Are we asking too much of young females? *

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Preliminary. Do not cite or distribute.

April 9, 2024

Abstract

Women's persistent under-representation in Math-intensive careers and top-managing positions is both puzzling and worrisome and perpetuates inequality among sexes.

Using the National Longitudinal Study of Adolescent to Adult Health (Add Health), 1994-2008, I explore how sex differences in time use and attitudes affect human capital accumulation during high school. I find that on average more engagement in housework, sports, and leisure is positively correlated with grades, and young females get better grades than males, even when controlling for the difficulty of the Math courses taken.

However, young females do housework more often and spend less time in healthy sctivities, and even when controlling for grades and other observables, the probability of enrolling in demanding Math courses at the beginning of high school is almost 20% lower for females than males. Surprisingly, this probability also depends on the frequency of sport practices and on teamwork attitudes, factors that increase the odds for males. Moreover, persistence in early academic choices carries on, amplifying sex differences in college Math preparedness by the end of high school.

*These views are those of the author and not necessarily those of the U.S. Bureau of Economic Analysis, or the U.S. Department of Commerce.

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1 Introduction

Grades throughout high school remain the most important factor in college admissions, and one of the best predictors of college success, together with student behavior during high school and family income. However, human capital accumulation during middle and high school is still poorly understood, and the choice of major, job sector, and position rank are key at explaining the 28% overall gender salary gap that Kahn and Ginther (2017) computed recently. Moreover, in spite of women earning 57% of all US bachelors' degrees, women continue to be massively under-represented in the highest paid Math-intensive and top-managing positions.

This paper takes a first step to understand human capital accumulation during early adolescence by focusing on how time use and executive-function skills, together with social and household norms shape Math academic choices during High school.

Using Add Health data from 1994-2008, I find that for middle and high schoolers, housework does not have a negative effect on grades, just as other leisure activities, so early on housework can be thought as a good sign of engagement in family life, and not as an activity taking time from other more marketable activities.[1]

However, I find that young females do more house chores and less leisure activities than males, specially sports, and they also tend to get better grades than males, even when controlling for the difficulty of the Math and Science courses taken during high school. In conjunction, my findings are indicative of females devoting more time to study in preparation for college.

Additionally, I find that the probability of taking a more rigorous Math (or Science) course during the first year of high school, depends on a student's past grades and their self-reported levels of academic executive function skills. However, this probability is also related with other non-academic behaviors, such as on how frequently students practice sports and on students' self-report teammate attitudes.

All in all, I find that, even when controlling for grades, the probability of enrolling in more difficult Math courses during the first year of high school is almost 20% lower for females.

[1] In adulthood, Kolpashnikova and Kan (2021) find that less than a half of the gender gap in housework time can be explained by the gender differences in resources, and Mussida and Patimo (2021) show that the current share and distribution of time use inside households is detrimental for women's health, employment, labor attachment, and wages.

This result helps explain the girls' under-representation among high-achieving students in middle and high school found by Ellison and Swanson (2018), and suggests that the low numbers of females in high-demanding Math courses in high school is not driven by differences in academic abilities, but by other factors. Francis, de Oliveira and Dimmitt (2019) focus on factors such discrimination and bias during high school by studying the role of academic counselors recommendations of advanced placement (AP) classes and find that counselors are less likely to recommend females for AP Calculus than males.

Moreover, academic choices are persistent and students taking less demanding Math courses in the first year of high school are much less likely to finish high school having taken AP Calculus. [2] For example, in Canada, Card and Payne (2021) find that most of the graduation gap in university STEM degrees in the Ontario province is coming from the differences in end-of-high school courses in Math ans Science taken by men and women.

So it seems that academic preparedness for college depends on both the mastery of the courses taken and on the difficulty of these courses. However, in the Add Health data used in this paper, young females tend to get better grades than males even conditional on the courses taken, but they also tend not to take as many difficult courses as males do. This is indicative of females placing a higher weight on mastering or showing mastery of courses than males and hyper-focusing on grades.

Ugalde (2023) documents gender differences to grade sensitivity at the beginning of college and its impact in major choices for undergraduate students at Arizona State University (ASU). Through a survey, she finds that anticipated beliefs about discrimination in the labor market of male-dominated fields are important to understand the gender gap in grade sensitivity, but this motive is unlikely to be present during the first years of high school, so in this paper I explore other factors more influential to teenagers' decisions such as time use, executive-function skills, and family characteristics.

More broadly, Kahn and Ginther (2017) provide an excellent review into the incremental steps that affect the under-representation of women in STEM, touching on the different mechanisms that play into STEM human capital accumulation such as cultural factors, rewards, or the degree of

[2] Oakes (2005) shows that AP classes provide access to highly effective teachers, improving academic performance and increasing the likelihood of matriculation to four year colleges and access to beneficial social networks.

competition and risk aversion between women and men.

The family economics literature finds that married women with children take upon a larger slack of housework and childcare duties than their partners, and that this is disruptive to their productivity and mentally and physically draining.[3] At the same time, previous research has shown that by high school, females devote more time to paid and unpaid labor than males, and males spend more time on extracurricular and leisure activities.

However, less is known about how persistent these early differences in time use are and what effects they have on adolescence development and human capital accumulation, so this paper adds to the literature by exploring the links between adolescence time use, executive-function skills, and academic Math choices during high school.

I find that the extra housework burden carried by young females is unlikely to come from preferences, as youth housework depends on demand factors such as number of siblings in the family or the education and job status of the mother.

At the same time, in the labor economics literature, the presence and the effects of gender bias and discrimination on the job market are well known. Agan, Cowgill and Gee (2021) show that when women get job offers, their starting salaries tend to be lower than those of similar men. In academic medicine, Oliveira, Ma, Woodruff and Uzzi (2019) find that female first-time investigators are awarded smaller size of National Institutes of Health (NIH) funds than comparable males, and Hengel (2022) finds that higher writing standards for females in economic journals contribute to their under representation in top journals.

Moreover, it is also well known that labor policies aimed at correcting biases and discrimination after the early formative years have very limited effects. Goldin, Kerr, Olivetti and Barth (2017) show that the gender gap in earnings expands throughout the working years and Huggett, Ventura and Yaron (2011) find that, as of age 23, differences in initial conditions account for more of the variation in lifetime earnings, lifetime wealth, and lifetime utility than do differences in shocks received over the working lifetime.

Thus, it is key that we understand what affects early decisions on human capital accumulation and what dynamic effects they have, and that we expand our view of what constitutes human capital. Nollenberger, Rodríguez-Planas and Sevilla (2016) measured how much the transmission of cultural

[3]See Bridgman, Craig and Kanal (2022).

beliefs on the role of women in society contributes to the gender Math gap, and Fernández, Fogli and Olivetti (2004) found that the growing number of families in which sons were brought up by working mothers during WWII was a significant factor in the increase in female labor force participation observed later.

2 Data description and sample selection

The National Longitudinal Study of Adolescent to Adult Health (Add Health) is a study of adolescent health. Add Health started in 1994 with an in-school questionnaire administered to a nationally representative sample of students in grades 7-12 during the 1994-95 school year, and the study continued with a series of follow-up, in-home interviews conducted in 1995, 1996, 2001-02, 2008, and 2016-2018.

For this paper, I use two sections of the in-home questionnaire of Waves I, II and III. For Waves I and II, the section 1 reports daily activities, collecting information about how the respondent spends free time, and section 5 contains information about academics and education, gathering data on the progress of their schooling.

The format of section 1 questions is: During the past week, how many times did you ....?

Table 1 shows the activities I focused on and the questions' codes associated with them in Wave I. Notice that except for housework, H1DA1, all the other activities are different types of leisure.

The possible coded answers used for the analysis are 0, meaning *not at all*, 1, meaning *1 or 2 times*, 2, meaning *3 or 4 times*, or 3, meaning *5 or more times*. Thus a higher number means that the activity was performed more frequently during a week, but not necessarily that more time was spent in that activity.

From section 5 in Waves I and II, I only use the reported grades in English and Mathematics in the most recent grading period. [4]

Lastly, from Wave III, I use the sections in which students answer about their perception of different executive function skills, answering questions

[4]These are questions H1ED11 and H1ED12 in section 5 of Wave I. For these, only teenagers that did not report answers such as "did not take this subject", "took the subject, but it was not graded this way", "refused", "legitimate skip", or "don't know" are part of the samples used in this paper.

Table 1: Description of activities of interest and codes in Wave I

Code	Daily activities
H1DA1	Work around the house, such as cleaning, cooking, laundry, yard work, ..
H1DA2	Hobbies, such as collecting baseball cards, playing an instrument, reading
H1DA3	Watch television or videos, or play video games
H1DA4	Go roller-blading, roller-skating, skate-boarding, or bicycling
H1DA5	Play an active sport, such as baseball, softball, basketball, soccer, swimming, ..
H1DA6	Exercise, such as jogging, walking, karate, jumping rope, gymnastics or dancing
H1DA7	Hang out with friends

Source: Add Health, Wave I 1994-95

such: When you were between 5 and 12, ...?, with coded answers 0, meaning *never or rarely*, 1, meaning *sometimes*, 2, meaning *often*, and 3, meaning *very often*, and the educational section where very detailed academic information is provided. Information such as what courses were taken and when, whether courses were taken for credit or not, and the grades obtained in them.

Also, throughout the paper, I will be using two different samples, an unconditional sample with all the teenagers that reported valid coded answers to the activities described in Table 1, and a more restricted sample, named fully engaged sample, with the teenagers that reported some time spent in *all* activities in Table 1. These are the most active, busy, and engaged students in the sample.

Table 2 shows the size, grade, and sex composition of both samples. The unconditional sample in panel (a) is slightly unbalanced with 51% of females and 49% of males, and 33% of students in middle school and the remaining 67% in high school.

Panel (b) is more unbalanced than panel (a), but towards males, since only 18% of females in the unconditional sample are part of the fully engaged sample, while for males this number is 25%. At the end, 47% females and 53% males are fully engaged in middle school and a corresponding 41% and 59% in high school.

3 Early grades and activity engagement

I start doing a cross-sectional analysis, computing averages of the first reported grades and frequencies of activities when students enter the ADD

Table 2: Sample sizes Wave I

Grade	Males	Females
7th	463	495
8th	459	508
9th	518	544
10th	529	549
11th	540	495
12th	328	412
Total	2837	3003

(a) Unconditional sample

Grade	Males	Females
7th	172	162
8th	156	126
9th	150	98
10th	105	73
11th	83	49
12th	36	45
Total	702	553

(b) Fully engaged sample

panel in Wave I. Table 3 shows these averages for females and males in middle and high school separately, and their differences by sex. [5]

These results paint an unfair view of female adolescence. For both the unconditional and the fully engaged sample shown in Table 3, on average girls have better grades in English and Math, help with housework more often, and spend less time in sports and in all leisure activities. [6]

Also, in high school, average grades in English and Math are a bit worse for both sexes than in middle school. For the unconditional sample, the favorable female gap in English remains the same, but shrinks to half in Math. Meanwhile, the grades of the most engaged kids are slightly better than the rest, and the favorable female gaps in English and Math remains mostly unchanged from middle to high school.

During childhood, being active outside school and helpful at home is positively correlated with better behavior and better academic performance, but as academic demands grow during high school, the relationship between activity engagement outside school and grades is murkier. [7]

In our sample, females consistently do household chores more often than

[5] Only variables whose difference is significant at the 95% level or higher are shown.

[6] The finding that young females do not see friends more frequently than males is at odds with the psychology literature describing women as more people-oriented than men.

[7] Greaney (1980) found a significant negative relationship between empty hours and amount of reading in children, and Anderson, Wilson and Fielding (1988) found that time spent outside and eating dinner had positive relationships with reading proficiency in 5^{th} grade and growth in reading proficiency from 2^{nd} to 5^{th} grade.

Table 3: Unconditional and fully engaged sample averages.

	Middle school			High school		
Unconditional	Males	Females	Diff	Males	Females	Diff
English	2.69	3.08	**-0.39**	2.62	3.01	**-0.39**
Math	2.67	2.90	**-0.23**	2.58	2.69	**-0.11**
Housework	2.00	2.20	**-0.20**	1.91	2.10	**-0.19**
Hobbies				1.53	1.38	0.15
Screens				2.33	2.25	0.08
Outdoors	1.19	0.72	0.47	0.61	0.38	0.23
Sports	1.88	1.38	**0.50**	1.69	0.99	**0.69**
Exercise	1.65	1.77	-0.11			
Friends				2.08	1.93	0.15

Fully engaged	Males	Females	Diff	Males	Females	Diff
English	2.85	3.23	**-0.38**	2.71	3.16	**-0.45**
Math	2.76	2.98	**-0.23**	2.67	2.89	**-0.22**
Housework	2.12	2.35	**-0.22**	2.19	2.30	**-0.11***
Hobbies	2.03	1.88	0.16	2.12	1.88	0.24
Screens	2.63	2.50	0.13			
Outdoors	1.96	1.54	0.43	1.75	1.50	0.25
Sports	2.28	2.03	**0.26**	2.34	1.89	**0.46**
Exercise				2.18	2.03	0.15
Friends						

*Significant only at 10% confidence level.

males. In the unconditional sample, during high school, both sexes do less household chores than during middle school, but the housework gap against females remains the same. For the fully engaged sample, when compared to middle school, during high school males do slightly more chores and females slightly less, so the housework gap against women is cut in half and is only significant at the 10% confidence level.

Lastly, for the unconditional sample, even though both sexes spend less time in sports on average in high school compared to middle school, female participation in sports falls noticeably more and the gender sport gap in-

creases in favor of males during high school.

For the fully engaged sample and maybe surprisingly, these busiest females and males also practice sports more often than the rest of same-sex peers, and the gender sport gap is smaller than in the unconditional sample, even though it grows from middle to high school from a combination of males practicing sports a bit more often and females a bit less.

Apart from the gender gaps found in Table 3, another message that this table seems to convey is that housework, sports, and leisure activities do not crowd out study time at this age, and if something, they are positively correlated with better grades.

To confirm this hypothesis, I run different specifications of Regression (1) with the average English and Math grades first reported in Wave I as the dependent variable, both in levels and in logs, on dummy variables of the frequency of housework, sport practice, and other activities, and demographic characteristics like number of siblings, order of birth among siblings, and sex, where sex takes the value of 1 if female and 0 if male.

$$Grade_i = \alpha + D^{'}\beta_d + \varepsilon_i \tag{1}$$

The results are shown in Table 4. There one can see that students that engaged in some housework and sports' practice tend to have better grades than those who do no housework and no sports at all.

Also, the interaction dummy between students that help with house chores and practice sports 5 or more times a week is also positive and significant, and a sign of the lack of conflict between time devoted to academics and time devoted to family and athletic activities.

Being the first born in a family also has a positive effect on grades. The mechanisms behind this effect are not clear. It could be that first children receive more attention or encouragement from parents with convex preferences for kids, or that they feel they are a role model for younger siblings and show more ambition than them.

Enjoying a lot of healthy leisure seems to be good not only for mental health but also for academic performance, as the coefficient of this variable in Regression (1) is positive and significant.

Also, the female dummy is positive and very significant. This could be explained by females independently devoting more time to study than males, consistent with Ellison and Swanson (2018) that show that among high Math achievers, females get more disappointed and discouraged by lower grades.

Table 4: Regression results

	Average English and Math grade:	
	In levels	In logs
Hw=1	0.140**	0.081***
	(0.070)	(0.029)
Hw=2	0.189***	0.097***
	(0.069)	(0.029)
Hw=3	0.171**	0.091***
	(0.070)	(0.030)
Sp=1	0.101***	0.049***
	(0.033)	(0.014)
Sp=2	0.137***	0.062***
	(0.037)	(0.016)
Sp=3	0.131***	0.064***
	(0.042)	(0.018)
First born	0.085***	0.035***
	(0.025)	(0.010)
Healthy leisure	0.059**	0.026**
	(0.027)	(0.011)
Female	0.299***	0.125***
	(0.025)	(0.011)
Hw=3 x Sp=3	0.086***	0.032**
	(0.033)	(0.014)
Fully engaged	0.106*	0.036
	(0.056)	(0.024)
Constant	2.290***	0.740***
	(0.071)	(0.030)
Observations	4,569	4,569
Adjusted R^2	0.044	0.044

*p<0.1; **p<0.05; ***p<0.01

But parents could also be pushing females to work harder to compensate for the growing obstacles they expect they will need to face later in life due to sex discrimination.

4 Executive-function skills

Wave III of ADD Health has very detailed information about how students saw themselves in terms of executive-function skills between the ages of 5 to 12, as well as the choices and grades of the different Math and Science courses took in high school.

In particular, there was a total of 18 questions related to executive-function skills between the ages of 5 to 12 such as "Did you fail to pay close attention to details or made careless mistakes in your work?", "Did you fidget with your hands or feet or squirmed in your seat?", "Did you have difficulty sustaining your attention in tasks or fun activities?", "Did you leave your seat in the classroom or in other situations when being seated was expected?", "Didn't you listen when spoken to directly?", "Didn't you follow through on instructions and failed to finish work?", "Did you have difficulty organizing tasks and activities?", "Did you avoid, dislike, or were reluctant to engage in work requiring sustained mental effort?", and so on.

The possible coded answers used for the analysis are 0, meaning *Never or rarely*, 1, meaning *Sometimes*, 2, meaning *Often*, and 3, meaning *Very often*. Thus a higher number indicates students see themselves as having poorer executive function skills.

Table 5 shows the average views of executive-function skills by sex. The first noticeable feature shown in the table is that females report better executive-function skills in all skills except when they were asked if they talked too much.

Also, all averages are between 0 and 1, or closely above to 1, indicating that on average our sample of students perceived that their skills were pretty good, and although the difference in perceived average skills by sex are not big in magnitude, they are very significant. [8]

Thus, one would think that females are in a good position to success academically, both because they tend to get better grades than males and because they report having better executive-function skills, even though students were not asked directly if they believed those skills were relevant for academic success or their definition of academic success.

By middle school, sex differences in time use, grades, and executive-function skills do not seem big, but by the beginning of high school, stu-

[8] As before p-values are not reported because all differences in averages by sex are significant above the 95% confidence level.

Table 5: Perception of skills between 5 and 12 yo

Skill	Males	Females
Mistakes	1.1	0.9
Fidgety	1.3	1.1
No attention	0.7	0.5
Leaving class	0.6	0.3
No listening	0.6	0.5
Restless	0.9	0.7
Unfinished work	0.7	0.5
Loud	0.8	0.5
Disorganized	0.7	0.5
Impulsive	1.1	0.8
No mental effort	0.6	0.4
Too talkative	**1.0**	**1.2**
Unprepared	0.8	0.6
Constantly interrupting	1.0	0.8
Distracted	1.2	0.9
Difficult teammate	0.8	0.6
Forgetful	0.8	0.7
Spiteful	0.5	0.4

dents are faced with some poorly defined trade-offs that will be reflected in their college applications. They can start taking increasingly difficult Math courses to complete the AP Calculus course offered by most high schools and valued by prospective colleges at risk of getting worse grades and a worse GPA if the courses turn exceedingly difficult, or they can take easier courses where they are more likely to get better grades.[9]

Thus, without a clear understanding about how colleges weight extra curricular activities, AP courses, and students' GPA in their applications, it is important to understand how students make choices in high school.

Given the persistent under-representation of women in some of the best paid math-intensive fields, I am going to focus on the choice of math courses during the first year of high school and its impact on grades and on the likelihood of completing AP Calculus by the end high school. The reason

[9]This is complicated even more by the fact that AP courses follow a different scale, with an A grade being equivalent to 5, instead of 4.

is that in order to be able to take AP Calculus by the third or fourth year of high school, students need to take a demanding sequence of math courses starting the first year of high school.

Thus, for every year in high school, I assign students into four Math groups, 0, 1, 2, or 3, ascending in the most difficult Math course taken that year. For example, in the first year of high school, group 0 has freshmen not taking any math courses or taking Remedial math Then I place students in group 1 if their most difficult math course taken in year 1 is either General math or Pre-Algebra, in group 2 if they completed Algebra I, and in group 3 if they took Geometry, Algebra II, Advanced math, or Pre-Calculus.

First, I run a regression of the overall GPA by the end of high school on demographics, time-use, and executive-function dummies allowing for some interaction terms, and on other academic variables like the first recorded average grade in Wave I (as a proxy for a student's unobserved academic ability) and a student's choice of math group during the first year of high school.

$$GPA_i = \alpha + D'\beta_d + TU'\beta_{tu} + EF'\beta_{ef} + A'\beta_a + \varepsilon_i \tag{2}$$

The results of Regression (2) in Table 6 are quite interesting. In terms of academics, the coefficient of past average grades is 0.45, indicating that an increase of 1 point in the past grade helps predict about an extra 0.45 points in future grades, showing that grades are quite persistent. Moreover, the dummies of the math group in the first year of high school are all very significant and increasing, which is indicative of the existence of a growth mindset, well documented in the psychology literature.

Then, there are two executive-function dummy variables that are significant. One is related academic skills: finishing work. And the other one to social skills: being a difficult teammate. Students describing themselves as never leaving work unfinished tend to get better grades, and students describing themselves as being difficult teammates often and very often, tend to finish high school with a slightly lower overall GPA, even after controlling for past grades.

Differences in sex remain and again, even after controlling for past grades and difficulty of math courses during the first year of high school, females tend to finish high school with a higher overall GPA than males, reaffirming the idea that females seem to focus more on academic grades than males.

Once we control for initial grades and math groups the first year of high

Table 6: Regression results: Overall GPA by end of high school.

	Dependent variable:
	Overall GPA
Ave grade Wave I	0.448^{***}
	(0.014)
Female	0.153^{***}
	(0.024)
Difficult teammate (2 or 3)	-0.097^{***}
	(0.032)
No unfinished work	0.094^{***}
	(0.021)
Math group 1 H1	0.120^{***}
	(0.039)
Math group 2 H1	0.475^{***}
	(0.036)
Math group 3 H1	0.766^{***}
	(0.041)
Male x Hw=3	0.053^{*}
	(0.031)
Male x No sports	0.094^{**}
	(0.040)
Constant	0.901^{***}
	(0.049)
Observations	2,508
Adjusted R^2	0.542

*p<0.1; **p<0.05; ***p<0.01

school, most time-use variables lose their significance and only a few remain informative when interacting with the male dummy. Table 6 shows that there are two types of males that fair better than other males when it comes their overall GPA by the end of high school, those helping with house chores 5 or more times a week, and those not practicing sports.

5 Academic choices

High school is the first time that children start having some real control over the core subjects that they study, so the math courses chosen during the first year of high school are important and can be thought as proxies for preparedness, ambition, confidence in math skills, and academic risk taking.

In particular, since women continue to be underrepresented in STEM careers, I am especially interested in computing the factors that affect the probability of belonging to math group 3 the first year of high school.

To that end, I run a binomial logistic regression where the probability of belonging to a math group 3 the first year of high school depends on on demographics, time-use, and executive-function dummies, and on the first English and Math grades recorded in Wave I.

$$ln(\frac{P(Group_{y1}=3)}{P(0<Group_{y1}<3}) = \alpha+\beta_f Female+TU^{'}\beta_{tu}+EF^{'}\beta_{ef}+G^{'}\beta_g+\varepsilon_j \quad (3)$$

The results of this binomial logistic regression are shown in Table 7. As expected, high grades are the best predictors of Regression (3) a one point increase in the log of past Math or English grades boosts the likelihood of being in group 3 during the first year of high school by a lot.

Maybe, also not surprising is that students that reported high consistency in academic skills like completion and effort are also more likely to enroll in a math course in group 3 during the first year of high school.

The last three coefficients are more surprising: First, students that practice sports 3 or 4 times a week are more likely to belong to group 3 than students that don't practice much sports or that practice sports very seriously 5 or more times a week. Second, for females, the odds of being in group 3 in the first year of high school are a whooping 19% lower than for males, holding constant all other variables in the regression. And third, defining yourself as being a difficult teammate sometimes instead of never or often and very often makes a student more likely to belong to group 3 during the first year of high school.[10]

[10] Groves (2009) has shown that being "aggressive" or more competitive in school pays off for males, but here being difficult sometimes make both sexes more likely to enroll in a challenging math course the first year of high school.

Table 7: Binomial Logistic Results Regression

	Dependent variable:
	Group 3 first year high school
	Odds Ratios
Log of Math Grade	3.62***
	(0.175)
Log of English Grade	3.82***
	(0.225)
No unfinished work	1.34**
	(0.127)
No lack of effort	1.28*
	(0.128)
Frequent sport practice	1.33**
	(0.129)
Female	0.81*
	(0.113)
Sometimes Unconforming	1.28**
	(0.113)
Constant	0.01***
	(0.300)
Akaike Inf. Crit.	2,109.134

*p<0.1; **p<0.05; ***p<0.01

Table 6 already showed that the choice of math group the first year of high school has a positive effect on the overall GPA by the end of high school, but can it also help us predict how much students will advance in the math track by the end of high school? To answer that, first I classify students in the last year of high school as follows: group 0 students remained short of completing Algebra II, group 1 students completed Algebra II, group 2 students completed Advanced math or Pre-Calculus, and group 3 students completed Calculus. Then, I run a multinomial logistic regression where the dependent variable is the math group the student belonged to the last year of high school J and the independent variables are the math group and overall

GPA in the first year of high school.

IF IT IS LOGISTIC, I NEED TO PUT LOGS IN THE SPECIFICATION HERE

$$Group_J = \alpha + \beta GPA_1 + \delta Group_1 + \varepsilon_J \tag{4}$$

The exponential of the coefficients of Regression (4) or odds ratios are shown in Table 8. Together, they show that the math group a student belonged the first year of high school, as well as the overall GPA in that first year of transition between middle and high school, are important predictors of the students accomplishments in math by the end of high school.

For example, for every increase of one point in a student's overall GPA, the odds of finishing high school in group 2 versus group 1 is multiplied by 2.47, holding constant other variables, and the odds of finishing up in group 3 and completing Calculus is much higher.

Table 8: Regression results: Math accomplishment by end of high school.

	Dependent variable:	
	Math group at the end of high school	
	Odds Ratios	
	Group 2	Group 3
Overall GPA Y1	2.47***	6.47***
	(0.113)	(0.125)
Math Group 1 Y1	1.37	0.28***
	(0.280)	(0.373)
Math Group 2 Y1	2.00***	3.00***
	(0.264)	(0.308)
Math Group 3 Y1	2.76**	31.12***
	(0.475)	(0.469)
Constant	0.10***	0.01***
	(0.337)	(0.418)
Akaike Inf. Crit.	3,118.638	3,118.638

*p<0.1; **p<0.05; ***p<0.01

Table 8 shows that there is a lot of persistence among math groups

through time, so understanding the distribution of students in the math groups of the first year of high school is important.

Moreover, this persistence in math groups indicates that we do not see students taking it easy on math courses early on to increase their load of math courses later. Starting slow the first year and completing courses only in group 1 makes students much less likely to finish high school having taken Calculus. The odds ratios also indicate that students choosing or placed in demanding math courses during the first year of high school rise up to the challenge and are more likely to keep up the pace of math courses throughout high school and complete Calculus, again hinting at the existence of a growth mindset effect.

6 Conclusions

Grades, behavior, and family income during high school are the best predictors of college success, and this paper shows that as early as in middle school, on average, females focus and excel academically, and report a greater mastery of executive function skills than males.

However, females continue to be greatly underrepresented in the highest paying STEM careers.

At the same time, I find that young males spend time in a greater variety of leisure activities than females, and they also spend more time in each of these activities, while females help more frequently at home with house chores.

Moreover, this paper shows that sex differences in time use inside and outside their household, executive function skills, and non-conformity attitudes during middle and high school years are correlated with grades and early decision making in academic settings. In particular, the focus on grades and conforming attitudes that females exhibit, away from some types of healthy leisure have a negative effect on the difficulty of the Math courses taken during the first year of high school.

Thus, despite this early academic advantage in preparedness, I show that females are still less likely to enroll in demanding Math and Science courses at the beginning of high school, and persistence in academic choices carries on, amplifying differences between males and females by the end of high school.

Therefore, since non-academic variables have turned out to be significant for high school decisions that affect how students prepare for college, one

can only imagine how other important decisions related to human capital accumulation will be affected by other difficult-to-measure variables rooted in family, social, and cultural norms.

The evidence highlighted in this paper can inform policy decisions in secondary education aimed at increasing the representation of females in challenging Math and Computer Science courses during high school, as a first step to provide women with some of the STEM skills most highly paid in today's labor markets.

Moreover, the takeaways in this paper can be used to construct early broader structural models of human capital accumulation beyond formal education, capturing other features that seem to be important for academic decision making and career choices such some forms of social and health capital.

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