

Among the other most significant variables, by comparison with non-Blacks, we find that black boys are 6-8% less likely to get an A and 6% more likely to get a C+, while black girls 9%-10% less likely to get an A and 5% more likely to get a C+. Along the lines of Balsa et al. (2011), alcohol binging is associated with a significantly lower probability of getting an A, about -4%, and a higher probability of getting a C+, about 1-4%. Similar effects are found for smoking variables, in the -3% to -6% range for getting an A and the +2% for a C+. We view these correlations as symptomatic of time impatience or caring less about the future.

Focusing on family background variables, we find that controlling for school ability (going from Specification 1 to 2) substantially reduces the impact of parental education on students' probabilities of getting an A or a C+, although that association remains significant for girls. To the extent that parental education is capturing the family socio-economic status, these results are consistent with past research (e.g., Cameron and Heckman (2001) and Reynolds and Pemberton (2001)), showing that the biggest influence of parental resources on the children's education operates through academic performance. Other important family influences, more impervious to the addition of subjective school ability, are the actual presence of parents in the household. The father not living in the same household and the mother working have significant effects (about -1 to-4%) on the probability of getting an A, and positive effects on the probability of getting a C+ (about 1%-2%). Interestingly the effect of the absent father is somewhat greater for girls, and that of the mother working is somewhat greater for boys. Consistent with Buchmann and DiPrete (2006), we find that these effects have increased from the 1980s to the 2000s.[57]

In comparison to the above regressors, the effects of the variables related to working during school are generally less significant and show some of the non-linear patterns found in the literature. However, there are significant gender differences in the coefficients of the work variables. In Table 3a, the coefficient of "work during school" is negative in the range of -2% to -3% for boys and positive, but not significant for girls. Conversely, in Table 3b, it is positive in

[57] Regression coefficients not shown, but this result will be clear in the Figures below.

the 1% to 2% range for girls and not significant for boys. Thus the effects of changes over time in the gender differentials associated with working during school are likely to be captured in the educational response portion of the decomposition.

5.2 Decomposition results

5.2.1 Overview

To succinctly summarize the decomposition results, we will mostly present them in the form of graphs in order to display the entire GPA distributions. Figures 6a and 6b display the aggregate decomposition for 12th graders, for Specification 1 and 2 respectively. They show how the female/male differences in percentage for each GPA levels, $\Delta_{O,R}^{c}, c = 1, \ldots 9$, can be decomposed into composition effects, $\Delta_{X,R}^{c}$, the portion "explained" by gender differences in characteristics, and educational response effects, $\Delta_{E,R}^{c}$, the portion attributed to the fact that the relationship between characteristics and GPA levels differs by gender. For each of the three time periods, positive bars indicating the excess percentage of girls in a GPA level (negative bars indicating the excess percentage of boys) are divided into two; the bottom darker (blue) portion corresponds to the composition effects and the upper lighter (beige) portion corresponds to the educational response effects. We see that the portions attributable to composition effects have generally increased over the three time periods, especially at the top of the grade distribution. Averaging over all GPA levels, the "explained" part grew from a mere 10% of the total gender differential in the 1980s to 32% in the 1990s and to 37% in the 2000s.

Figures 7a and 7b show the results of the aggregate decomposition for 10th and 8th graders, respectively. The specification of the educational response functions for these younger students includes two proxies for school ability and a school misbehavior index not available for seniors.[58] Owing to these added measures of cognitive and non-cognitive skills, the figures show that an even larger share of the gender differentials is accounted for by gender differences in the explanatory variables, especially at the bottom of the GPA distribution. There are a few

[58] The list of variables available for 10th graders and 8th graders is the following: dummies for race (white/non-white), SMSA, ever held back, smoked cigarettes per day (4), alcohol binging last two weeks (4), sibling not same household, father not same household, mother not same household, mother working (3), father's education (7), mother's education (7), worked during school, average hours of work (6), average earnings (7), type of high school program (4), indexes for school misbehavior last year, school too hard last year, educational expectations (army, vocational, go to college, complete 4 year college). So the main differences with Specification 2 for seniors are the absence of the number of siblings, of the aspirations for post-secondary choices, and the expectations of going to graduate school.

exceptions in the middle of the grade distribution where the gender differentials are quite small: GPA levels C+ (2.7) and B (3) in 2000s for 10th graders; GPA level B(3) for 8th graders. Therefore, for 10th graders, we will present the detailed decomposition results for the A and C grades, where the gender achievement gaps are the largest. Among 10th graders, averaging over all GPA levels, the "explained" part accounts for almost half of the total gender differential: more precisely 54.1% in the 1990s and 31.1% in the 2000s. Among 8th graders, the "explained" part also accounts for a large portion of the total gender differential, more precisely 41.7% in the 1990s and 62.1% in the 2000s.

5.2.2 Tabular Decomposition Results for Selected GPA Levels

We also present a subset of results in a more classic tabular form, which includes standard errors.[59] As in Table 3a and 3b, Table 4a and 4b present the decomposition results for seniors for the two GPA levels where the gender differentials are the largest (A and C+) and for Specifications 1 and 2, but for all three time periods. Table 4a presents the detailed decomposition of the composition effects and Table 4b the detailed decomposition of the educational response effects. Note that the specification errors $\Delta^c_{X,e}$ are reported in Table 4a and the reweighting errors $\Delta^c_{E,e}$ are reported in Table 4b. The specification and reweighting errors are generally found to be at least an order of magnitude smaller than the main effects $\Delta^c_{X,p}$ and $\Delta^c_{E,p}$. Tables 5a and 5b present similar decomposition results for the 10th and 8th grade students.

Going through column 1 of Table 4a shows the increasing female advantage in top grades, as the female/male difference in the percentage of seniors getting A's increases from 3.747 in the 1980s, to 4.711 in the 1990s to 6.063 percentage points in the 2000s.[60] At the same time, the male percentage advantage in the C+ grade decreases from 4.429 in the 1980s, to 3.898 in the 1990s to 3.152 percentage points in the 2000s. Table 5a shows that the female/male difference in the percentage of 10th and 8th students getting A's increases from 3.585 and 5.246, respectively in the 1990s, to 4.740 and 5.957, respectively in the 2000s. The similar decreases in male advantage in mediocre grades for 10th and 8th graders are from 3.110 and 2.383 percentage points in the 1990s to 2.586 and 1.481 percentage points in the 2000s. Thus the changes in

[59] Because of the large number of observations statistical significance is never an issue in the decomposition results, it is the issue of economic significance that is more important.

[60] These numbers are a bit different from the ones reported in Table 1, Panel B, row 3 (3.2, 4.4, and 5.4) because for the analysis, we restrict the sample to those observations for which we have complete data.

gender differentials to be accounted for range from 0.711 to 2.316 percentage points for top grades, and from 0.524 to 1.276 percentage points for mediocre grades.

Because the female/male difference in own school ability is negative, the effects of subjective school ability for seniors, and the two more retrospective measures for 10th and 8th graders, go in the wrong direction: Their coefficients are positive for top grades and negative for mediocre grades. This reduces the part of the gender differentials, negative for top grades and positive for mediocre grades, accounted for by the explanatory variables. For example in Table 4a, going from Specification 1 to Specification 2 see the reduction in "Total Explained".[61] We also note that race, SMSA, and family background variables are other sets of "contrarian" or "swimming upstream" variables, whose effects increase over time: these variables work to the advantage of boys (because there are more black girls, more girls with absent father, etc.,) and reduce the percentage of girls with top grades and of boys with mediocre grades. That is, if girls were as confident as boys about their school ability, if they lived in similar families, if there were as few Black girls living in SMSA as boys, the girls' grades would be even higher. For example, in the 2000s, there would be from 0.641 to 0.928 percent more girls than boys earning A's.

One set of variables has consistent explanatory power (right direction) across all specifications. Table 4a shows that from the 1980s through the 2000s, gender differences in smoking and alcohol binging consistently account for 0.560 to 0.602 points in Specification 1, and robustly from 0.427 to 0.489 in Specification 2 (that is, after controlling for subjective school ability) of the gender gap in getting A's. Smoking and alcohol binging also account for gender differences in getting C+, reliably but declining over time from -0.402 to -0.198 in Specification 1 (from 0.300% to 0.163% in Specification 2). Table 5a shows that smoking, alcohol binging and school misbehavior also account for 0.640 and 0.577 of the gender gap in top grades among 10th graders, and for 1.164 to 1.286 of the gender gap in top grades among 8th graders. For mediocre grades, the numbers are of similar order of magnitude, from -0.537 to -0.358 among 10th graders, and from -0.502 to -0.542 among 8th graders. The fact that the much talked about gender differences in non-cognitive skills account for a substantial share of the "explained" gender differences in academic achievement is reassuring. However, we do not find evidence that the effect of non-cognitive skills is increasing over time, to the contrary their

[61] This effect is similar to the gender differences in educational attainment on the gender pay gap. In recent years, gender differences in education reduce the explained part of the gender pay gap. In the 2000s, the Total Explained corresponds to more 40% of the gender achievement gap in Specification 1, but only 17% in Specification 2.

importance decreases for 12th and 10th graders, so these factors are not helpful in accounting for the changes over time in gender differences in academic achievement.

On the other hand, we find that the portion of gender differentials accounted for by educational expectations increases over time. Indeed, Table 4a shows that, for A grades with Specification 1, gender differences in expectations initially account for 0.211 in the 1980s, building up to 1.132 in the 1990s and to 2.029 percentage points in the 2000s. In Specification 2, expectations account for more than 100% of the gender gap in achievement in the later period. For the C+ grades, the growth over time in the portion of gender differentials account for by gender educational expectations is even greater, from -0.083 initially to -1.192 in the 2000s. Comparing the results from Specification 1 and 2 shows that controlling for subjective school ability reduces the absolute magnitude of the gender differentials accounted for by expectations, but not their magnitude relative to other factors. Accordingly, in Table 5a, where we also account for school ability, we find similar although less dramatic increases in the accounting power of expectations: for the A grades, the "explained" portion grows from 1.040 to 1.260 for 10th graders, and from 1.065 to 1.525 for 8th graders, or in this last case, from 57% to 70% of the "Total Explained." Overall these results convey the same message as the one suggested by Table 1: Even after controlling for a host of other factors, changes in gender differences in educational expectations largely account for the most salient changes in gender differentials in academic achievement.

It is also interesting to consider the contribution of changes in gender differences in educational responses presented in Table 4b, noting that the interpretation of these differences crucially depends on the omitted category in each case. The most persistent factor from the 1980s to 2000s is the type of high school program attended, where the omitted category is "other (not specified) high school." As we saw in previous tables, not only are girls increasingly attending college preparatory high school, but they are benefiting more (in terms of grades) from it than boys. This differential educational response adds to the total effect of "plans for the future" factors in accounting for gender differences in academic achievement.

One factor that has become increasingly important over the decades in accounting for gender differences in educational responses is "work during school," where the omitted

categories are not working, zero hours of work and zero wages.[62] Table 4b shows that over the three decades, working during school seems to have increasingly acted as a complement rather than a distraction for high- achieving girls. Consistent with a non-linear effect of work, the educational responses linked to working during school contributed to the positive gender gap in favor of boys in getting a C+, although the magnitude of this effect is smaller than the previous effect. Similar effects of smaller magnitude are found in Table 5b.

The effects of gender differences in educational responses associated with family background is more difficult to interpret because departures from the omitted category (families with father present, mother present, one sibling, mother not working, both parents with high school education) are a more complex affair and the results are sensitive to which number of siblings is the omitted category (especially in the 1990s).[63] Nevertheless, they indicate that family background generally bolsters the response of high achieving girls by comparison with boys.

5.2.3 Graphical Detailed Decomposition Results for all GPA Levels

Figures 8 and 9 display the results of the detailed decomposition for each GPA level where the effects of all factors have been aggregated into four categories: student attributes (race, SMSA, smoking and binging, school ability and misbehavior where available), family background, working during school, plans for the future (includes type of high school program and educational expectations). Figures 8a and 8b present the results for seniors using Specification 1 and 2, respectively. Figures 9a and 9b present the results for grade 10 and grade 8 students, respectively. As in previous figures, the lines trace the magnitude of the gender gap in academic achievement to be explained across the GPA distribution, and the bars for each GPA levels are divided into two, the darker (blue) one capturing the composition effects and the lighter (beige) the educational response effects. In some instances, either effect can be negative, as explained above. The distance between the height of the bars and the symbol on the line corresponds to the portion of the gender differential accounted for by the other factors presented in the other panels.

[62] Note that working during school is always the factor that has the least economic significance in the composition effects.

[63] Such sensitivity is not surprising given that even using an instrumental variable strategy that exploit exogenous variation in family size, Conley and Glauber (2006) find a strong effect of sibship size on second-born boys' grade retention, but no effect on first-born boys.

The overall message emerging from Figures 8a and 8b is the same as the one we took away from Tables 4a and 4b. The effects of "Plans for the future" displayed in Panel A, are by far the most important explanatory factors contributing to both the composition and educational response effects, generally with the right signs, except for the very low GPA levels. More girls than boys are aiming for professions that require a graduate degree, more girls are getting A's. More boys than girls are aiming for skilled worker jobs and protective service occupations, more boys are getting C+'s.[64] That message is even stronger among 10th graders and 8th graders as shown in Figures 9a and 9b. The composition effects associated with plans for the future are generally accounting for more than 50% of the gender differentials, both at the low and high end of the GPA distribution. For these younger students, plans after high school are arguably further in the future and thus less likely endogenous (in the sense of resulting from cognitive dissonance issues). Youth with lower GPA are less likely to say that they will not go to college because of their lower GPA, given that many believe that there is still time for improvement.

Figures 8a and 8b for seniors show that the other factors of interest contribute to a much smaller extent to the gender differentials in achievement among seniors. Among 10th and 8th graders on the other hand, Figures 9a and 9b show in Panel B that students' attributes are a non-negligible set of factors. Here, they include not only smoking and alcohol binging, but also school misbehavior which accounts for a sizeable share of the gender differentials at the lowest GPA levels.

Panel C displays the effect of family background: It works to the advantage of boys, but girls' response to unfavorable family backgrounds helps them achieve higher grades. The phenomena of high achieving girls "swimming upstream" against unfavorable family environments is found among seniors, is also present among 10th and 8th graders, but the magnitude of the effect is small. Panel D presents the effect of working during school. The boys' response to working during school appears to prevent them from moving from the B range to the A range, while it helps girls getting straight A's, but generally working during school has a negligible effect. Overall, the contribution of these two set of factors is very small.

In summary, the decomposition results show a marked improvement, over the three time periods, in the model's ability to account for gender differences in academic achievement. This finding is essentially due to the increasing explanatory power of gender differences in "plans for

[64] See Table A1.

the future" and applies equally well to grade 12, grade 10, and grade 8 students. Indeed, when the expectation variables are omitted, we can account for relatively little of the gender differences.[65] A startling aspect here comes from the fact that the explanatory power of the educational expectations is as great for 8th graders as it is for 12th graders. To the extent that educational expectations of 8th graders are less likely endogenous with respect to GPA levels than those of seniors, this is welcome news for the validation of the model. Certainly, among 12th graders, Specification 2, which controls for subjective school ability and educational aspirations, grants less explanatory power to the model, but this does not diminish the relative importance of educational expectations, to the contrary. By comparison with the cohorts of students studied in Goldin, Katz, and Kuziemko (2006), the educational expectations of young women has risen even more in the 2000s, and are the most likely explanation for why girls are leaving boys behind in terms of earning top grades in high school. By comparison, boys' disruptive behavior has a sizeable and persistent effect, but it does not grow over time.

6. Conclusion

Using a long-lived series of detailed cross-sectional surveys of high school students, this paper set out to identify which factors among a set of plausible culprits,— plans for the future, non-cognitive traits, family environment, and labor market work during school—, are relatively more important in accounting for the changes over the past three decades in the gender achievement gap, especially at the top of the GPA distribution. The paper proposes a "threshold" model of academic achievement where high school students can optimally choose a GPA level lower than their maximum attainable given their aptitude level, if the lower GPA level is above the threshold necessary to enact their detailed post-secondary plans. By comparison with other studies that simply focus on college-going, we are able to better distinguish the drivers of the academic achievement of boys and girls because of the full range of post-secondary options available in our data, from serving in the army, to attending a vocational, a two-year college, a four-year college and even graduate or professional schools. Indeed, in our models most of the identification of the effect of educational expectations comes from either the two-

[65] Detailed results are available upon request. To give an example, while specification 1 allows us to account for more than a third of the gender differences in A's (2.4 out of 6.07 points) in the 2000s among 12th graders (Table 4a). Without the expectations variables, this is reduced to 0.81 points.

year college or the graduate school options. Wanting to "go to college" is simply a too common aspiration to be informative.

Our findings show that the predominance of girls at the top of the GPA distribution is rooted in their higher educational expectations, themselves linked to career plans that include a graduate degree (such a law or medical degree). More precisely, in the 2000s, "Plans for the Future" is the most important set of explanatory factors accounting for the girls' higher share of A's at the three grade levels (12^{th}, 10^{th}, and 8^{th} graders).This set of factors is important enough to account for all of the increase of 2.3%, from the 1980s to 2000s, in the gender difference in the percentage of students earnings A's. A more minor, but still interesting finding is that high achieving girls are "swimming upstream," since they are more likely from a disadvantaged family environment.

By comparison with girls, more boys think that they are likely to enter military service or to attend a vocational school. Because the career plans of boys include more predominantly male occupations (craftsmen, protective service and military service occupations, engineers and architects) that do not require advanced degrees, their lower share of high grades is consistent with the "threshold" model that we propose. In an era where much emphasis for improving students' achievement is placed on schools and teachers, this paper offers a long term view, which highlights the role of students' motivation and gender differences therein. Clearly, among 8^{th} and 10^{th} graders, the second dominant factor accounting for the lower grades of boys is a measure of the frequency of having been set to the office or to detention over the previous year. This suggests that motivation and misbehavior may go hand-in-hand. We note that there are on-going field experiments such as SDRC's "Future to Discover", whose preliminary results indeed seem to suggest that boys' plans for the future are more moveable than girls.

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Table 1. Difference-and-Differences Estimates in Academic Performance and Plans for the Future - 12th graders

Time period	1976-1988	1988-1999	Change over time (2)-(1)	2000-2009	Change over time (4)-(2)	Change over time (4)-(1)
	(1)	(2)	(3)	(4)	(5)	(6)
A: Average grades						
Girls	**3.004**	**3.106**	0.102	**3.218**	0.112	0.214
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Boys	**2.804**	**2.907**	0.103	**3.030**	0.123	0.225
	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
Difference	0.200	0.199	-0.001	0.189	-0.010	-0.011
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)
B: Proportion with A grade						
Girls	**0.100**	**0.143**	0.043	**0.192**	0.048	0.091
	(0.001)	(0.004)	(0.001)	(0.004)	(0.002)	(0.002)
Boys	**0.069**	**0.099**	0.030	**0.137**	0.038	0.068
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Difference	0.032	0.044	0.012	0.054	0.011	0.023
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
C: Proportion definitely will attend graduate or professional school [a]						
Girls	**0.101**	**0.205**	0.104	**0.249**	0.044	0.147
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Boys	**0.099**	**0.150**	0.051	**0.168**	0.018	0.069
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Difference	0.003	0.055	0.053	0.081	0.026	0.078
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
Number of observations	207,152	160,403		118,173		
D: Proportion think that will work as a professional with doctoral degree (or equiv) when 30 [b]						
Girls	**0.143**	**0.258**	0.115	**0.266**	0.008	0.123
	(0.003)	(0.004)	(0.004)	(0.004)	(0.006)	(0.005)
Boys	**0.136**	**0.169**	0.033	**0.165**	-0.005	0.028
	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Difference	0.006	0.089	0.082	0.101	0.012	0.095
	(0.004)	(0.005)	(0.006)	(0.006)	(0.008)	(0.007)
Number of observations	36,699	23,592		19,168		

Note: Self-reported grades in 9 categories (D, C-,C,C+,B-,B,B+,A-,A) are translated into the numbers 1, 1.7,2,2.3,2.7,3,3.3,3.7 and 4 following standard institutional practice.

[a] The numbers for other post-secondary choices are reported in Table 2.

[b] The numbers for other intented occupations are reported in Table A-1.

Table 2. Means of Select Core Variables by Gender - 12th graders

Core Variables	1976-1988			1989-1999			2000-2009		
	Boys	Girls		Boys	Girls		Boys	Girls	
Self-reported Grades:									
D (69 or below): 1	0.014	0.006	*	0.015	0.006	*	0.014	0.005	*
C- (70-72): 1.7	0.045	0.022	*	0.036	0.018	*	0.031	0.016	*
C (73-76): 2	0.104	0.065	*	0.086	0.053	*	0.065	0.039	*
C+ (77-79): 2.3	0.146	0.101	*	0.126	0.087	*	0.099	0.068	*
B- (80-82): 2.7	0.165	0.133	*	0.149	0.120	*	0.129	0.103	*
B (83-86): 3	0.203	0.218	*	0.202	0.200		0.187	0.169	
B+ (87-89): 3.3	0.154	0.201	*	0.160	0.197	*	0.175	0.190	*
A- (90-92): 3.7	0.093	0.140	*	0.119	0.165	*	0.154	0.203	*
A (93-100): 4	0.076	0.113	*	0.108	0.155	*	0.147	0.207	*
School Grade Index	2.845	3.055	*	2.944	3.144	*	3.067	3.258	*
Subjective School Ability Index (scaled between 0 and 1)	0.652	0.651		0.658	0.654		0.664	0.658	*
Race: Black	0.083	0.097	*	0.085	0.105	*	0.084	0.107	*
Live in MSA	0.683	0.683		0.731	0.738	*	0.755	0.759	
Smoked cigarettes per day: None	0.715	0.673	*	0.678	0.694	*	0.749	0.774	*
Less than one-half pack	0.212	0.260	*	0.258	0.260		0.217	0.201	*
One to 1½ pack	0.070	0.064	*	0.060	0.044	*	0.030	0.023	*
Two packs or more	0.003	0.002	*	0.005	0.002	*	0.004	0.002	*
Alcohol binging last 2 weeks: None	0.534	0.713	*	0.635	0.775	*	0.686	0.780	*
Once	0.129	0.111	*	0.109	0.092	*	0.100	0.094	*
Two to nine times	0.307	0.167	*	0.231	0.127	*	0.197	0.121	*
Ten or more times	0.030	0.008	*	0.025	0.006	*	0.017	0.006	*
Siblings not same household	0.243	0.235	*	0.326	0.312	*	0.329	0.311	*
Siblings: None	0.046	0.042		0.056	0.051	*	0.060	0.052	
One	0.268	0.256	*	0.326	0.311	*	0.323	0.300	*
Two	0.262	0.254		0.271	0.270		0.282	0.272	*
Three or more	0.424	0.449	*	0.344	0.365	*	0.332	0.374	*
Father not same household	0.169	0.185	*	0.201	0.228	*	0.207	0.244	*
Mother not same household	0.075	0.066	*	0.098	0.084	*	0.096	0.089	*
Mom working: No	0.312	0.299	*	0.198	0.184	*	0.146	0.140	*
Some of the time	0.312	0.302	*	0.254	0.242	*	0.206	0.196	*
Most of the time	0.175	0.164	*	0.195	0.176	*	0.185	0.170	*
All the time	0.201	0.234	*	0.353	0.398	*	0.462	0.495	*
Father education: less than primary	0.062	0.076	*	0.034	0.046	*	0.031	0.041	*
Some high school	0.145	0.154	*	0.101	0.110	*	0.098	0.108	*
Completed high school	0.320	0.320		0.285	0.298	*	0.288	0.304	*
Some college	0.156	0.153		0.195	0.191		0.182	0.180	
Completed College	0.190	0.176	*	0.230	0.214	*	0.253	0.225	*
Graduate or professional	0.127	0.121	*	0.155	0.141	*	0.147	0.142	

Note: Asterisk indicates statistically significant gender difference at the 5% level.

(continued next page)

Table 2. Means of Select Core Variables by Gender - 12th graders (continued)

Core Variables	1976-1988			1989-1999			2000-2009		
	Boys	Girls		Boys	Girls		Boys	Girls	
Mother education: less than primary	0.032	0.042	*	0.027	0.035	*	0.027	0.034	*
Some high school	0.126	0.149	*	0.082	0.101	*	0.071	0.082	*
Completed high school	0.441	0.416	*	0.339	0.333		0.277	0.280	
Some college	0.166	0.175	*	0.210	0.215		0.210	0.222	
Completed College	0.164	0.146	*	0.234	0.211	*	0.290	0.257	*
Graduate or professional	0.071	0.072		0.108	0.104		0.125	0.124	
Works over school year	0.848	0.798	*	0.801	0.792	*	0.755	0.756	
Average hours of work: None	0.177	0.222	*	0.223	0.223		0.271	0.260	*
5 or less hours	0.101	0.101		0.097	0.095		0.097	0.096	
6 to 10 hours	0.099	0.103		0.095	0.107		0.097	0.107	*
11 to 20 hours	0.262	0.300	*	0.260	0.303	*	0.252	0.281	*
21 to 30 hours	0.234	0.203	*	0.220	0.205	*	0.194	0.191	
More than 30 hours	0.128	0.071	*	0.104	0.067	*	0.090	0.065	*
Average earnings per week from job:									
None	0.227	0.281	*	0.269	0.283	*	0.311	0.314	
$1-5	0.037	0.046		0.018	0.022		0.010	0.010	
$6-10	0.040	0.045		0.025	0.028		0.036	0.044	*
$11-50	0.289	0.326	*	0.176	0.215	*	0.114	0.140	*
$51-75	0.253	0.200	*	0.128	0.151	*	0.086	0.106	*
$76-125	0.106	0.080	*	0.222	0.209	*	0.197	0.213	*
$126+	0.047	0.022	*	0.162	0.092	*	0.246	0.174	*
High school program: Academic	0.487	0.514	*	0.550	0.611	*	0.518	0.589	*
General	0.300	0.307	*	0.283	0.272	*	0.328	0.298	*
Vocational	0.155	0.120	*	0.107	0.068	*	0.081	0.049	*
Other	0.059	0.060		0.059	0.049	*	0.073	0.065	*
Education Expectations: index of likeness to attend (scaled between 0 and 1)									
Army	0.281	0.102	*	0.215	0.078	*	0.202	0.079	*
Vocational	0.319	0.264	*	0.268	0.210	*	0.274	0.208	*
Two-year college	0.338	0.364	*	0.362	0.370	*	0.383	0.386	
Four-year college	0.584	0.585		0.702	0.758	*	0.737	0.816	*
Graduate or professional	0.389	0.385	*	0.471	0.530	*	0.490	0.571	*
Education Aspirations: want to attend (binary dummy)									
Army	0.203	0.092	*	0.177	0.079	*	0.179	0.078	*
Vocational	0.284	0.219	*	0.207	0.141	*	0.203	0.124	*
Two-year college	0.206	0.293	*	0.214	0.256	*	0.240	0.266	*
Four-year college	0.635	0.650	*	0.744	0.810	*	0.773	0.850	*
Graduate or professional	0.416	0.432	*	0.529	0.613	*	0.519	0.625	*
Number of observations	74230	79942		60469	66875		50549	57202	

Note: Asterisk indicates statistically significant gender difference at the 5% level.

Table 3a. Coefficients of LPM on Specific Grades - 12th graders - 2000-2009

Dependent variable: A (93-100)	Specification 1				Specification 2			
Explanatory Variables	Boys		Girls		Boys		Girls	
Race: Black	-7.534	(-13.06)	-10.330	(-18.51)	-5.828	(-10.37)	-8.729	(-16.35)
SMSA	-5.404	(-14.96)	-8.525	(-22.02)	-5.270	(-15.02)	-8.227	(-22.23)
Subjective School Ability					44.457	(53.75)	70.881	(72.68)
Smoked cigarettes per day: None (base)								
Less than one-half pack	-4.928	(-12.39)	-7.789	(-17.68)	-3.635	(-9.39)	-6.107	(-14.48)
One to 1½ pack	-3.911	(-4.23)	-7.383	(-6.64)	-2.513	(-2.79)	-5.382	(-5.06)
Two packs or more	13.153	(5.27)	-1.031	(-0.25)	14.792	(6.09)	2.882	(0.74)
Alcohol binging last 2 weeks: None (base)								
Once	-4.087	(-7.92)	-4.502	(-7.94)	-3.991	(-7.96)	-3.864	(-7.13)
Two to nine times	-4.984	(-12.01)	-5.247	(-9.81)	-4.664	(-11.57)	-4.007	(-7.83)
Ten or more times	-4.409	(-3.68)	-6.093	(-2.77)	-3.398	(-2.92)	-3.150	(-1.50)
Siblings not same household	0.078	(0.21)	0.243	(0.62)	0.382	(1.08)	0.295	(0.78)
Siblings: One (base)								
None	1.491	(2.10)	-1.119	(-1.38)	1.166	(1.69)	-1.847	(-2.39)
Two	-0.796	(-2.04)	-1.107	(-2.59)	-0.624	(-1.65)	-0.914	(-2.24)
Three or more	-1.615	(-4.17)	-1.797	(-4.36)	-1.493	(-3.96)	-1.476	(-3.75)
Don't know	-0.909	(-0.32)	-8.712	(-2.53)	1.816	(0.65)	-5.119	(-1.55)
Father not same household	-1.228	(-3.07)	-2.319	(-5.69)	-0.870	(-2.24)	-1.895	(-4.87)
Mother not same household	0.169	(0.31)	-1.853	(-3.05)	0.620	(1.16)	-1.460	(-2.51)
Mom working: No (base)								
Some of the time	-3.779	(-7.32)	-2.718	(-4.81)	-3.433	(-6.84)	-2.360	(-4.37)
Most of the time	-4.192	(-7.87)	-4.730	(-8.07)	-3.593	(-6.94)	-3.742	(-6.68)
All the time	-3.855	(-8.26)	-4.764	(-9.46)	-3.513	(-7.75)	-3.844	(-7.98)
Father education: less than primar	0.170	(0.16)	-2.468	(-2.52)	1.407	(1.36)	-0.826	(-0.88)
Some high school	-1.731	(-2.98)	-1.728	(-2.92)	-1.265	(-2.24)	-0.959	(-1.69)
Completed high school (base)								
Some college	0.358	(0.78)	0.581	(1.19)	0.003	(0.01)	-0.201	(-0.43)
Completed College	0.910	(2.04)	2.883	(6.00)	0.133	(0.31)	1.708	(3.72)
Graduate or professional	2.635	(4.66)	2.917	(4.88)	1.074	(1.95)	0.408	(0.71)
Mother education: less than prima	-1.717	(-1.50)	-3.926	(-3.63)	-0.144	(-0.13)	-2.827	(-2.73)
Some high school	-2.298	(-3.45)	-2.685	(-4.02)	-1.876	(-2.90)	-2.068	(-3.24)
Completed high school (base)								
Some college	-1.215	(-2.73)	0.310	(0.67)	-1.480	(-3.42)	-0.169	(-0.38)
Completed College	1.420	(3.30)	2.945	(6.27)	0.662	(1.58)	1.445	(3.22)
Graduate or professional	0.789	(1.34)	1.973	(3.16)	-0.178	(-0.31)	0.408	(0.68)

Note: Dependent variables is set to 100 if the student has a GPA of 4, and to 0 otherwise. T-statistics are in parentheses.

(continued next page)

Table 3a. Coefficients of LPM on Specific Grades - 12th graders - 2000-2009 (continued)

Dependent variable: A (93-100)	Specification 1				Specification 2			
Explanatory Variables	Boys		Girls		Boys		Girls	
Works over school year	-3.092	(-2.55)	0.325	(0.22)	-2.206	(-1.87)	2.141	(1.50)
Average hours of work: None								
5 or less hours	4.386	(3.96)	5.993	(4.26)	2.817	(2.62)	3.205	(2.39)
6 to 10 hours	1.529	(1.39)	2.543	(1.84)	0.687	(0.64)	0.744	(0.56)
11 to 20 hours	-0.607	(-0.58)	0.227	(0.17)	-1.310	(-1.29)	-0.955	(-0.74)
21 to 30 hours	-0.279	(-0.26)	-0.261	(-0.19)	-0.758	(-0.73)	-1.564	(-1.19)
More than 30 hours	2.062	(1.82)	-0.511	(-0.35)	1.061	(0.97)	-1.793	(-1.28)
Average earnings per week from job: None								
$1-5	4.664	(2.82)	3.866	(2.20)	5.648	(3.52)	3.473	(2.07)
$6-10	2.625	(2.60)	-2.200	(-2.20)	3.175	(3.23)	-1.550	(-1.62)
$11-50	2.002	(2.67)	0.192	(0.25)	1.724	(2.37)	-0.249	(-0.34)
$51-75	1.681	(2.04)	-1.556	(-1.86)	1.057	(1.32)	-2.085	(-2.60)
$76-125	0.242	(0.32)	-2.103	(-2.69)	-0.054	(-0.07)	-2.744	(-3.67)
$126+	-0.238	(-0.32)	-2.172	(-2.65)	-0.743	(-1.02)	-2.915	(-3.72)
High school program: Academic	5.905	(9.39)	9.090	(12.99)	1.287	(2.08)	2.010	(2.97)
General	-1.433	(-2.30)	-0.288	(-0.41)	-2.827	(-4.65)	-1.885	(-2.78)
Vocational	2.468	(3.12)	4.776	(4.87)	-0.251	(-0.33)	1.334	(1.42)
Other (base)								
Education Aspirations: want to attend (binary dummy)								
Army					-2.522	(-5.06)	-2.214	(-3.11)
Vocational					-0.138	(-0.29)	1.152	(1.89)
Two-year college					0.235	(0.54)	-0.198	(-0.42)
Four-year college					-1.739	(-3.98)	-1.321	(-2.50)
Graduate or professional					1.644	(4.34)	2.071	(5.04)
Educational Expectations: index of likeness to attend								
Army	-2.328	(-4.47)	-0.132	(-0.16)	0.310	(0.47)	2.342	(2.40)
Vocational	-3.945	(-7.18)	-3.929	(-6.52)	-3.522	(-5.62)	-3.938	(-5.67)
Two-year college	-9.946	(-21.99)	-11.409	(-24.47)	-7.536	(-14.45)	-7.042	(-12.68)
Four-year college	3.672	(6.07)	4.384	(6.40)	0.150	(0.23)	0.572	(0.77)
Graduate or professional	13.711	(24.63)	10.543	(18.49)	8.660	(14.07)	4.102	(6.43)
Constant	25.242	(28.44)	28.758	(29.58)	-1.310	(-1.25)	-13.363	(-11.36)
R-squared	0.116		0.126		0.166		0.202	
Number of observations	49328		56156		49328		56156	

Note: Dependent variables is set to 100 if the student has a GPA of 4, and to 0 otherwise. T-statistics are in parentheses.

Table 3b. Coefficients of LPM (100%) on Specific Grades - 12th graders - 2000-2009

Dependent variable: C+(77-79)	Specification 1				Specification 2			
Explanatory Variables	Boys		Girls		Boys		Girls	
Race: Black	6.870	(13.71)	5.158	(14.46)	6.020	(12.08)	4.699	(13.28)
SMSA	2.864	(9.13)	2.512	(10.15)	2.792	(8.97)	2.454	(10.00)
Subjective School Ability					-20.698	(-28.22)	-20.586	(-31.84)
Smoked cigarettes per day: None (base)								
Less than one-half pack	1.865	(5.40)	2.941	(10.44)	1.275	(3.71)	2.431	(8.69)
One to 1½ pack	2.579	(3.21)	2.612	(3.67)	1.949	(2.44)	1.992	(2.82)
Two packs or more	-0.091	(-0.04)	-0.064	(-0.02)	-0.840	(-0.39)	-1.334	(-0.52)
Alcohol binging last 2 weeks: None (base)								
Once	0.752	(1.68)	0.703	(1.94)	0.698	(1.57)	0.525	(1.46)
Two to nine times	1.533	(4.26)	1.709	(5.00)	1.373	(3.84)	1.362	(4.02)
Ten or more times	1.828	(1.75)	4.423	(3.14)	1.381	(1.34)	3.540	(2.54)
Siblings not same household	0.019	(0.06)	-0.294	(-1.17)	-0.118	(-0.38)	-0.318	(-1.27)
Siblings: One (base)								
None	-0.701	(-1.14)	0.175	(0.34)	-0.556	(-0.91)	0.372	(0.73)
Two	0.308	(0.91)	0.349	(1.28)	0.222	(0.66)	0.306	(1.13)
Three or more	0.497	(1.48)	0.440	(1.67)	0.443	(1.33)	0.350	(1.34)
Don't know	1.196	(0.48)	-0.202	(-0.09)	-0.051	(-0.02)	-1.239	(-0.57)
Father not same household	1.044	(3.00)	1.728	(6.64)	0.870	(2.52)	1.587	(6.15)
Mother not same household	0.579	(1.21)	-0.051	(-0.13)	0.392	(0.83)	-0.175	(-0.45)
Mom working: No (base)								
Some of the time	0.068	(0.15)	0.841	(2.33)	-0.095	(-0.21)	0.750	(2.10)
Most of the time	1.148	(2.48)	1.641	(4.38)	0.861	(1.87)	1.373	(3.70)
All the time	1.542	(3.81)	1.509	(4.69)	1.380	(3.43)	1.269	(3.97)
Father education: less than primar	1.164	(1.26)	1.444	(2.31)	0.616	(0.67)	0.945	(1.52)
Some high school	0.826	(1.64)	2.117	(5.59)	0.624	(1.25)	1.876	(5.00)
Completed high school (base)								
Some college	0.153	(0.38)	-0.223	(-0.71)	0.311	(0.78)	0.015	(0.05)
Completed College	-0.302	(-0.78)	-0.222	(-0.72)	0.062	(0.16)	0.123	(0.40)
Graduate or professional	-0.444	(-0.90)	-0.382	(-1.00)	0.296	(0.61)	0.331	(0.87)
Mother education: less than prima	-0.387	(-0.39)	0.172	(0.25)	-1.139	(-1.16)	-0.191	(-0.28)
Some high school	1.500	(2.59)	0.712	(1.67)	1.290	(2.25)	0.547	(1.29)
Completed high school (base)								
Some college	-0.717	(-1.86)	-0.675	(-2.27)	-0.593	(-1.55)	-0.529	(-1.79)
Completed College	-0.977	(-2.61)	-1.504	(-5.01)	-0.631	(-1.70)	-1.073	(-3.60)
Graduate or professional	-1.299	(-2.55)	-1.062	(-2.66)	-0.852	(-1.69)	-0.620	(-1.57)

Note: Dependent variables is set to 100 if the student has a GPA of 2.3, and to 0 otherwise. T-statistics are in parentheses.

(continued next page)

Table 3b. Coefficients of LPM on Specific Grades - 12th graders - 2000-2009 (continued)

Dependent variable: C+(77-79)	Specification 1				Specification 2			
Explanatory Variables	Boys		Girls		Boys		Girls	
Works over school year	0.996	(0.95)	2.283	(2.40)	0.601	(0.58)	1.713	(1.82)
Average hours of work: None								
5 or less hours	-2.086	(-2.17)	-3.144	(-3.50)	-1.362	(-1.43)	-2.317	(-2.60)
6 to 10 hours	-2.198	(-2.31)	-3.021	(-3.41)	-1.796	(-1.90)	-2.481	(-2.82)
11 to 20 hours	-1.714	(-1.89)	-2.463	(-2.87)	-1.383	(-1.53)	-2.084	(-2.45)
21 to 30 hours	-1.678	(-1.81)	-2.115	(-2.42)	-1.437	(-1.56)	-1.700	(-1.96)
More than 30 hours	-0.746	(-0.76)	-2.652	(-2.83)	-0.263	(-0.27)	-2.229	(-2.40)
Average earnings per week from job: None								
$1-5	1.578	(1.10)	-0.816	(-0.73)	1.111	(0.78)	-0.637	(-0.57)
$6-10	-0.270	(-0.31)	-0.211	(-0.33)	-0.507	(-0.58)	-0.404	(-0.64)
$11-50	-0.367	(-0.56)	-0.483	(-1.00)	-0.244	(-0.38)	-0.343	(-0.71)
$51-75	0.031	(0.04)	-0.546	(-1.02)	0.288	(0.41)	-0.392	(-0.74)
$76-125	-0.350	(-0.54)	-0.605	(-1.21)	-0.225	(-0.35)	-0.407	(-0.82)
$126+	-0.406	(-0.62)	-0.205	(-0.39)	-0.159	(-0.25)	-0.002	(0.00)
High school program: Academic	-4.472	(-8.19)	-5.978	(-13.36)	-2.344	(-4.28)	-3.900	(-8.69)
General	-0.181	(-0.33)	-1.912	(-4.21)	0.450	(0.83)	-1.421	(-3.16)
Vocational	-1.720	(-2.50)	-1.507	(-2.41)	-0.456	(-0.67)	-0.635	(-1.02)
Other (base)								
Education Aspirations: want to attend (binary dummy)								
Army					-0.290	(-0.66)	0.287	(0.61)
Vocational					0.241	(0.56)	0.733	(1.81)
Two-year college					-0.285	(-0.75)	0.488	(1.56)
Four-year college					1.298	(3.35)	-0.761	(-2.17)
Graduate or professional					-0.773	(-2.30)	-0.147	(-0.54)
Educational Expectations: index of likeness to attend								
Army	2.328	(5.15)	0.469	(0.89)	2.296	(3.96)	0.134	(0.21)
Vocational	0.473	(0.99)	0.876	(2.27)	0.125	(0.23)	0.175	(0.38)
Two-year college	5.951	(15.15)	3.446	(11.57)	4.884	(10.56)	1.995	(5.42)
Four-year college	-5.343	(-10.17)	-3.373	(-7.70)	-4.019	(-6.92)	-1.387	(-2.82)
Graduate or professional	-5.101	(-10.55)	-3.123	(-8.57)	-2.762	(-5.06)	-1.606	(-3.80)
Constant	7.884	(10.23)	6.896	(11.10)	20.066	(21.54)	19.544	(25.05)
R-squared	0.051		0.051		0.066		0.069	
Number of observations	49328		56156		49328		56156	

Note: Dependent variables is set to 100 if the student has a GPA of 2.3, and to 0 otherwise. T-statistics are in parentheses.

Table 4a. Detailed Decomposition Results - Composition Effects
Percentage Female/Male Difference for Selected GPA Levels

12th graders	Specification 1				Specification 2			
A: 1976-1988	A (93-100): 4		C+ (77-79): 2.3		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	3.747	(0.005)	-4.429	(0.007)	3.747	(0.005)	-4.429	(0.007)
Total Explained	0.787	(0.003)	-0.321	(0.004)	0.549	(0.003)	-0.097	(0.004)
Race, SMSA	-0.151	(0.000)	0.234	(0.001)	-0.095	(0.000)	0.190	(0.001)
Own School Ability					-0.081	(0.001)	0.068	(0.001)
Smoking, Binging	0.602	(0.001)	-0.402	(0.002)	0.479	(0.001)	-0.300	(0.002)
Family Background	-0.083	(0.001)	0.004	(0.001)	-0.032	(0.001)	-0.033	(0.001)
Work	0.143	(0.001)	0.024	(0.001)	0.149	(0.001)	0.025	(0.001)
High school program	0.065	(0.001)	-0.098	(0.001)	0.006	(0.000)	-0.044	(0.001)
Educ. Expectations	0.211	(0.002)	-0.083	(0.003)	0.123	(0.002)	-0.004	(0.003)
Specification Error	0.001	(0.005)	0.152	(0.007)	-0.011	(0.005)	0.172	(0.007)
B: 1989-1999	A (93-100): 4		C+ (77-79): 2.3		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	4.711	(0.006)	-3.898	(0.005)	4.711	(0.006)	-3.898	(0.005)
Total Explained	1.499	(0.003)	-0.713	(0.003)	0.517	(0.003)	-0.103	(0.003)
Race, SMSA	-0.258	(0.001)	0.284	(0.001)	-0.212	(0.001)	0.257	(0.001)
Own School Ability					-0.355	(0.002)	0.209	(0.001)
Smoking, Binging	0.560	(0.001)	-0.246	(0.001)	0.427	(0.001)	-0.167	(0.001)
Family Background	-0.145	(0.001)	0.062	(0.001)	-0.058	(0.001)	0.013	(0.001)
Work	-0.010	(0.001)	0.002	(0.001)	0.019	(0.001)	-0.016	(0.001)
High school program	0.220	(0.001)	-0.237	(0.001)	0.031	(0.001)	-0.121	(0.001)
Educ. Expectations	1.132	(0.002)	-0.579	(0.002)	0.665	(0.002)	-0.279	(0.002)
Specification Error	0.114	(0.006)	-0.085	(0.007)	0.030	(0.006)	0.021	(0.006)
C: 2000-2009	A (93-100): 4		C+ (77-79): 2.3		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	6.063	(0.007)	-3.152	(0.005)	6.063	(0.007)	-3.152	(0.005)
Total Explained	2.395	(0.004)	-1.224	(0.003)	1.034	(0.004)	-0.590	(0.003)
Race, SMSA	-0.293	(0.001)	0.254	(0.001)	-0.232	(0.001)	0.224	(0.001)
Own School Ability					-0.463	(0.002)	0.215	(0.001)
Smoking, Binging	0.562	(0.001)	-0.198	(0.001)	0.489	(0.001)	-0.163	(0.001)
Family Background	-0.348	(0.001)	0.194	(0.001)	-0.233	(0.001)	0.143	(0.001)
Work	0.060	(0.001)	-0.026	(0.001)	0.079	(0.001)	-0.038	(0.001)
High school program	0.385	(0.001)	-0.257	(0.001)	0.185	(0.001)	-0.163	(0.001)
Educ. Expectations	2.029	(0.003)	-1.192	(0.003)	1.207	(0.003)	-0.809	(0.003)
Specification Error	-0.005	(0.008)	0.102	(0.006)	-0.048	(0.007)	0.112	(0.006)

Note: Standard errors are in parentheses. Reweighted decomposition follows methodology of section 4. In specification 2, educational aspirations are included among the variables in the educational expectations category.

Table 4b. Detailed Decomposition Results - Educational Response Effects
Percentage Female/Male Difference for Selected GPA Levels

12th graders	Specification 1				Specification 2			
A: 1976-1988	A (93-100): 4		C+ (77-79): 2.3		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	3.747	(0.005)	-4.429	(0.007)	3.747	(0.005)	-4.429	(0.007)
Total Unexplained	3.099	(0.005)	-4.294	(0.005)	3.200	(0.004)	-4.435	(0.005)
Race, SMSA	-1.243	(0.007)	0.222	(0.008)	-1.290	(0.013)	0.064	(0.008)
Own School Ability					0.493	(0.001)	0.002	(0.000)
Smoking, Binging	-0.701	(0.004)	0.166	(0.004)	-0.240	(0.005)	0.106	(0.004)
Family Background	1.119	(0.018)	-1.830	(0.021)	1.196	(0.026)	-1.549	(0.021)
Work	0.412	(0.009)	0.766	(0.011)	1.569	(0.012)	0.899	(0.010)
High school program	1.700	(0.019)	-1.618	(0.021)	1.381	(0.027)	-1.758	(0.021)
Educ. Expectations	0.006	(0.002)	-0.179	(0.002)	0.796	(0.022)	0.660	(0.012)
Constant	1.807	(0.029)	-1.821	(0.033)	1.501	(0.046)	-2.859	(0.035)
Reweighting Error	-0.139	(0.001)	0.034	(0.001)	-0.009	(0.002)	-0.068	(0.001)
B: 1989-1999	A (93-100): 4		C+ (77-79): 2.3		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	4.711	(0.006)	-3.898	(0.005)	4.711	(0.006)	-3.898	(0.005)
Total Unexplained	3.035	(0.006)	-3.204	(0.005)	3.885	(0.005)	-3.627	(0.005)
Race, SMSA	-1.772	(0.010)	-0.419	(0.009)	-2.250	(0.010)	-0.342	(0.009)
Own School Ability					-0.046	(0.000)	0.008	(0.000)
Smoking, Binging	-0.582	(0.004)	-0.020	(0.004)	-0.378	(0.004)	-0.123	(0.004)
Family Background	-0.493	(0.019)	-0.996	(0.018)	-0.470	(0.018)	-0.937	(0.018)
Work	0.998	(0.011)	0.081	(0.010)	0.583	(0.011)	0.195	(0.010)
High school program	1.001	(0.026)	-2.365	(0.024)	0.862	(0.025)	-2.819	(0.024)
Educ. Expectations	0.036	(0.002)	-0.247	(0.002)	0.887	(0.016)	-0.080	(0.015)
Constant	3.845	(0.036)	0.762	(0.033)	4.695	(0.037)	0.471	(0.036)
Reweighting Error	0.062	(0.002)	-0.057	(0.001)	0.279	(0.002)	-0.189	(0.001)
C: 2000-2009	A (93-100): 4		C+ (77-79): 2.3		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	6.063	(0.007)	-3.152	(0.005)	6.063	(0.007)	-3.152	(0.005)
Total Unexplained	3.593	(0.007)	-1.933	(0.005)	4.802	(0.007)	-2.489	(0.005)
Race, SMSA	-1.414	(0.013)	-0.493	(0.009)	-1.509	(0.013)	-0.507	(0.009)
Own School Ability					-0.089	(0.001)	0.005	(0.000)
Smoking, Binging	-0.467	(0.005)	0.335	(0.003)	-0.333	(0.005)	0.320	(0.003)
Family Background	1.591	(0.027)	0.313	(0.019)	1.086	(0.025)	0.706	(0.019)
Work	1.590	(0.013)	0.303	(0.009)	1.616	(0.012)	0.087	(0.009)
High school program	2.646	(0.028)	-0.905	(0.020)	1.406	(0.027)	-1.503	(0.020)
Educ. Expectations	-0.117	(0.002)	0.153	(0.002)	1.081	(0.021)	-1.331	(0.016)
Constant	-0.236	(0.043)	-1.639	(0.030)	1.542	(0.045)	-0.267	(0.034)
Reweighting Error	0.080	(0.003)	-0.097	(0.001)	0.276	(0.003)	-0.185	(0.001)

Note: Standard errors are in parentheses. Reweighted decomposition follows methodology of section 4. In specification 2, educational aspirations are included among the variables in the educational expectations category.

Table 5a. Detailed Decomposition Results - Composition Effects
Percentage Female/Male Difference for Selected GPA Levels

	10th graders				8th graders			
A: 1991-1999	A (93-100): 4		C (73-76): 2		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	3.585	(0.006)	-3.110	(0.005)	5.246	(0.006)	-2.383	(0.005)
Total Explained	1.328	(0.003)	1.574	(0.003)	1.872	(0.004)	-0.800	(0.003)
Race, SMSA	-0.183	(0.001)	0.087	(0.001)	-0.196	(0.001)	0.132	(0.001)
School Hard, Held back	-0.454	(0.001)	0.108	(0.001)	-0.322	(0.001)	0.059	(0.001)
Misbehavior, Smoking	0.640	(0.002)	-0.537	(0.002)	1.164	(0.002)	-0.502	(0.002)
Family Background	-0.140	(0.001)	0.106	(0.001)	-0.177	(0.001)	0.150	(0.001)
Work	0.083	(0.001)	0.128	(0.001)	-0.016	(0.001)	-0.070	(0.001)
High school program	0.343	(0.001)	-0.254	(0.001)	0.354	(0.001)	-0.124	(0.001)
Educ. Expectations	1.040	(0.002)	-1.212	(0.002)	1.065	(0.002)	-0.445	(0.002)
Specification Error	0.004	(0.006)	-0.242	(0.006)	0.165	(0.007)	-0.258	(0.006)
B: 2000-2009	A (93-100): 4		C (73-76): 2		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	4.740	(0.006)	-2.586	(0.005)	5.957	(0.007)	-1.481	(0.005)
Total Explained	1.348	(0.004)	-1.424	(0.003)	2.207	(0.004)	-0.864	(0.003)
Race, SMSA	-0.138	(0.001)	0.042	(0.000)	-0.158	(0.001)	0.133	(0.000)
School Hard, Held back	-0.654	(0.001)	0.146	(0.001)	-0.632	(0.001)	0.096	(0.001)
Misbehavior, Smoking	0.577	(0.001)	-0.358	(0.001)	1.286	(0.002)	-0.542	(0.002)
Family Background	-0.230	(0.001)	0.148	(0.001)	-0.308	(0.001)	0.180	(0.001)
Work	0.006	(0.001)	0.038	(0.001)	-0.024	(0.001)	-0.059	(0.001)
High school program	0.527	(0.001)	-0.224	(0.001)	0.518	(0.001)	-0.138	(0.001)
Educ. Expectations	1.260	(0.002)	-1.215	(0.002)	1.525	(0.003)	-0.534	(0.002)
Specification Error	0.153	(0.006)	-0.343	(0.005)	0.187	(0.007)	-0.320	(0.006)

Note: Standard errors are in parentheses. Reweighted decomposition follows methodology of section 4.

Table 5b. Detailed Decomposition Results - Educational Response Effects
Percentage Female/Male Difference for Selected GPA Levels

	10th graders				8th graders			
A: 1991-1999	A (93-100): 4		C (73-76): 2		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	3.585	(0.006)	-3.110	(0.005)	5.246	(0.006)	-2.383	(0.005)
Total Unexplained	1.981	(0.006)	-1.184	(0.005)	2.783	(0.006)	-1.075	(0.005)
Race, SMSA	-1.476	(0.010)	0.300	(0.009)	1.058	(0.011)	-0.387	(0.010)
School Hard, Held back	-0.020	(0.002)	-0.023	(0.002)	-0.129	(0.003)	0.050	(0.002)
Misbehavior, Smoking, E	-0.332	(0.005)	0.075	(0.004)	-0.115	(0.004)	0.379	(0.004)
Family Background	-0.156	(0.017)	0.724	(0.015)	0.369	(0.019)	-0.393	(0.016)
Work	0.165	(0.006)	0.373	(0.005)	0.078	(0.007)	-0.386	(0.006)
High school program	0.785	(0.013)	0.086	(0.011)	0.917	(0.008)	-0.084	(0.007)
Educ. Expectations	0.007	(0.002)	0.204	(0.002)	-0.173	(0.002)	0.096	(0.002)
Constant	3.009	(0.025)	-2.923	(0.022)	0.779	(0.025)	-0.350	(0.021)
Reweighting Error	0.272	(0.002)	-0.110	(0.001)	0.426	(0.003)	-0.068	(0.001)
B: 2000-2009	A (93-100): 4		C (73-76): 2		A (93-100): 4		C+ (77-79): 2.3	
Total Differential	4.740	(0.006)	-2.586	(0.005)	5.957	(0.007)	-1.481	(0.005)
Total Unexplained	3.231	(0.006)	-0.721	(0.004)	3.068	(0.007)	-0.090	(0.005)
Race, SMSA	-0.746	(0.012)	-0.548	(0.009)	-0.690	(0.013)	-0.382	(0.009)
School Hard, Held back	-0.194	(0.002)	0.143	(0.001)	-0.097	(0.002)	0.137	(0.002)
Misbehavior, Smoking	-0.456	(0.004)	0.142	(0.003)	-0.039	(0.004)	0.347	(0.003)
Family Background	0.754	(0.019)	-0.360	(0.014)	1.543	(0.021)	0.731	(0.015)
Work	0.171	(0.005)	-0.190	(0.004)	0.462	(0.006)	-0.043	(0.004)
High school program	0.016	(0.012)	0.180	(0.009)	1.534	(0.008)	-0.071	(0.006)
Educ. Expectations	0.027	(0.002)	0.218	(0.002)	-0.215	(0.002)	0.102	(0.002)
Constant	3.658	(0.026)	-0.307	(0.019)	0.569	(0.027)	-0.910	(0.020)
Reweighting Error	0.315	(0.003)	-0.099	(0.001)	0.495	(0.003)	-0.208	(0.001)

Note: Standard errors are in parentheses. Reweighted decomposition follows methodology of section 4.

Table A1. Means of Non-Core Variable by Gender - 12th graders

	Module 4 Variable	1976-1988		1989-1999		2000-2009	
	Kind of work respondent thinks will be doing when age 30	Boys	Girls	Boys	Girls	Boys	Girls
	In the Labor Force[a]	99.92	93.22	99.75	97.74	99.63	98.34
1	**Laborer** (Car Washer, Sanitary Worker, Farm Laborer)	0.62	0.11	0.51	0.06	0.65	0.08
2	**Service worker** (Cook, Waiter, Barber, Janitor, Gas Station Attendand, Practical Nurse,	0.79	5.11	0.75	3.51	1.31	3.58
3	**Operative or semi-skilled worker** (Garage Worker, Taxicab, Bus or Truck Driver, Assembly Line Worker, Welder)	5.11	0.39	2.30	0.20	1.88	0.14
4	**Sales clerk in a retail store** (Shoe Salesperson, Department Store Clerk, Drug Store Clerk)	0.67	2.33	0.34	0.57	0.41	0.57
5	**Clerical or office worker** (Bank Teller, Bookkeeper, Secretary, Typist, Postal Clerk or Carrier, Ticket Agent)	1.69	21.03	1.20	9.02	0.86	2.67
6	**Protective Service** (Police Officer, Fireman, Detective)	4.71	1.25	7.45	2.05	6.71	2.51
7	**Military Service**	6.00	1.28	5.57	1.44	5.92	1.17
8	**Craftsman or skilled worker** (Carpenter, Electrician, Brick Layer, Mechanic, Machinist, Tool and Die Maker, Telephone Installer)	19.11	0.78	13.65	0.57	11.49	0.48
9	**Farmer owner or manager**	2.68	0.69	1.53	0.53	1.40	0.70
10	**Owner of small business** (Restaurant Owner, Shop Owner)	7.22	4.81	8.22	4.93	8.50	6.75
11	**Sales presentative** (Insurance Agent, Real Estate Broker, Bond Salesman)	2.19	1.37	2.50	1.34	2.25	1.36
12	**Manager or administrator** (Office Manager, Sales Manager, School Administrator, Government Official)	7.85	8.22	7.21	7.23	6.10	4.65
13	**Professional without doctoral degree** (Registered Nurse, Librarian, Engineer, Architect, Social Worker, Technician, Accountant, Actor, Artist, Musician)	27.91	37.37	32.05	42.17	36.10	48.29
14	**Professional with doctoral degree** (or equiv) (Lawyer, Physician, Dentist, Scientist, College Professor)	13.46	15.26	16.73	26.38	16.42	27.05
	Total in the Labor Force	100.00	100.00	100.00	100.00	100.00	100.00
	Number of observations	18369	19343	11667	12560	9242	10396

[a] Computed as 100 minus the percentage f observations in occupation 15 (Full-time homemaker or housewife omitted).

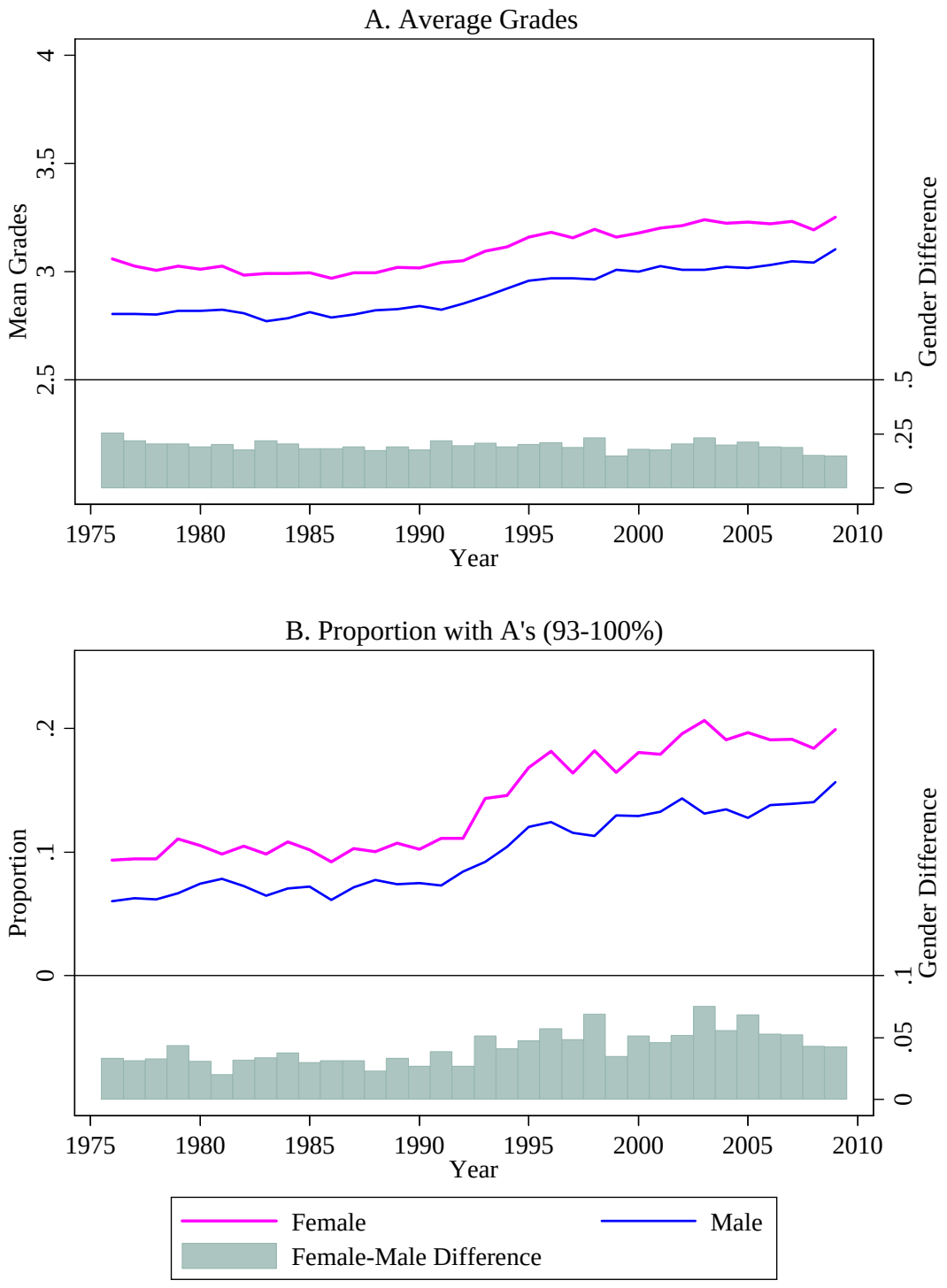
Table A2. Proportion and Average Wages of 25 to 39 years old from MORG-CPS and IPUMS-USA in the same occupational categories as MTF

	Years	1976-1988				1989-1999				2000-2009			
		Men		Women		Men		Women		Men		Women	
	Percentage in	%	Wage	%	Wage	%	Wage	%	Wage	%	Wage	%	Wage
	the Labor Force	95.05		68.83		93.46		75.01		92.11		74.72	
	the Occupation Category												
1	**Laborer**	5.83	11.99	2.19	9.63	6.46	10.26	1.89	8.67	6.04	10.88	1.49	8.66
2	**Service worker**	4.26	10.24	13.31	8.22	6.12	9.01	13.60	7.87	7.21	9.74	15.59	8.78
3	**Operative**	14.85	14.51	8.16	9.87	14.86	12.38	6.29	9.19	11.99	12.79	3.80	9.95
4	**Sales clerk**	1.99	13.40	5.24	8.85	2.43	12.03	5.08	8.39	4.28	14.10	6.13	10.05
5	**Clerical or office worker**	5.59	15.65	30.57	11.71	5.76	13.80	25.91	11.54	5.87	13.32	20.96	12.07
6	**Protective Service**	2.69	15.54	0.46	13.04	3.12	15.41	0.74	13.33	3.46	15.85	1.00	13.04
7	**Military Service**	3.15	—	0.30	—	2.29	—	0.38	—	1.61	—	0.30	—
8	**Skilled Worker**	18.76	16.80	2.11	12.21	17.53	14.86	1.76	11.29	17.09	14.78	1.52	11.39
9	**Farmer owner or manager**	0.09	10.75	0.02	8.59	0.11	10.82	0.03	9.32	0.10	12.71	0.03	12.98
10	**Owner of small business**[a]	12.44	13.57	6.91	8.53	11.74	14.10	7.28	9.20	9.88	14.39	6.41	9.82
11	**Sales presentative**	5.20	18.79	3.17	14.47	6.77	18.22	5.10	14.48	4.85	20.62	3.77	16.58
12	**Manager or administrator**	8.47	20.68	6.10	15.69	4.54	20.43	5.27	16.16	6.82	23.16	6.83	19.12
13	**Professional without doctoral degree**	14.42	20.31	20.07	16.01	16.12	20.01	25.01	16.79	18.31	21.88	29.56	17.89
14	**Professional with doctoral degree**	2.25	21.79	1.38	19.47	2.15	23.59	1.68	22.09	2.48	25.10	2.62	23.14
	Total in the Labor Force	100.00		100.00		100.00		100.00		100.00		100.00	

Note: Percentage of the workforce in the military is from the IPUMS-USA (1970, 1980, 1990, 2000) and the American Community Surveys (2000-2009). Percentages in the other occupations and wages are average occupational real hourly wages in 1982-84 dollars from the MORG-CPS for the corresponding years.

[a] Self-employed in class of worker.

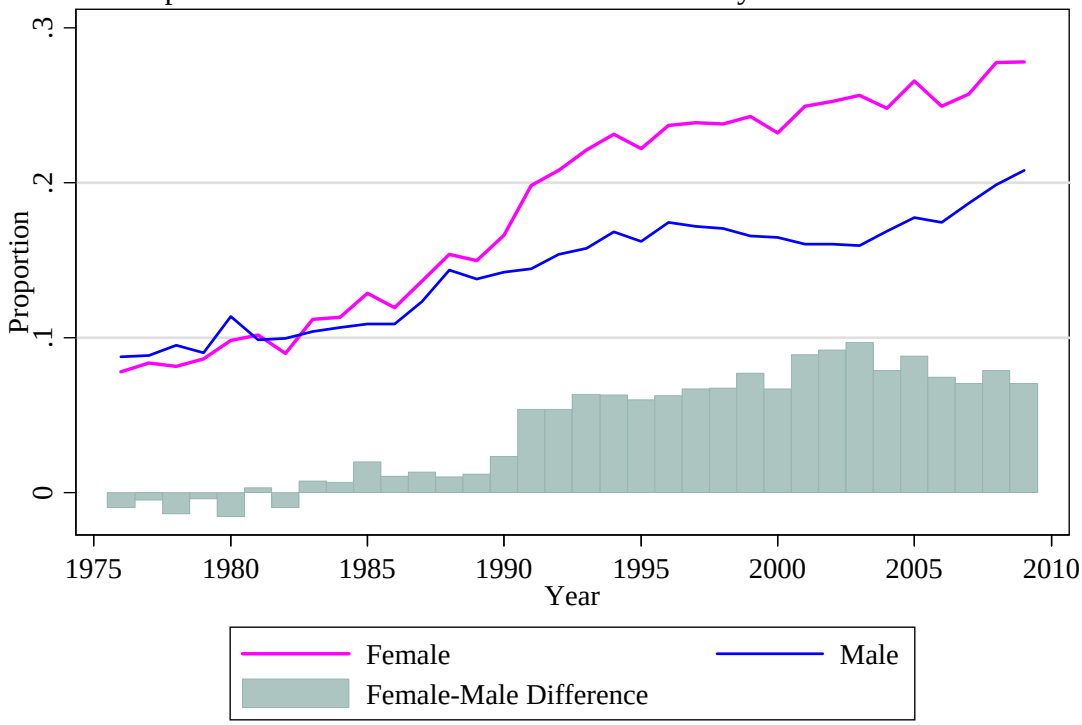
Figure 1. Self-Reported Grades of High School Seniors by Gender



Note: In Figure 1A, self-reported grades in 9 categories (D, C-,C,C+,B-,B,B+,A-,A) are translated into the numbers 1, 1.7,2,2.3,2.7,3,3.3,3.7 and 4 following standard institutional practice.

Figure 2. Educational Expectations of High School Students

A. Proportion of 12th Graders Who Will Definitively Attend Graduate School



B. Female Share among Students Who Will Definitively Go to College

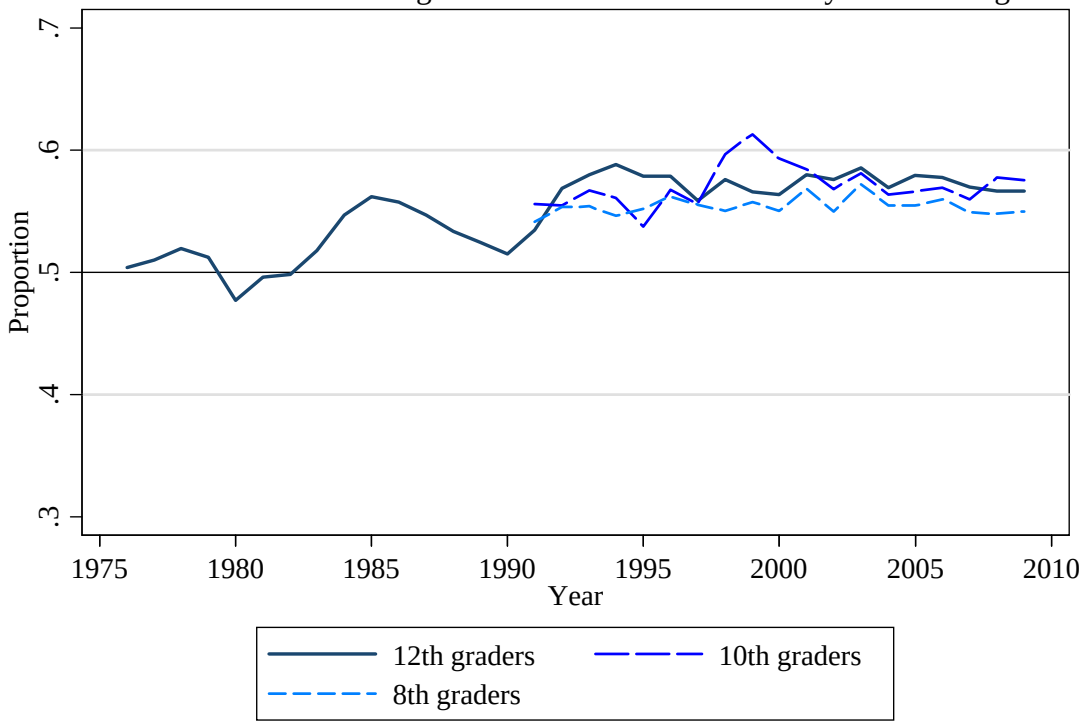


Figure 3. Utility and Cost of Academic Achievement

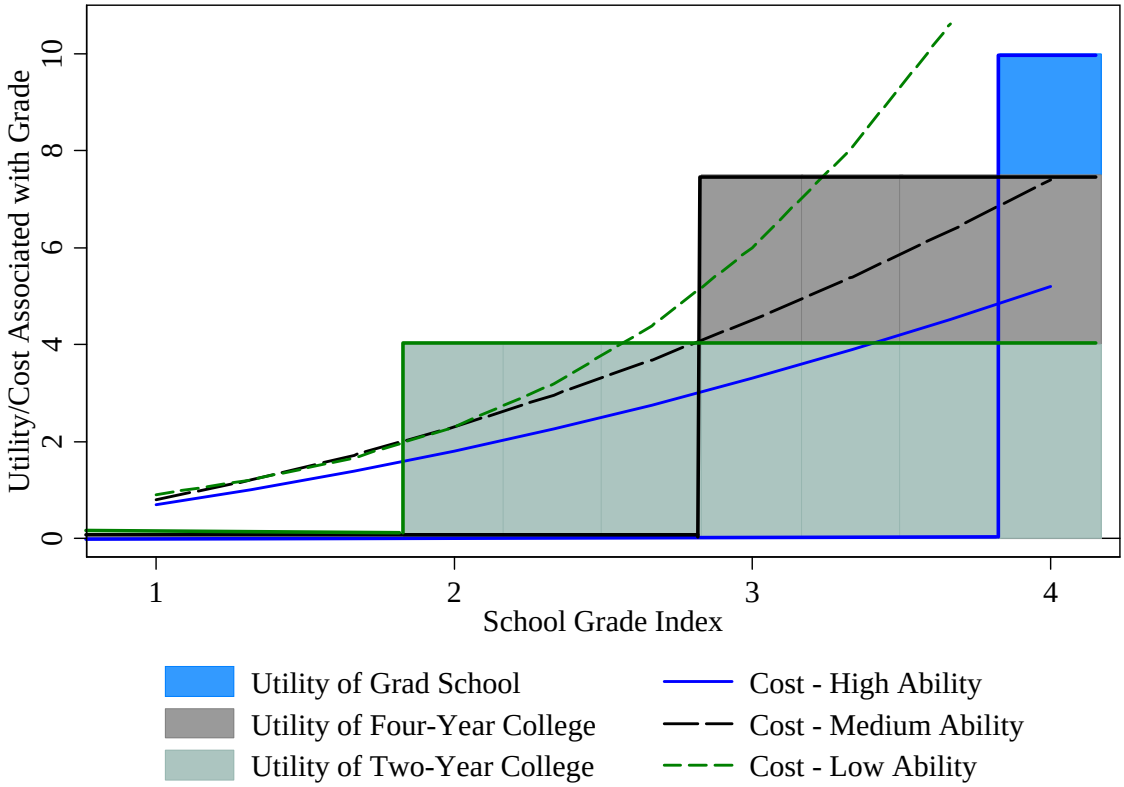
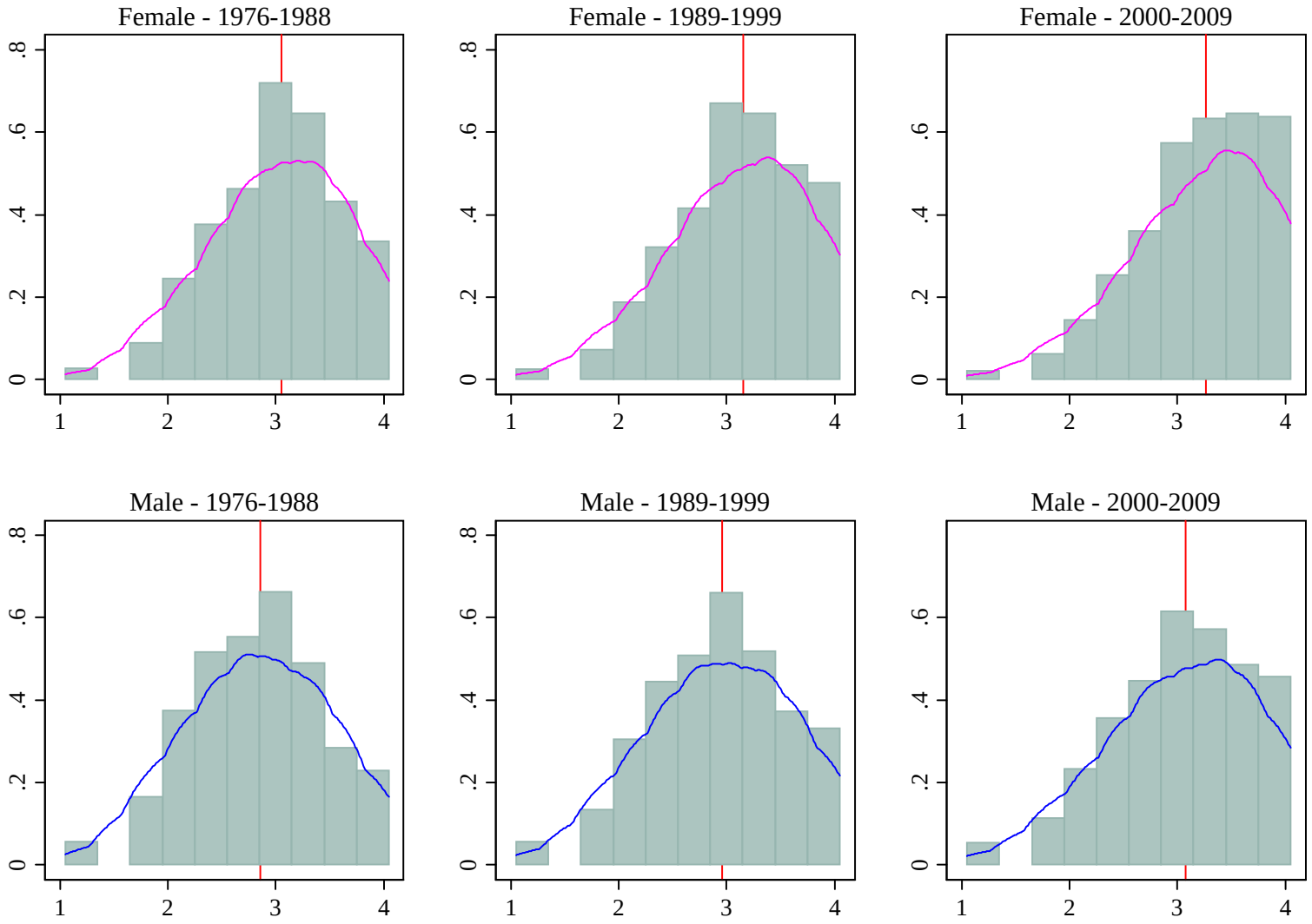


Figure 4. Male and Female Densities of Self-Reported Grades among 12th Graders

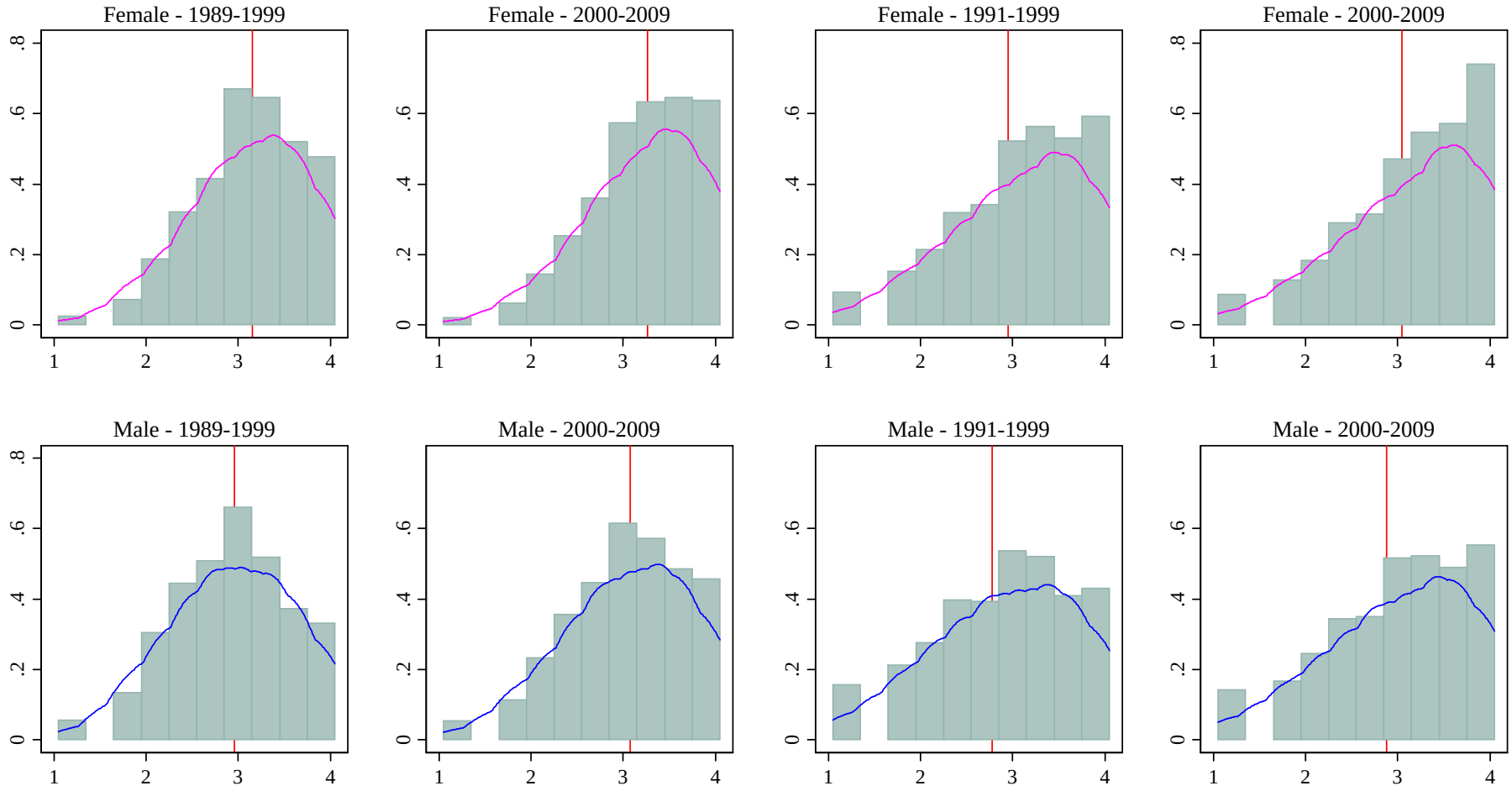


Note: Average grades is indicated by vertical line. Histogram which corresponds to actual data is overlaid with a kernel density.

Figure 5. Male and Female Densities of Self-Reported Grades among 10th and 8th Graders

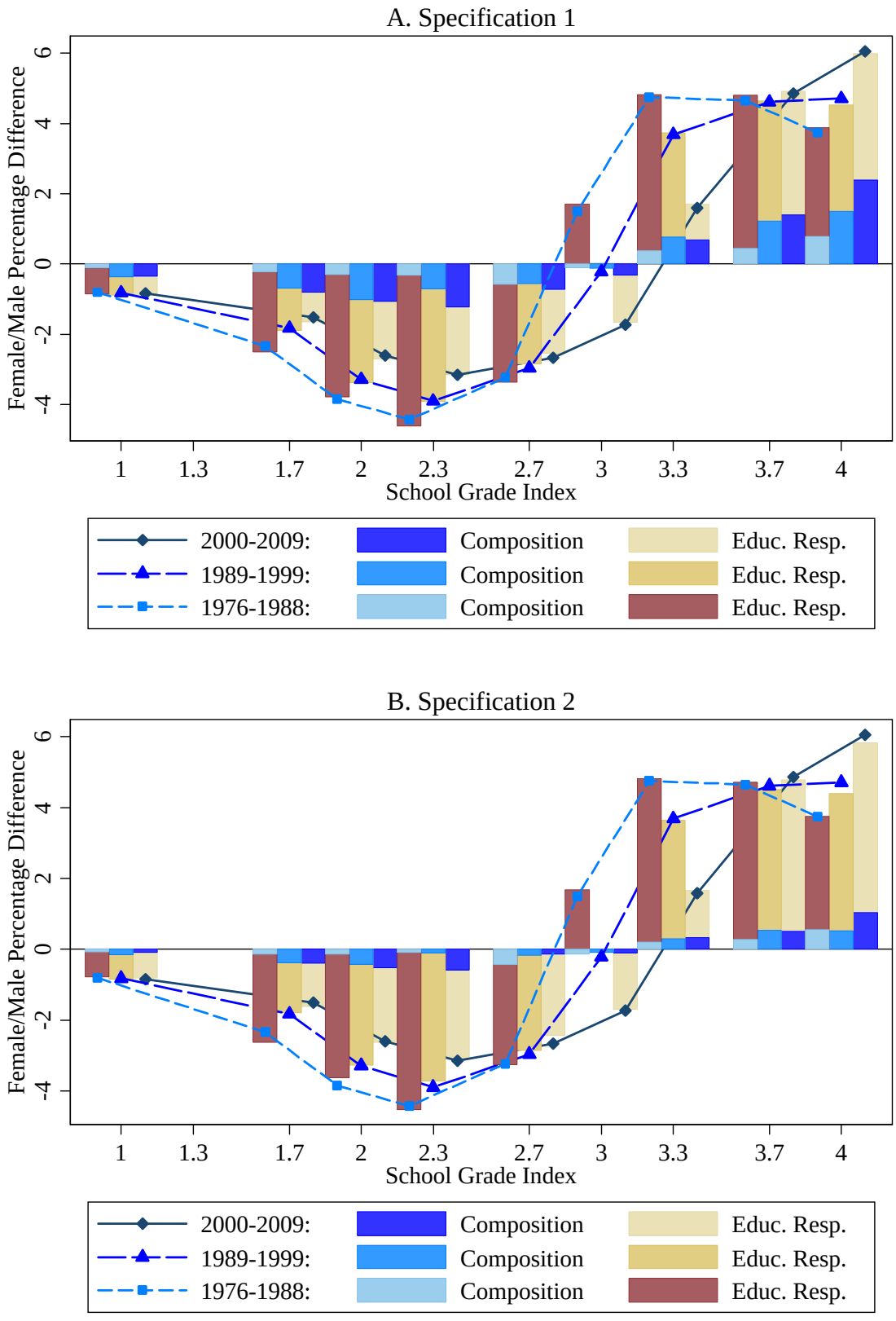
A. 10th Graders

B. 8th Graders



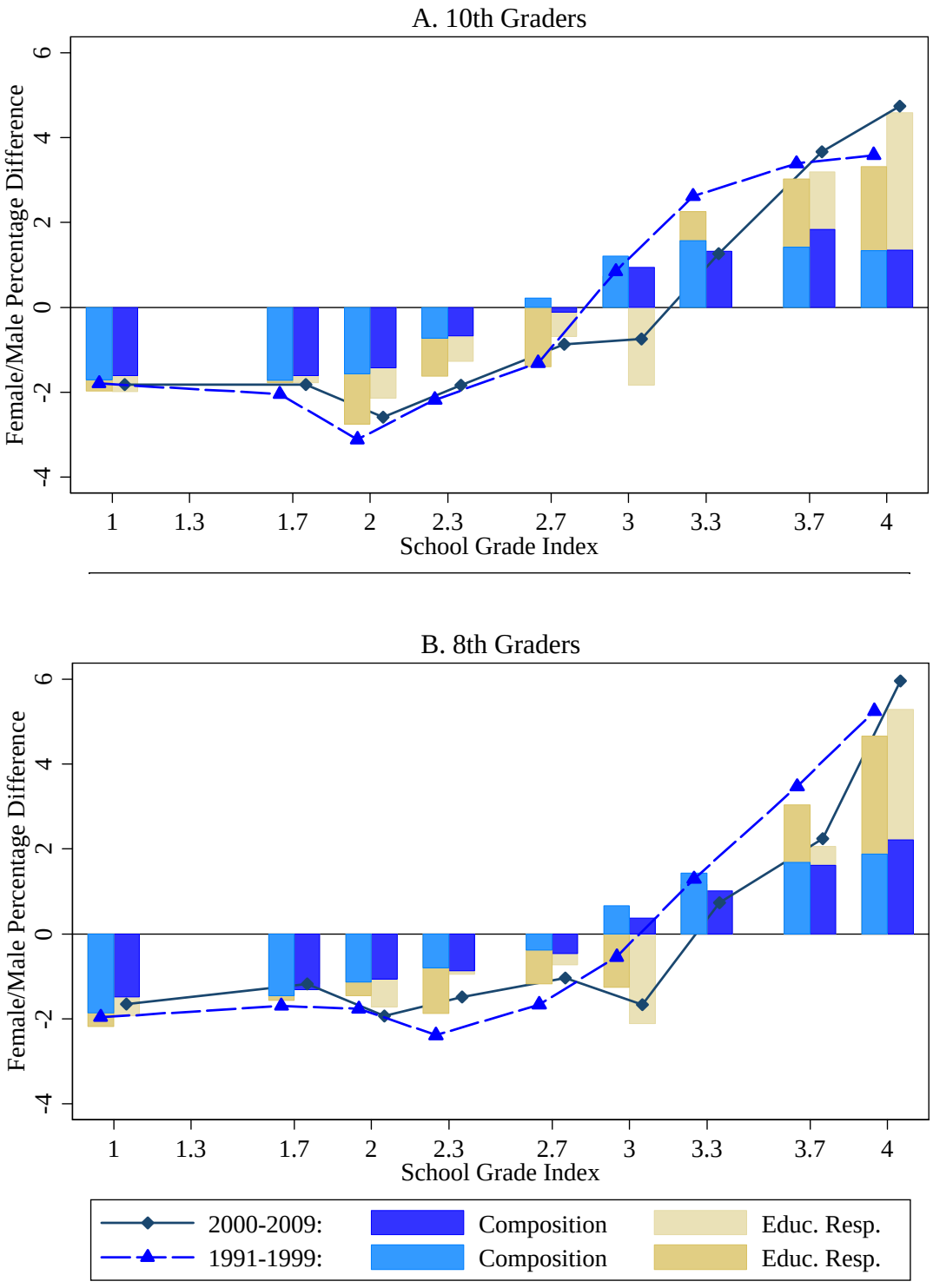
Note: Average grades is indicated by vertical line. Histogram which corresponds to actual data is overlaid with a kernel density.

Figure 6. Female/Male Differences in School Grades of 12th Graders



Note: Self-reported grades in 9 categories (D, C-,C,C+,B-,B,B+,A-,A) are translated into the numbers 1, 1.7,2,2.3,2.7,3,3.3,3.7 and 4 following standard institutional practice.

Figure 7. Female/Male Differences in School Grades of 10th and 8th Graders



Note: Self-reported grades in 9 categories (D, C-,C,C+,B-,B,B+,A-,A) are translated into the numbers 1, 1.7,2,2.3,2.7,3,3.3,3.7 and 4 following standard institutional practice.

Figure 8a. Detailed Decomposition of Female/Male Differences in School Grades of 12th Graders (Specification 1)

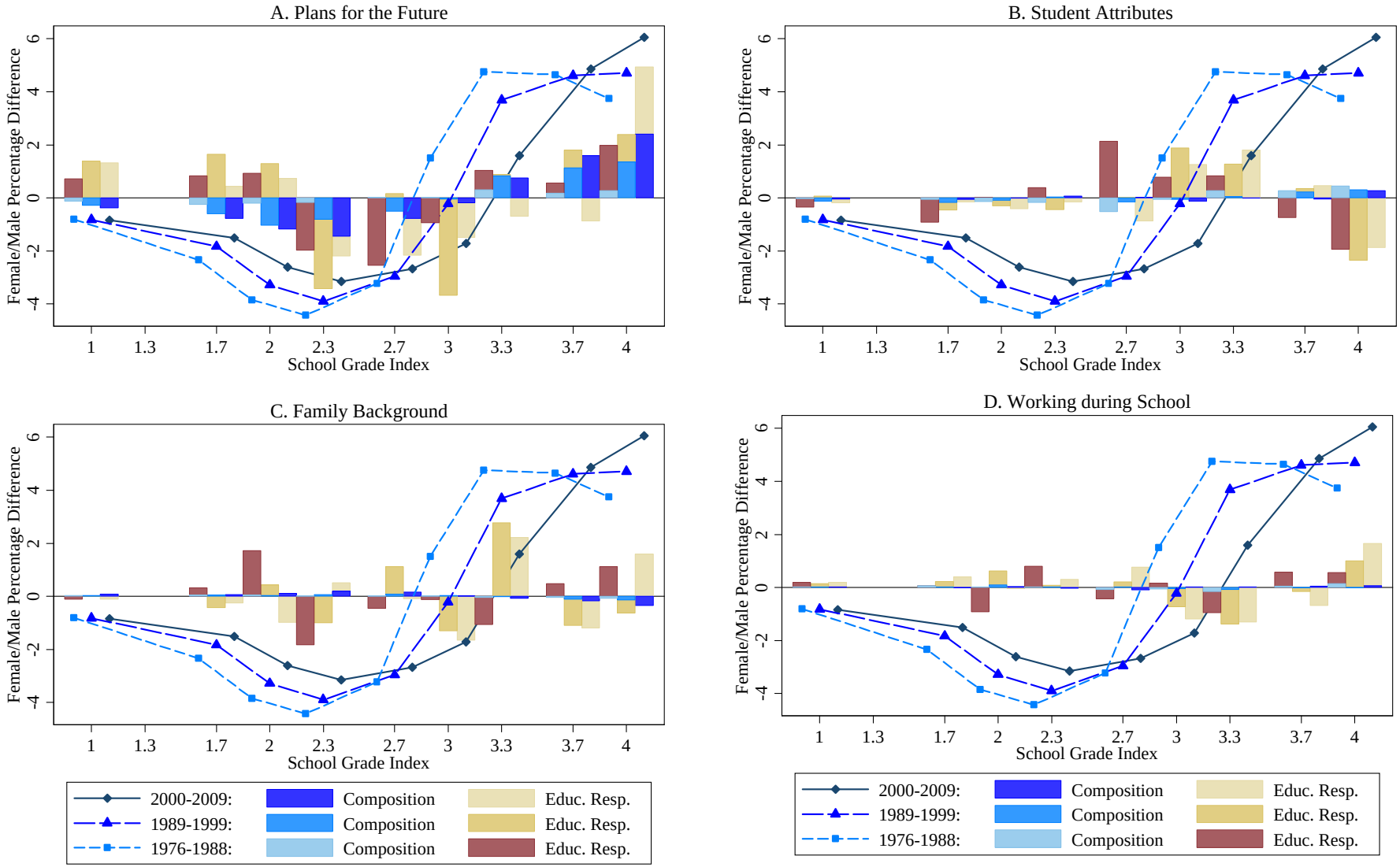


Figure 8b. Detailed Decomposition of Female/Male Differences in School Grades of 12th Graders (Specification 2)

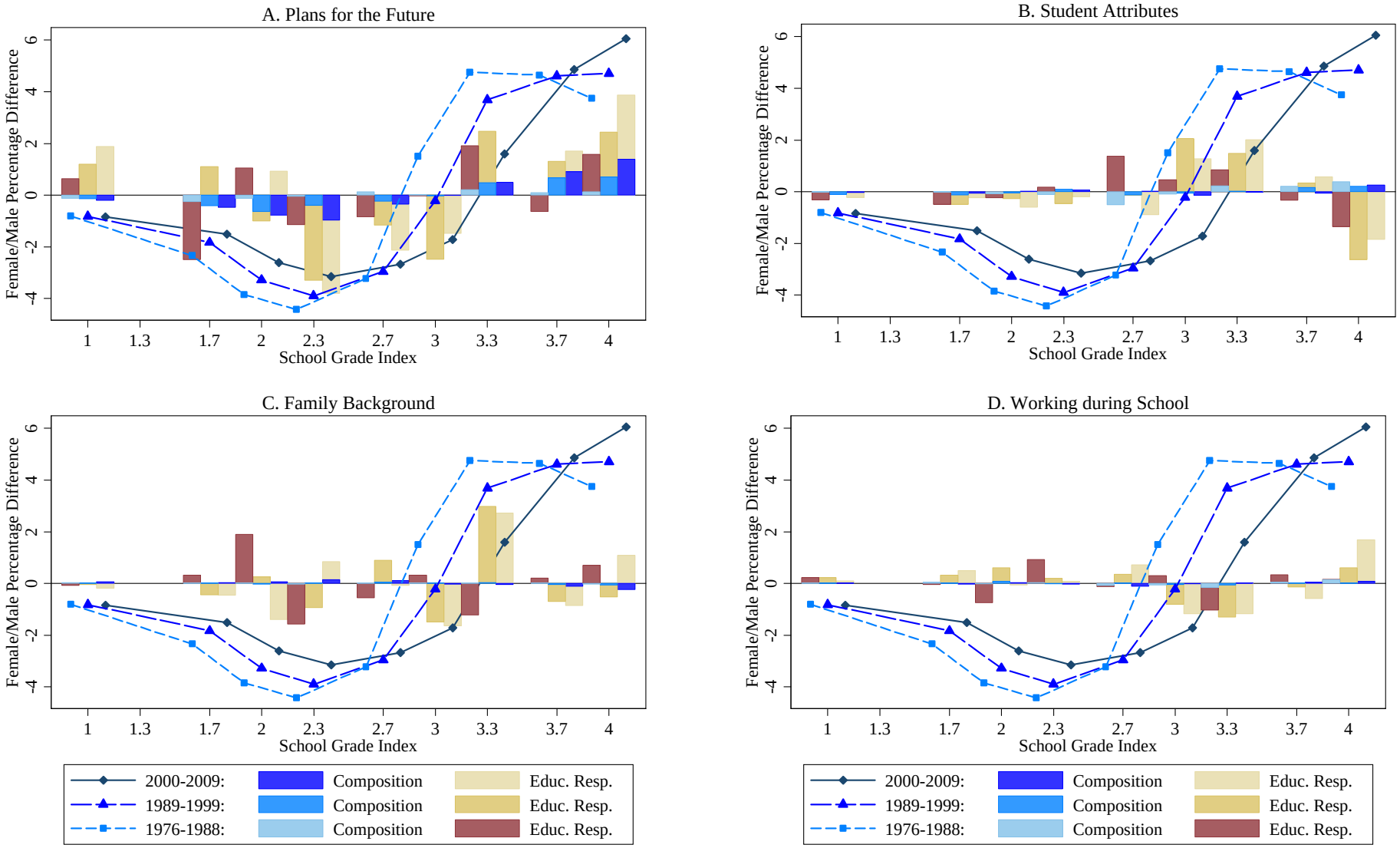


Figure 9a. Detailed Decomposition of Female/Male Differences in School Grades of 10th Graders

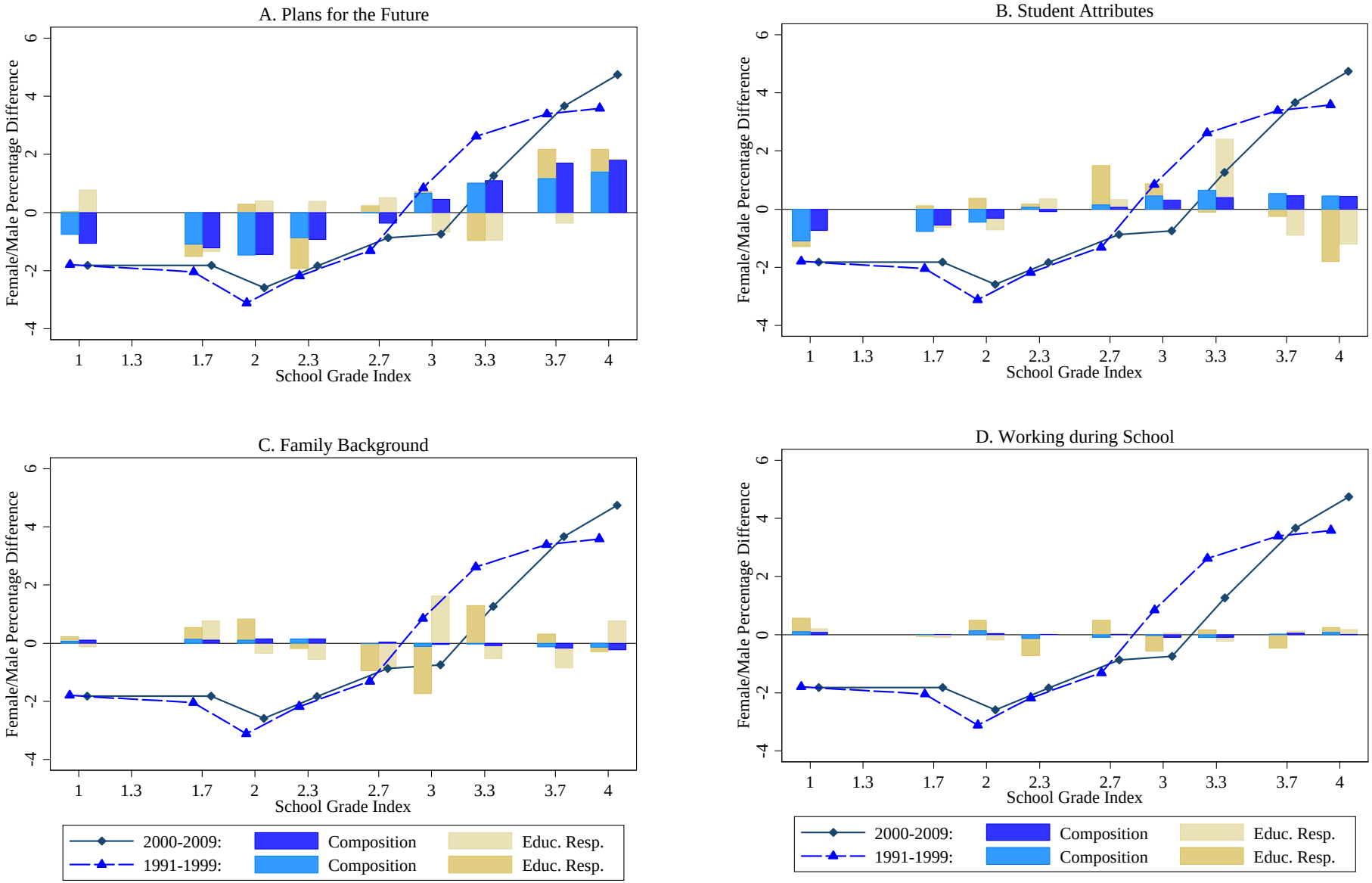


Figure 9b. Detailed Decomposition of Female/Male Differences in School Grades of 8th Graders

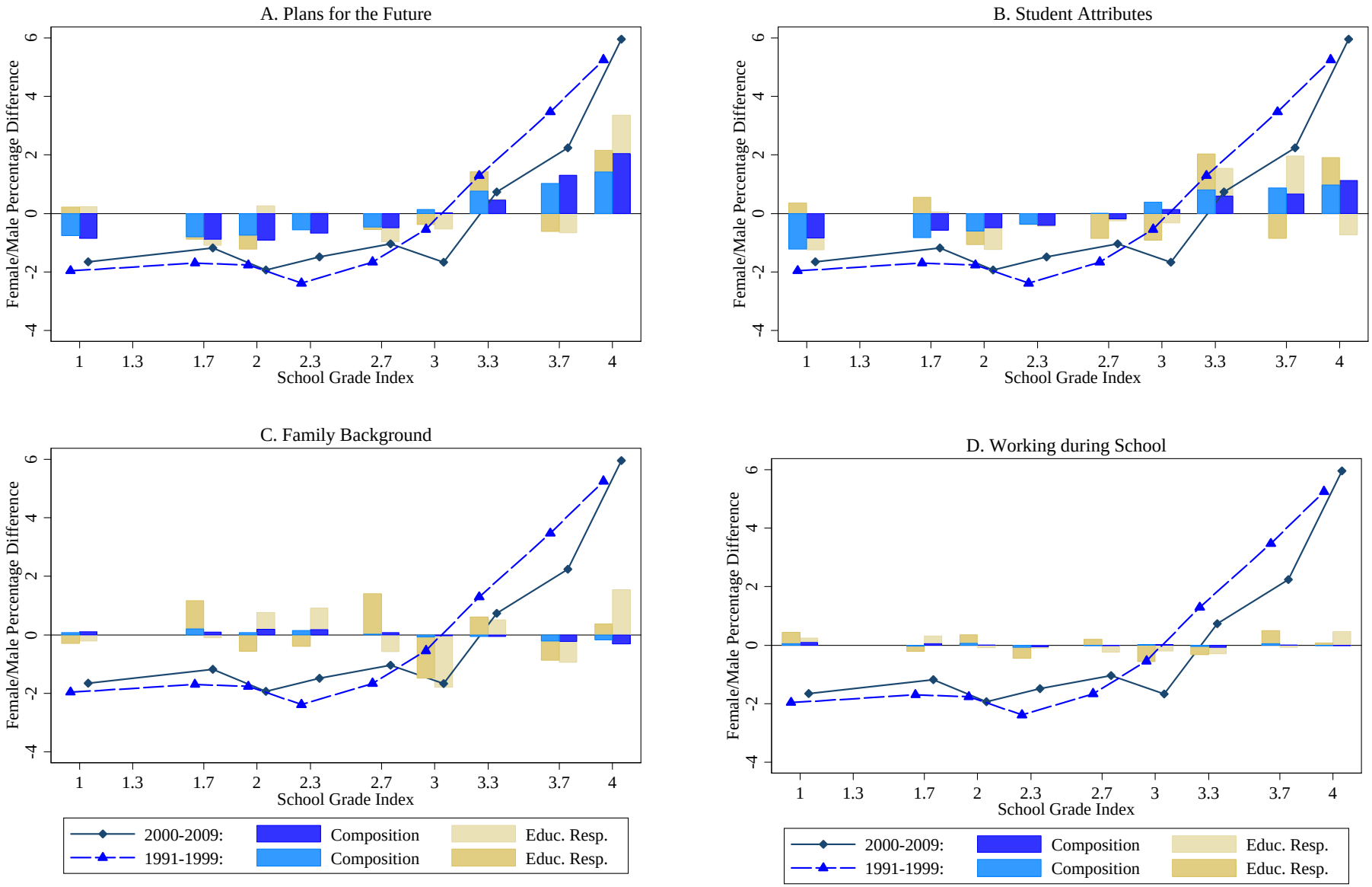


Figure A1. Trends by Gender

Figure A2. Average Subjective School Ability and Intelligence Among 12th Graders by Gender