FEATURE ARTICLES

Gender Gaps in High School Students' Homework Time

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Gender differences in human capital investments made outside of the traditional school day suggest that males and females consume, respond to, and form habits relating to education differently. We document robust, statistically significant one-hour weekly gender gaps in secondary students' non-school study time using time diary data from the 2003–2012 waves of the American Time Use Survey (ATUS) and transcript data from the Educational Longitudinal Study of 2002 (ELS). These complementary data sets provide consistent evidence of gender gaps that favor females and are not explained by gender differences in after-school time use, parental involvement, educational expectations, course taking, past academic achievement, or cognitive ability.

Keywords: gender gap; homework; motivation; noncognitive skills; out-of-school time; studying; time use

Introduction

The longstanding gender gap in educational attainment has closed and reversed over the past 30 years as women now attend and complete college at higher rates than men (Bailey & Dynarski, 2011; Bound & Turner, 2011). The reversal of the gender gap has largely been at the expense of low socioeconomic status (SES) males (Buchmann & DiPrete, 2006). Sociodemographic patterns in educational attainment have received attention from policymakers, educators, scholars, and pundits. However, the underlying causes of these phenomena remain unclear (Bound & Turner, 2011).

Gender gaps in students' noncognitive (i.e., "soft") skills, such as self-control and persistence, have been suggested as one potential source of corresponding gaps in educational attainment (Jacob, 2002; Lundberg, 2013). Time devoted to academics outside the traditional school day (i.e., homework time) is associated with educational volition, a potentially important noncognitive skill (Jacob, 2002; Singh, Granville, & Dika, 2002; Sockett, 1988). Additionally, homework time reflects many characteristics that are broadly associated with educational success: parental involvement (Hoover-Dempsey et al., 2001; Ramey & Ramey, 2010; Xu & Corno, 1998), academic interest (Hidi & Renninger, 2006; Xu, 2008), motivation (Eccles & Wigfield, 2002), and current and future effort (Cavanaugh, Schiller, & Riegle-Crumb, 2006). Moreover, homework is a unique educational input that both requires and develops educational volition (Alleman & Brophy, 1991; Corno, 1993). Indeed, research finds direct effects of homework time on educational achievement and attainment (e.g., Cooper, Robinson, & Patall, 2006; Jacob, 2002; Kalenkoski & Pabilonia, 2014).

This suggests that there is likely a gender gap in homework time, the sources of which have implications for education policy and practice. The current study provides systematic, rigorous analyses of the size, relationship with SES, and potential explanations of gender gaps in secondary school students' non-school study time. Specifically, we investigate conditional and unconditional gender and SES gaps in homework time by examining the practical and statistical significance of SES and gender indicators in multivariate time-use regressions. The empirical analysis relies on two nationally representative data sets, each with its own unique strengths and weaknesses. First, we analyze time diaries completed by secondary school students in the 2003–2012 waves of the American Time Use Survey (ATUS). Time diaries are the ideal instruments with which to measure homework time as they are relatively robust to social desirability bias (Juster & Stafford, 1991) and contain detailed information on time spent in activities that may "crowd out" homework on the day in question.

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However, the ATUS is limited by a lack of information on students' academic backgrounds, which may be associated with gender, SES, and homework time. Accordingly, we augment the ATUS analyses with similar analyses of the Educational Longitudinal Study of 2002 (ELS), which contains the high school transcripts of 10th graders in 2002 and students' performance on standardized math and reading tests. While the ELS did not conduct time diary surveys, it does contain students' self-reported typical weekly homework time.

Theoretical Background and Literature Review

Students may have both intrinsic and extrinsic reasons for doing homework, though empirical evidence suggests that only intrinsic motivation is significantly related to homework completion (Xu, 2005). Interest is another important predictor of homework completion, which comes from three sources: demographic and SES background, parental attitudes and involvement, and intellectual ability (Xu, 2008). Similarly, Cooper, Lindsay, Nye, and Greathouse (1998) show that parental attitudes toward homework influence children's attitudes. There is likely heterogeneity in the benefits that students receive from completing homework, particularly across home environments (Corno, 1996; Kalenkoski & Pabilonia, 2014). There are also gender differences in secondary school students' homework interest (Xu, 2008) and homework management skills (Xu, 2006). These differences, which likely map into gender gaps in homework time, result from both sociological and psychological factors. For example, girls in this age range are more self-reliant, disciplined, and ambitious in course taking than boys (Duckworth & Seligman, 2006; Xu, 2006).

A large empirical literature investigates the relationship between time spent on homework and children's cognitive and noncognitive development; see Cooper et al. (2006) for a review. Xu and Corno (1998) found that homework contributed to noncognitive development. Singh et al. (2002) showed that time spent on homework improved math and science achievement. Cooper et al. (1998) found that time spent on homework had larger effects on student achievement in secondary grades than in earlier grades, which is perhaps an instance of "skills begetting skills." Most relevant to the current study, Kalenkoski and Pabilonia (2014) used time diary data to show that homework time has a positive impact on boys' high school grade point averages (GPAs).

Researchers have also investigated the relationship between homework habits and educational outcomes. For example, using homework time as one measure of noncognitive skills, Jacob (2002) found that gender differences in noncognitive skills partly explain gender gaps in college completion. Kalenkoski and Pabilonia (2014) similarly showed that high school boys' homework time increases the probability they attend college.

The current study furthers our understanding of the magnitude and determinants of gender gaps in secondary students' time use outside the traditional school day. Specifically, we use two complementary, nationally representative data sets to test the hypotheses that female and high-SES secondary students spend more time on homework, on average, than their male and less advantaged counterparts. We then probe some factors that might explain homework gaps, such as household structure, academic ability, patterns in course taking, and participation in activities that might "crowd out" homework time.

Data

The current study examines the magnitude and possible explanations of gender differences in secondary students' non-school study time. Because non-school study time is arguably socially desirable, traditional survey questions potentially yield upward-biased responses (Grimm, 2010). Retrospective time diaries are therefore the preferred instrument for accurately measuring students' non-school study time (Juster & Stafford, 1991). Accordingly, we analyze time diaries collected by the American Time Use Survey.

The ATUS is nationally representative and has been administered annually since 2003 by the Bureau of Labor Statistics. The ATUS collects a 24-hour retrospective time diary from one individual over age 15 per household from a subset of the Current Population Survey (CPS) sampling frame and links each diary to sociodemographic household data from the CPS. The analytic sample of more than 5,000 time diaries is restricted to respondents aged 15 to 19 who self-reported being enrolled in high school at the time of completing the time diary, for whom basic demographic variables are observed, and who completed a time diary during the academic year (September–May). Because weekends and certain demographic groups and months are oversampled by the ATUS, all subsequent analyses are weighted by person-day weights that account for unequal probabilities of selection across households, months, and days of the week. The person-day nature of the sampling weights reinforces the fact that time diary surveys sample both individuals and calendar days.

However, the ATUS is limited by its lack of academic information. For example, advanced course taking, cognitive ability, course grades, and school climate potentially explain gender and SES gaps in non-school study time. To provide a fuller understanding of the size and nature of gaps in homework time, we augment the ATUS analyses with similar analyses of the Educational Longitudinal Study of 2002 (ELS), which is a nationally representative survey of 10th-grade students in 2002 that was conducted by the National Center for Education Statistics. Importantly, the ELS contains student transcripts that provide information on students' course grades and the semesters in which specific courses were taken, students' performance on standardized math and reading tests, and school indicators that facilitate a school fixed effects (FE) strategy that controls for school climate. The analytic sample contains 13,210 students in 740 schools for whom all relevant variables are observed.[1] Subsequent analyses are weighted to adjust for unequal probabilities of sample selection and survey nonresponse.

Dependent Variables

The outcome of interest is time spent on homework outside the traditional school day.[2] In the ATUS, time spent on homework is measured in minutes per day. Specifically, the "Research/Homework" time diary activity code includes non-school time

Table 1
Homework Time Summary Statistics

	All	Males	Females
A. American Time Use Survey (ATUS)			
Respondent is male	0.52	1	0
Daily homework time (T; in minutes)	50.72	42.50***	59.60
	(85.19)	(77.48)	(91.99)
Zero homework time (T = 0)	0.55	0.60***	0.50
Daily T | T > 0	112.69	105.02***	119.41
	(95.61)	(90.95)	(99.07)
Weekly homework time (in hours)	5.45	4.62	6.33
N	5,058	2,634	2,424
B. Educational Longitudinal Study (ELS)			
Respondent is male	0.50	1	0
Weekly homework time (T; in hours)	5.7	5.1***	6.3
	(5.7)	(5.5)	(5.9)
Zero homework time (T = 0)	0.07	0.10***	0.04
Weekly T | T > 0	6.13	5.66***	6.57
	(5.70)	(5.47)	(5.87)
Weekly T ≥ 26 hours (top-coded)	0.01	0.01**	0.02
N	13,210	6,490	6,710

Note. Means and standard deviations (*SD*, in parentheses) are weighted by sampling weights that adjust for unequal probabilities of sample selection. *SD* are only reported for non-binary variables. Daily reports are measured in minutes, and weekly reports are measured in hours. Weekly ELS reports are top-coded at "26 or more." The ATUS weekly average is computed by multiplying the daily average by 7. The statistical significance of mean differences between male and female respondents is tested using *t* tests.
$^{**}p < .05$. $^{***}p < .01$.

spent doing required (assigned) homework and research, time spent doing homework and research for personal interest or fulfillment, waiting time associated with homework and research, and miscellaneous time associated with homework and research. We do not decompose the broad measure of homework time or conduct analyses of specific subcategories due to a lack of power and to avoid "multiple comparison" problems (Schochet, 2008).

Panel A of Table 1 summarizes students' daily homework time in the ATUS analytic sample both overall and by gender. The average respondent spent about 51 minutes per day on homework, and the standard deviation (*SD*) of 85.2 indicates a substantial amount of variation in homework time across respondents. On average, females spent about 17 more minutes per day on homework than males, a statistically significant difference, and there is more variation in female homework time than in male homework time. A statistically significant 10 percentage point gender gap is also observed in homework participation rates. Implications of this nonparticipation, or "pile up" at zero, are discussed in the methodology section. Conditional on the respondent completing some homework on the diary day, the overall average increases to 112 minutes, but a significant difference of nearly 15 minutes between males and females remains. In sum, unconditional gender gaps in ATUS respondents' homework time exist on both the extensive (participation) and intensive (time) margins.

The ELS contains self-reported, top-coded, categorical indicators of students' typical weekly hours of homework performed both during and after school. The latter is of primary interest in the current study, though sensitivity analyses reported in Appendix Tables A.3 and A.4 (available on the journal website) show that there are gender gaps in "during school" and "total" homework time, respectively, that favor girls and indicate that boys do not compensate for the out-of-school gap by performing more homework in school (e.g., during study halls). Accordingly, aggregate gender gaps that account for both types of homework time favor females by an even greater margin. The top-code includes reports of 26 or more hours of weekly homework. It is unclear whether the "zero hours" category is limited to strict nonparticipation or if it includes small amounts of homework time that respondents rounded to zero. The implications of the categorical nature of the ELS homework variable are discussed in the methodology section.

Panel B of Table 1 shows a statistically significant gender gap of about 1.2 hours of non-school study time per week in the ELS, where the top-code category is treated as 26 hours. It is unlikely that the bias attributable to the top-coding is large, as only 1% of respondents reside in this category and the fixed number of hours per day limits the maximum possible value of this variable. There is also a significant gender gap in the probability of ELS respondents reporting zero homework time. In fact, Appendix Table A.5 (available on the journal website) shows that the unconditional gender gap in weekly homework time persists across the entire distribution: Males are significantly more likely than females to do 1 hour or less of homework, the two sexes are about equally likely to report 2 hours of weekly homework, and females are systematically more likely than males to report spending 3 or more hours on homework per week.[3]

One concern with the ELS estimates is that self-reported homework times are potentially biased upward by social desirability bias.

It is therefore instructive to compare ATUS estimates, which are less susceptible to this problem, to the ELS estimates. After scaling the ATUS estimates up to the weekly level, we see that the ELS average weekly homework time is about 0.25 hours (5%) greater than the corresponding ATUS estimate, as expected. Interestingly, this over-reporting is entirely due to male students, as the mean weekly homework time among females is nearly identical in the two data sets. As a result, gender gaps identified in the ELS data likely represent lower bounds of true gender gaps.

Independent Variables

The independent variables of interest in the current study are gender and socioeconomic status. We measure SES using categorical indicators of household income and parents' educational attainment as household income likely affects children's after-school time use (e.g., market work, household child care) and differences by parents' educational attainment in parental involvement are well documented (e.g., Gershenson, 2013; Ramey & Ramey, 2010). Household income in both data sets is top-coded and reported in coarse brackets. We combine households earning less than $20,000 in one "low-income household" category, which is in line with the U.S. census poverty line for a family of four.[4] Appendix Table A.6 (available on the journal website) summarizes the key independent variables for both data sets. The two samples are similar, which is unsurprising given that both are nationally representative cross-sections.

Control Variables

In addition to documenting unconditional gender and SES gaps in secondary students' non-school study time, we also estimate "adjusted" gaps conditional on a rich set of observed household and student characteristics. This is done to identify potential explanations of the unconditional gender gap. The demographic controls are summarized in Panel A of Appendix Table A.7 (available on the journal website). The average ATUS respondent was about 16 years old, while all ELS respondents were 10th graders. Students in the ATUS sample are more likely to be White and to live in a two-parent household than students in the ELS sample, which is likely due to the fact that ATUS sampled the U.S. population while the ELS sampled the U.S. 10th-grade student population. The demographic, household structure, and employment characteristics of male respondents resemble those of females.

Panel B of Table A.7 available on the journal website reports the percentage of respondents who participated in three specific activities on the diary day (ATUS) or in a typical week (ELS) as well as the time spent in each activity that might "crowd out" homework time (Kalenkoski & Pabilonia, 2014): organized extracurricular activities (including sport and non-sport activities), child care (for household children), and market work (outside household).[5] Gender differences in participation in these activities might contribute to gender gaps in time spent on homework. Boys are twice as likely to participate in an organized activity on the diary day, and this difference, which is statistically significant, is driven by participation in sports. Girls are about two-thirds more likely to care for household children than boys, and this difference is statistically significant. Male and female respondents were equally likely to work for pay. The econometric model controls for participation and time spent in each activity.

Analyses of the ATUS utilize a number of other controls common to time-use regressions (e.g., Gershenson, 2013). When relevant, these controls are included in ELS regressions. First, race and ethnicity indicators control for cultural differences in time use. Second, differences in time-use patterns across geographic locales are captured by a metropolitan area indicator. Differences across geographic locales may result from differential access to parks, playgrounds, and so on. Attitudes toward homework may also vary across states, as Bound, Hershbein, and Long (2009) find that the intensity of competition over college admissions varies by state. Accordingly, we consider specifications that control for state of residence. In the ELS analyses, school fixed effects (FE) play a similar role and make state FE redundant. Third, household characteristics such as household size, number of household children, presence of a young child, and parents' marital status are commonly included in time-use regressions as such variables might jointly predict SES and time use (Zick & Bryant, 1996). Similarly, we control for age, as age is an important predictor of child time use (Zick & Bryant, 1996).

Time-use patterns likely differ between weekdays and weekends and even across weekdays. Similarly, there may be fewer homework assignments and extracurricular activities in months at the start and end of the school year. The ATUS analyses therefore condition on month and day FE as well as year FE that control for nationwide secular trends.

Finally, Panel C of Table A.7 available on the journal website summarizes several measures of academic ability, parental support, and attitudes toward education available in the ELS that both vary by gender and predict time spent on homework. The first is 9th-grade GPA, as low grades in 9th grade might prompt parents to facilitate additional homework time. The second is performance on age-appropriate, low-stakes math and reading standardized tests, which were administered by the ELS in the spring semester of 10th grade. We model test scores using a series of categorical indicators to allow for possibly nonlinear relationships between cognitive ability and time spent on homework as both high and low achievers might spend more time on homework. Consistent with previous research (e.g., Jacob, 2002), the ELS data show that girls have higher GPAs and reading test scores but lower math test scores than boys. The third is a set of categorical indicators for whether and how recently the student repeated a grade as males may be more likely to be retained than females, which in turn might influence homework habits (Dauber, Alexander, & Entwisle, 1993). The fourth is a set of categorical indicators that measure parents' involvement in their children's education. Specifically, these variables measure the frequencies with which parents assist with children's homework, incentivize academic performance, and discuss school, all of which are thought to vary by gender (e.g., Muller, 1998). Finally, Muller (1998) suggests that expectations for educational attainment and beliefs about academic ability vary by gender. Accordingly, we control for students' educational expectations.

Another potential difference between male and female high school students that might affect time spent on homework is

differences in course taking. For example, girls are more likely to be in academic tracks while boys are more likely to be in vocational tracks (Jacob, 2002). To estimate the size of the gender homework gap conditional on course taking, we estimate models that control for 10th-grade course FE constructed from student transcripts. Appendix Table A.8 (available on the journal website) summarizes the coding scheme.

Methodology

We estimate linear time-use regressions of the form:

$$T_i = \alpha + \delta Male_i + \gamma SES_i + \beta X_i + u_i, \quad (1)$$

where i indexes respondents, T is non-school study time, *Male* is a gender indicator, *SES* is the vector of categorical indicators of respondents' parents' educational attainment and household income described previously, X is the vector of statistical controls described previously, and u is an idiosyncratic error term. We estimate versions of Equation 1 that restrict β to equal zero to see how conditioning on various covariates changes estimated time-use gaps (δ). To further investigate the underlying sources of gender gaps in non-school study time, we estimate Equation 1 separately for different subsets of the student population.

The linear model (Equation 1) is estimated by ordinary least squares (OLS) with standard errors clustered at the state (school) level to make statistical inference robust to arbitrary forms of heteroskedasticity and serial correlation within states over time (or unobserved school effects). OLS estimates of linear time-use regressions are preferred despite the "pile-up" at zero (ATUS) and top-coding at 26 (ELS) documented in Table 1 for two reasons. First, Stewart (2013) shows that OLS estimates are more robust than Tobit estimates when daily nonparticipation is caused by measurement error attributable to time diary surveys' sampling of days. Second, OLS estimates allow for straightforward comparisons between the ATUS and ELS estimates.

Sensitivity analyses confirm the robustness of the OLS results. Specifically, the ATUS analysis is augmented with Tobit model estimates that account for the non-negative nature of time use and "pile up" at zero. Tobit average partial effects (APE) (Wooldridge, 2013), which can be directly compared to OLS coefficient estimates, are reported in Appendix Table A.9 (available on the journal website). As expected, the Tobit APE are qualitatively similar to the preferred OLS estimates (Foster & Kalenkoski, 2013). Similarly, Appendix Table A.10 (available on the journal website) reports estimates of several nonlinear models that address the top-coded, count nature of the ELS homework variable: Type 1 Tobit, two-limit Tobit, Poisson regression, right-censored Poisson regression, and interval regression (Raciborski, 2011; Wooldridge, 2013). Once again, these estimates are remarkably similar to the preferred OLS estimates.

Results

Daily Homework Time in the ATUS

Table 2 presents baseline OLS estimates of Equation 1. Column 1 shows that on average, males spend about 17 fewer homework minutes per day than females. This gender gap is strongly statistically significant and remains so after conditioning on SES indicators, statistical controls, daily activities, and state FE in Columns 3 through 6, respectively. Column 2 shows that there are significant SES gaps in homework time that are primarily driven by the children of college-educated parents and students in the wealthiest households. The parental education gaps in non-school study time are robust to conditioning on gender, statistical controls, after-school time use, and state FE in Columns 3 through 6.

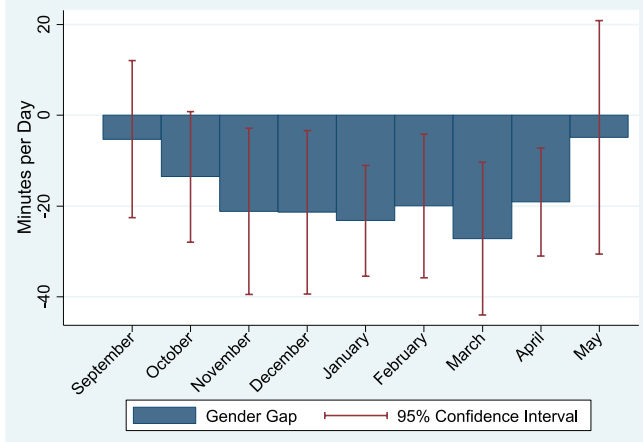

FIGURE 1. *Average daily gender gaps in homework in the American Time Use Survey (ATUS), by month*
Note. Conditional gender gaps are reported in terms of males' homework time relative to that of females. The point estimates and standard errors are reported in Appendix Table A.11 (available on the journal website).

We exploit the fact that ATUS time diaries were completed throughout the academic school year by estimating the fully specified model of Column 6, Table 2 separately by month. The resulting estimates of monthly conditional gender gaps in daily homework time are plotted in Figure 1.[6] Daily gender gaps in homework time favor girls in each month, suggesting that boys do not compensate for the overall gender gap by "out-studying" girls at the end of semesters. Aside from the start and end of the school year, when less homework is likely assigned, gender gaps of about 20 minutes per day are statistically significant in each month.

Weekly Homework Time in the ELS

Table 3 presents baseline OLS estimates of Equation 1. Column 1 shows that on average, males spend about 1.25 fewer hours on homework per week than females. This gender gap is strongly statistically significant and remains so after conditioning on SES indicators, statistical controls and academic achievement, daily activities, and coursework and school FE in Columns 3 through 6, respectively. In the richest specifications that condition on academic achievement, daily activities, educational expectations, parental involvement, and coursework and school FE, the gender gap decreases by about one quarter of an hour, but the remaining one hour gender gap in non-school study time is statistically significant. Column 2 reveals significant unconditional SES gaps in homework time, both in terms of household income

Table 2
Daily Homework Time Use Regressions (ATUS, All Students, OLS estimates)

	1	2	3	4	5	6
Male	–17.10	Omitted	–17.07	–17.57	–15.86	–16.00
	(2.21)***		(2.35)***	(2.30)***	(2.50)***	(2.50)***
R's father						
Not in HH	Omitted					
No HS		–1.39	–0.21	–2.28	–1.87	–0.65
		(3.70)	(3.80)	(8.15)	(8.20)	(8.24)
HS diploma		1.71	2.49	2.03	2.50	3.31
		(3.96)	(3.85)	(7.19)	(7.13)	(7.38)
Some college		8.02	9.26	7.03	6.82	6.67
		(3.53)**	(3.60)**	(7.95)	(7.87)	(7.99)
College degree		26.50	27.65	23.09	23.10	22.53
		(5.61)***	(5.57)***	(8.75)**	(8.76)**	(8.99)**
R's mother						
Not in HH	Omitted					
No HS		6.08	6.09	0.36	0.61	0.81
		(4.90)	(4.84)	(6.46)	(6.29)	(6.57)
HS diploma		–4.68	–4.84	–5.06	–4.34	–3.26
		(4.14)	(4.11)	(5.66)	(5.48)	(5.65)
Some college		–0.74	–1.08	–1.90	–1.05	–0.45
		(4.47)	(4.39)	(5.55)	(5.33)	(5.61)
College degree		19.88	19.10	15.02	15.20	16.18
		(5.89)***	(5.94)***	(5.42)***	(5.36)***	(5.44)***
HH income						
< $20k	Omitted					
$20k–$40k		–3.37	–3.64	–4.50	–4.98	–4.53
		(3.02)	(2.96)	(2.68)*	(2.67)*	(2.65)*
$40k–60k		9.97	9.69	6.96	6.55	6.14
		(4.48)**	(4.65)**	(4.00)*	(3.91)*	(3.89)
$60k–$75k		–2.39	–3.77	–4.70	–4.38	–4.61
		(5.05)	(5.13)	(5.39)	(5.32)	(5.41)
$75k–$100k		4.30	3.83	4.48	4.39	4.10
		(5.34)	(5.35)	(5.04)	(5.04)	(4.87)
$100k–$150k		3.63	3.79	0.97	0.57	1.72
		(7.81)	(7.81)	(7.29)	(7.32)	(7.40)
> $150k		19.12	18.60	11.92	12.32	12.15
		(6.37)***	(6.31)***	(6.76)*	(6.62)*	(6.78)*
Base controls	No	No	No	Yes	Yes	Yes
"Other activities"	No	No	No	No	Yes	Yes
State FE	No	No	No	No	No	Yes
Adjusted R^2	0.01	0.06	0.07	0.14	0.15	0.15

Note. $N = 5{,}058$. Standard errors (in parentheses) are clustered at the state level. All regressions are weighted by ATUS sampling weights that adjust for unequal probabilities of sample selection. ATUS = American Time Use Survey; OLS = ordinary least squares; R = respondent; HS = high school; HH = household; FE = fixed effects. *$p < .10$. **$p < .05$, ***$p < .01$.

and parents' educational attainment. However, controlling for academic achievement, educational expectations, and parental involvement in column 4 eliminates the significant gap in weekly homework time by maternal education, suggesting that the unconditional SES gap was driven by these factors.

Ninth-grade GPA is positively associated with homework time in all specifications, and the effect is substantively large: A one point increase in GPA is associated with almost one additional hour of homework per week. Performance on English Language Arts (ELA) and mathematics standardized tests is positively associated with homework time.

Heterogeneity in Gender Gaps in Homework Time

Table 4 reports estimates of the conditional gender gap in fully specified ATUS and ELS versions of Equation 1 separately by student type. Each coefficient comes from a unique regression. The first row provides context by reproducing the conditional

Table 3
Weekly Homework Time Use Regressions (ELS, All Students, OLS Estimates)

	1	2	3	4	5	6
Male	–1.26	Omitted	–1.29	–0.89	–1.00	–0.92
	(0.14)***		(0.13)***	(0.12)***	(0.12)***	(0.11)***
R's father						
No HS	Omitted					
HS diploma		–0.01	–0.03	–0.10	–0.13	–0.12
		(0.18)	(0.17)	(0.17)	(0.17)	(0.17)
Some college		0.74	0.76	0.31	0.26	0.23
		(0.20)***	(0.19)***	(0.19)	(0.19)	(0.21)
College degree		1.53	1.49	0.66	0.59	0.27
		(0.27)***	(0.27)***	(0.26)**	(0.25)**	(0.25)
R's mother						
No HS	Omitted					
HS diploma		0.00	0.03	–0.00	–0.05	–0.05
		(0.21)	(0.21)	(0.25)	(0.25)	(0.21)
Some college		0.06	0.10	–0.14	–0.17	–0.25
		(0.22)	(0.21)	(0.25)	(0.25)	(0.22)
College degree		0.75	0.80	0.14	0.08	–0.23
		(0.28)***	(0.26)***	(0.24)	(0.24)	(0.25)
HH income						
< $20k	Omitted					
$20k–$35k		–0.02	–0.00	–0.22	–0.19	–0.32
		(0.23)	(0.23)	(0.19)	(0.18)	(0.19)*
$35k–$50k		0.13	0.19	–0.14	–0.18	–0.27
		(0.19)	(0.19)	(0.17)	(0.16)	(0.19)
$50k–$75k		0.30	0.34	–0.18	–0.23	–0.46
		(0.19)	(0.19)*	(0.15)	(0.15)	(0.18)**
$75k–$100k		0.39	0.44	–0.15	–0.27	–0.65
		(0.23)	(0.23)*	(0.24)	(0.23)	(0.25)**
$100k–$200k		0.78	0.83	0.03	–0.02	–0.78
		(0.26)***	(0.27)***	(0.28)	(0.27)	(0.29)***
> $200k		2.29	2.34	1.54	1.42	–0.09
		(0.59)***	(0.58)***	(0.52)***	(0.52)***	(0.49)
Academic achievement						
9th-grade GPA				0.82	0.70	0.80
				(0.10)***	(0.10)***	(0.10)***
Bottom Q ELA				–0.53	–0.52	–0.33
				(0.16)***	(0.16)***	(0.17)*
Middle 2 Q ELA	Omitted					
Top Q ELA				0.35	0.38	0.09
				(0.19)*	(0.19)*	(0.19)
Bottom Q Math				–0.76	–0.72	–0.49
				(0.23)***	(0.23)***	(0.21)**
Middle 2 Q Math	Omitted					
Top Q Math				0.70	0.67	0.10
				(0.18)***	(0.17)***	(0.18)
Base controls	No	No	No	Yes	Yes	Yes
"Other activities"	No	No	No	No	Yes	Yes
Course FE	No	No	No	No	No	Yes
School FE	No	No	No	No	No	Yes
Adjusted R^2	0.01	0.03	0.05	0.12	0.14	0.20

Note. $N = 13{,}210$. Standard errors (in parentheses) are clustered at the state level. All regressions are weighted by sampling weights that adjust for unequal probabilities of sample selection. ELS = Educational Longitudinal Study of 2002; OLS = ordinary least squares; R = respondent; HH = household; HS = high school; Q = quartile; ELA = English Language Arts; FE = fixed effects; GPA = grade point average.
*$p < .10$. **$p < .05$, ***$p < .01$.

Table 4
Heterogeneity in Conditional Gender Gaps in Homework Time

	ATUS		ELS	
Sample	Male Coefficient	*N*	Male Coefficient	*N*
Full	–16.00	5,058	–0.92	13,210
	(2.50)***		(0.11)***	
Low income	–18.96	1,108	–0.51	1,870
	(7.27)**		(0.51)	
High income	–16.17	851	–0.83	1,970
	(7.63)**		(0.44)*	
Mother has college degree	–16.82	1,955	–0.69	5,480
	(5.29)***		(0.26)**	
Mother has ≤ high school diploma	–12.34	2,320	–0.96	5,630
	(2.44)***		(0.22)***	
Single parent	–21.50	1,478	–0.61	2,870
	(4.15)***		(0.30)**	
Married parents	–14.94	3,402	–0.90	10,220
	(3.44)***		(0.12)***	
Top quartile ELA	NA		–0.98	3,660
			(0.32)***	
Bottom quartile ELA	NA		–0.84	2,900
			(0.23)***	
Top quartile math	NA		–1.61	3,690
			(0.31)***	
Bottom quartile math	NA		–0.61	2,760
			(0.26)**	
High GPA (≥3.0 on 4-point scale)	NA		–0.93	5,770
			(0.23)***	
Low GPA (≤2.0 on 4-point scale)	NA		–0.68	2,650
			(0.24)***	

Note. Each cell reports the estimated coefficient on the male indicator in a unique regression for a specific subsample of students. Standard errors (in parentheses) are clustered at the state level. All regressions are weighted by sampling weights that adjust for unequal probabilities of sample selection. These specifications are otherwise identical to those in Column 6 of Tables 2 and 3, respectively. Both models condition on basic controls. The ATUS regressions condition on state fixed effects (FE) and the ELS regressions condition on school and coursework FE. ATUS = American Time Use Survey; ELS = Educational Longitudinal Study of 2002; GPA = grade point average; ELA = English Language Arts.
*$p < .10$. **$p < .05$, ***$p < .01$.

gender gaps observed in the full ATUS and ELS samples previously reported in Column 6 of Tables 2 and 3. The next two rows estimate the fully specified model separately for low-income and high-income households. Gender gaps in daily homework time in the ATUS are slightly larger in low-income than in high-income households, though the gaps are similar in size and statistically significant in both cases. Interestingly, the gender gap in the low-income ELS sample is smaller than in the full sample and loses its statistical significance as the estimated standard error increases by a factor of five. However, the 0.5 hour gap still favors female students in low-income households. The gender gap of about 0.8 hours in high-income households is marginally statistically significant, due to a four-fold increase in the standard error.

The next two sets of estimates examine the conditional gender gap separately by maternal education. The ATUS estimates suggest that the gender gap is slightly larger among children whose mothers hold a college degree, though the gender gap remains sizable and statistically significant among the children of less educated mothers. The opposite pattern is true in the ELS data, though once again the gender gap remains sizable and statistically significant in both subsamples. The ATUS and ELS provide conflicting evidence on whether gender gaps are larger among the children of married parents than among the children of single parents, though the gaps are sizable and statistically significant among both groups. Like in the case of income, these results suggest that while subtle differences exist between sociodemographic groups, significant conditional gender gaps in homework exist across the socioeconomic spectrum.

The remainder of Table 4 investigates differences in the conditional gender gap in non-school study time by students' academic ability and performance. Regarding ability, we estimate the fully specified model separately for students who scored in the top and bottom quartiles of the standardized tests. In both subjects, the gender gap is larger among higher achieving students. This is particularly true in math, where the gender gap among students who scored in the top quartile is one hour larger

than the still sizable gender gap among students who scored in the bottom quartile. A similar pattern is observed when students are sorted by ninth-grade GPA: The gender gap is more pronounced among students who earned higher grades than among students who earned lower grades. Still, the conditional gender gap remains sizable and statistically significant among lower performing students.

Discussion and Conclusion

The current study uses time diary data from the American Time Use Survey and survey data from the Educational Longitudinal Study of 2002 to examine gender gaps in secondary students' non-school study time. These complementary data sets provide consistent evidence of a statistically significant gender gap in weekly homework time of about one hour that is robust to the regression specification and to conditioning on rich sets of covariates including daily activities, parental involvement, educational expectations, coursework, academic ability and performance, and school fixed effects. The daily gap in ATUS homework time is primarily driven by decisions made along the intensive margin as a gender gap of 14 minutes per day remains after conditioning on spending at least some time on homework. While subtle differences in the gender gap exist by students' SES, a sizable, significant gap favors females in most subsets of the student population. Moreover, we find no evidence that the gender gap is driven by students' participation in extracurricular activities, employment outside the home, or caring for household children. The gap is largest among high-achieving students. Participating in child care did not significantly reduce homework time, perhaps because it was passive child care during which the respondent also completed homework, which is consistent with research that finds females are more likely to multitask while doing homework than males (Pabilonia, 2014).

While this descriptive analysis identifies the presence of SES and gender homework gaps and rules out many plausible explanations, it is unable to identify the causes of such gaps. Schneider, Wallsworth, and Gutin (2014) argue that gaps might arise from mothers who experience competition in the workplace subsequently encouraging their daughters to work harder in school. Indeed, the authors find that gender gaps in homework are driven by students who feel more competitive. This suggests that underlying factors such as interest and motivation are malleable. Qualitative and small-N research that further investigates why females, particularly high-achieving and high-SES females, spend significantly more time on homework than observationally similar males would likely prove fruitful as the lack of nuanced information on students' interest, motivation, and goals is a limitation of the data sets analyzed in the current study. Similar analyses should be conducted in other countries as well, as social and cultural attitudes toward homework are likely context dependent.

The SES and gender gaps in homework time documented in the current study are consistent with hypotheses that the SES gap and the reversal of the gender gap in U.S. college completion rates are at least partly attributable to corresponding SES and gender gaps in noncognitive skills that originate in childhood and persist into young adulthood (Jacob, 2002; Lundberg, 2013). Time spent on homework is unique in that it both indicates possession of certain skills *and* facilitates learning and the development of new skills. Moreover, it is a marker for effort that students are likely to put toward future educational attainment (Cavanaugh et al., 2006). It is therefore important that future research identifies the origins of gender and SES gaps in homework time, the causal relationships between such gaps and long-run socioeconomic outcomes, and the policy levers that influence productive non-school study time.

NOTES

[1]Appendix Table A.1 (available on the journal website) summarizes the missing data in both surveys. Almost 1,000 cases in the Educational Longitudinal Study of 2002 (ELS) are missing either sex or homework time. To investigate patterns in data missingness, we regressed a variety of student socioeconomic status (SES) and academic performance variables on a "missing homework or gender" indicator, sometimes controlling for school fixed effects and sometimes not. Estimated coefficients on "missing" reflect the mean difference between students that were and were not missing at least one of these key variables. Estimated intercepts represent the means for students who were not missing either homework or gender. The estimates, presented in Appendix Table A.2 (available on the journal website) show that students who are missing either gender or homework data tend to be slightly lower achieving (about 6% to 10% lower GPA and test scores) and about 30% less likely to have a college-educated mother. There are generally no significant differences by household income. This suggests that there is some modest positive selection into the analytic sample. However, this is not likely to overturn the general results of our analysis because Table 5 shows significant gender gaps in all SES and achievement-level subsets of the analytic sample.

[2]The American Time Use Survey (ATUS) does not measure how in-school time is spent, so in-school homework time cannot be computed in the ATUS.

[3]The series of bivariate LPM estimates reported in Appendix Table A.5 (available on the journal website) shows that these differences are generally statistically significant.

[4]Source: http://www.census.gov/hhes/www/poverty/data/threshld/.

[5]Appendix Table A.7 (available on the journal website) documents a significant gender gap in participation in extracurricular activities that favors males. Further analysis of this gap falls outside the scope of the current study, but is worth considering in future research.

[6]Point estimates and standard errors are reported in Appendix Table A.11 (available on the journal website).

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