**Does High School Homework Increase Academic Achievement?**

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Abstract: Although previous research has shown that homework improves students’ academic achievement, the majority of these studies use data on students’ homework time from retrospective questionnaires, which may be less accurate than time-diary data. We use data from the combined Child Development Supplement (CDS) and the Transition to Adulthood Survey (TA) of the Panel Study of Income Dynamics to explore the effects of time spent on homework while attending high school on two measures of academic achievement: high school GPA and college attendance by age 20. We find that homework time has positive effects on academic achievement for boys.

Keywords: Academic achievement, homework, GPA, human capital, education

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1. **Introduction**

Employment has been shown to reduce the time high school students spend on homework (DeSimone 2006; Kalenkoski and Pabilonia 2009; Kalenkoski and Pabilonia 2012). In addition, while employment can potentially provide students with valuable work experience, some researchers have found that employment and working many hours while in high school negatively affect academic outcomes such as high school grades and the probability of completing high school (Lillydahl 1990; Ruhm 1997; Oettinger 1999; Tyler 2003; DeSimone 2006; Dustmann and Van Soest 2007; Montmarquette et al. 2007). Thus, one potential channel through which high school employment has a negative effect upon academic achievement is through its effects on homework time. However, only a few economic studies (Betts 1996; Aksoy and Link 2000; Eren and Henderson 2008) have directly investigated this channel, and they have examined the effects of completed or assigned homework in high school classes on students’ performance on math tests only, finding positive effects. Studies of middle school students (Eren and Henderson 2011) and college students (Stinebrickner and Stinebrickner 2008; Grodner and Rupp 2013) similarly have found that homework improves students’ performance on math and other tests as well as first-semester grade point averages (GPA).[[1]](#footnote-1) A concern with these studies, however, is that the majority are based on retrospective questionnaire data that provide information about assigned or completed homework during a typical week, which may not be accurate and also may be subject to social desirability bias. Time-diary data, on the other hand, are more accurate because of a shorter recall period and are not subject to social desirability bias because they are collected for all activities over an entire 24-hour period rather than just for specific activities (Juster, Ono, and Stafford 2003). In addition, time-diary data may be more detailed than questionnaire data if they capture the presence of secondary activities (i.e., activities performed at the same time as a reported main activity) that the usual survey questions do not.

Unfortunately, most time-diary data sets do not contain information on the future outcomes of those completing the diaries and thus are limited in the questions they can answer.[[2]](#footnote-2) One data set that does have both homework and outcome information, however, is the combined Child Development Supplement to the Panel Study of Income Dynamics (PSID-CDS) and its follow-up, the Transition to Adulthood Study (TA). Students participate in the TA a few years after participating in the CDS. The CDS data provide information on homework time from two time diaries, one for a weekday and the other for a weekend day. The TA data provide information on high school GPA and college attendance.

We measure homework time in four ways. Three of our measures account for the fact that multitasked homework may be less productive than sole-tasked homework. These include total homework time (homework performed as either a primary or secondary activity), time spent doing homework as a primary activity (homework may be combined with another activity but homework is deemed the more important activity by the respondent), and time spent doing homework as a sole activity (homework performed when no other activities were also being performed). Our fourth measure examines whether students did any homework during their two diary days. This is used as a measure of homework frequency. This last measure is included because Trautwein (2007) found a positive effect of homework frequency on achievement. Using each of these measures alternately, we estimate the effects of time spent on homework on high school GPA and college attendance by age 20, both long-term measures of academic achievement. We also examine whether these effects differ by gender, given substantial differences in how girls and boys spend their time. Because homework, however we measure it, is potentially endogenous given that an omitted factor, such as ability or motivation, may affect both homework time and academic performance directly, we include an extensive list of control variables in our analyses which may affect or be correlated with these unobserved factors. These variables include test scores, demographic and family background information, school-level characteristics, region, and whether or not a state mandates a college-entrance exam for high school students. Given the potential for remaining endogeneity and/or measurement error bias, we also use an instrumental variable approach when it is feasible to do so. Our results show that time spent on homework, however measured, has no effect on the long-term academic achievement of high school girls. However, the results do show that time spent on homework positively affects the long-term academic achievement of boys.

1. **Data**

The data used in our analyses primarily come from all waves of the CDS (1997, 2002-2003, 2007-2008) and TA (2005, 2007, 2009, and 2011) (PSID 2013). Information about children aged 0-12 first was collected in the 1997 CDS (CDS1) and additional information about them was collected in the 2002-2003 CDS (CDS2) when they were aged 5-19 and in the 2007-2008 CDS (CDS3) when they were aged 10-19. Even more information about former CDS respondents is provided in the TA for those aged 18 and older at the time of that survey. The CDS1 provides background information on the parent/caregiver of the CDS child as well as information on the child’s race. The CDS2 and CDS3 provide time-diary information for a weekday and a weekend day for a subset of CDS children, with diaries collected for up to two children per family. Each randomly assigned diary day records the child’s primary and secondary activities from midnight to midnight. By the time the child was in high school, most filled out the diaries themselves instead of the parent. The TAs provide information on high school GPA and college attendance for high school graduates. We obtain information on each child’s gender, family structure, parental education, and family income from the main PSID survey.[[3]](#footnote-3) We also control for school-level characteristics by matching our sample to the NCES’ Common Core of Data (CCD) using school identifiers from the restricted-use version of the PSID-CDS.

In the CDS2 and CDS3, there were 1,648 students who attended grades 9 through 12. We limit our sample to eventual high school graduates.[[4]](#footnote-4) We further exclude those who did not complete both a weekday and a weekend day diary, those who completed their time diaries over winter break or on any day in June when they did not attend school,[[5]](#footnote-5) those who were missing the child interview in 2007, those who were missing information on race, one respondent whose family income was negative, those who were missing TA information on college attendance by age 20, those who were missing a diary date, those who attended private school, and those who were missing a 2003 main family interview. This leaves us with an analysis sample of 817 respondents that includes 440 females and 377 males. Online Appendix Table A1 provides further details on sample construction.

Our measures of academic achievement are a continuous measure for high school GPA that ranges from 0 to 100 and an indicator variable for college attendance by age 20.[[6]](#footnote-6)  College attendance by age 20 is equal to 1 if a respondent attended college before the month of his or her 20th birthday and 0 otherwise.[[7]](#footnote-7)

Our key explanatory variables are total weekly hours spent doing homework, weekly hours spent doing homework as a primary activity, weekly hours spent doing homework as a sole activity, and an indicator for whether any homework was performed over the two diary days. Total homework time includes all time spent on homework regardless of whether it was reported to be the main activity. Primary homework time may be multitasked time; however, it may be a measure of higher quality homework time than total homework time because it includes homework time only when homework is reported as the main (or viewed by the student as the most important) activity. Time spent doing homework as a sole activity may be a measure of even higher quality homework because it captures homework time when homework is the only activity being performed. One study by Rosen, Carrier, and Cheever (2013) found that those who checked Facebook while studying had lower GPAs. A study by Pool, Koolstra and van der Voort (2003) found that those who watched TV simultaneously while studying completed their homework less accurately. Any homework is a measure of the frequency of homework performed.

Because we have only two days of time-diary information, one weekday and one weekend day, we constructed each of our weekly homework measures by multiplying the weekday time spent by 5, multiplying the weekend day time spent by 2, and then adding these two products together, as in Hofferth (2010). A disadvantage of time-diary data compared to survey data is that time diaries usually cover only one or two days of a person’s time use. Given that we are interested in examining the effect on future outcomes of time spent on homework during a student’s high school career, our time-use variables, which are based on two diary days, may be measured with error, biasing our estimated effects toward zero. However, this criticism applies to many survey data questions as well, as they often measure “usual” or “last week’s” activity. Instrumental variables techniques are one way to correct for measurement error (Frazis and Stewart 2012). However, it is difficult to find instruments that predict homework over the long term for all of our homework measures. Therefore, while we are able to use an instrumental variables approach for two of our homework measures (total homework and primary homework) when examining effects for boys, we are not able to do so for the other homework measures for boys or for any of the measures for girls.

All four of our homework measures include the following activity codes: 5040 (using a computer for homework, studying, or research), 5192 (being tutored), 5490 (general homework/studying), 5491 (non-computer-related homework), 5492 (studying, research, reading related to classes, or working on school project), 5493 (“Went to library”), and 5494 (reviewing homework with a parent/caregiver). Common activities performed while doing homework were listening to music and watching TV (Pabilonia 2015). Our measures do not capture homework done while in class.

Given the potential endogeneity of homework time, we control for a rich set of individual, family, and school characteristics. Our individual controls include indicators for being female, being black or Hispanic, the Census region of residence in high school, and a set of year dummies indicating the year prior to the student’s graduating high school. The year dummies control for the fact that students are interviewed in different grades and in different time periods.[[8]](#footnote-8)  We also control for whether or not a student was living in a state that required all high school students to take a college-entrance exam because this could affect a student’s motivation. Because some students are tracked in high school according to ability, and thus higher-ability students may be assigned more homework than others, one might be concerned about omitted variable bias if a measure of ability is not included as an explanatory variable in the analyses. To alleviate this concern, we include age-adjusted broad-reading and applied-problems standardized test scores from the Woodcock-Johnson Revised Tests of Basic Achievement (WJ-R) to control for ability.[[9]](#footnote-9) These scores are from the CDS interview occurring five years prior to the CDS high school interview and are more likely to measure inherent ability than tests administered during high school.

We control for several family characteristics, including the number of other household children under age 20, average real family income over the five years prior to the time diary and its square, and indicators for whether the mother has a college degree, mother’s degree is missing, whether the student lives with a single mother, and whether the student lives in some other family arrangement that is not a two-parent family.[[10]](#footnote-10) We also control for three school-level characteristics: the fraction of the respondent’s high school that was white (averaged over the respondent’s high school years)[[11]](#footnote-11), the fraction of the respondent’s high school that was free- or reduced-price-lunch eligible (also an average over the respondent’s high school years), and the respondent’s high school’s student-teacher ratio (also an average over the respondent’s high school years).[[12]](#footnote-12) [[13]](#footnote-13) In the instrumental variable specifications, we need a variable to identify homework in the outcome equations, in other words, a variable that is expected to affect how much time is spent on homework but that is otherwise uncorrelated with high school GPA and college attendance. It must predict a long-run measure of homework, that is, one that affects total time spent studying in high school, not just studying on a specific day, in order to address the potential measurement issue as well as the endogeneity issue (Frazis and Stewart 2012). Therefore, we use an indicator for whether or not a student was older than the state minimum driving age at the time of his or her weekday diary report. Eligibility for a driver’s license provides a student with more opportunities for work and socializing, which could leave less time for homework. Due to different birth dates and state driver’s licensing rules, students will encounter this eligibility at different points in their high school careers. Therefore, this is an exogenous source of variation that affects time spent on homework over the course of a high school career but not high school GPA or college attendance directly.

1. **Descriptive statistics**

For our sample of 817 high school graduates, Table 1 provides the weighted means for all variables used in the analyses and the standard deviations for the continuous variables. The outcome variables are presented first. The average high-school GPA was 81 out of 100. Girls had slightly higher GPAs than boys (83 versus 79 out of 100). Eighty-eight percent of high school graduates enrolled in college by the age of 20.

[Table 1 near here]

On average, students did 6.4 hours of total homework (primary plus secondary) over the course of a week. Girls engaged in 7.6 hours of total homework while boys averaged 5.2 hours. These means may surprise some, given a popular belief that children today are assigned too much homework (Lahey 2012).[[14]](#footnote-14) However, these weekly averages are not that different from retrospective questions on homework per week in recent history. Using the National Education Longitudinal Study of 1988 (NELS), McMullen (2011) found that 10th graders in 1990 did about 8 hours of homework per week and 12th graders in 1992 did about 14 hours of homework per week, including homework that they did while in school.[[15]](#footnote-15) According to the Higher Education Research Institute at UCLA (Loveless 2014), only 33 percent of college freshman in 2002 reported spending six or more hours per week doing homework in their senior year.

The average time spent in homework as a primary activity is, of course, smaller than that for total homework because it does not include homework performed as a secondary activity, but girls still have a higher average than boys (7 hours versus 5 hours). The results also show that students often are doing other things while doing their homework. Time spent doing homework as a sole activity is roughly half the amount of total homework time, with an average of 3.6 hours for girls and 2.4 hours for boys.

Over the course of the two observed diary days, 66 percent of students did some homework outside of school hours, but there were large differences in homework frequency by gender. While 72 percent of females did some homework outside school hours, only 58 percent of males did some homework. These figures are consistent with measures from other time-diary data from the American Time Use Survey (ATUS). Using these data, Kalenkoski and Pabilonia (2012) found that, on any given school day, only 51 percent of teenagers aged 15-18 did some homework and that, on any given non-school day, only 29 percent of teenagers did some homework. In addition, according to the 2008 National Assessment of Educational Progress (NAEP) (Loveless 2014), about 28 percent of all seventeen year olds were not assigned any homework and another 12 percent did not do their homework the day before. Loveless (2014) also shows that 17 year olds did not significantly change the amount of homework they did over the 1984-2012 period. In addition, in 2004, 12 percent of 17-year-old respondents to the NAEP reported doing no homework on a “usual” day while another 12 percent reported doing more than two hours.

Table 2 shows differences in hours spent on homework across GPA quartiles and between those attending or not attending college by age 20. Panel A shows the results using the total homework measure, Panel B shows the results using the homework as a primary activity measure, Panel C shows the results using the homework as a sole activity measure, and Panel D shows the results using the any homework measure. Regardless of measure, those students in the top GPA quartile did statistically significantly more homework, on average, than those in the bottom GPA quartile. Those in the top GPA quartile also did more than those in the middle quartiles though the difference was not statistically significantly different for the homework as a sole activity measure. In every quartile, girls did more homework than boys. On average, students who attended college did about two hours more homework than those who did not. The difference in homework time by college attendance was largest for boys. Boys who attended college did 3.22 hours more homework than those who did not. Differences in average homework time between girls who attended college and those who did not were not statistically significant. However, even girls who did not attend college did more homework than boys who attended college.

[Table 2 near here]

1. **Econometric analyses**

For high school GPA, we first estimate the following linear regression model using Ordinary Least Squares (OLS):

Z = b0 + b1\*H + b2\*X + u (1)

where Z represents high school GPA; b0, b1, and b2 are the coefficients to be estimated; H is a measure of time spent on homework, X is the matrix of control variables, and u is a normally-distributed error term. The subscripts indicating observation are suppressed. For college attendance, which is a discrete outcome, we estimate a probit model via maximum likelihood:

Y\* = a0 + a1\*H + a2X + e (2)

Y = 1 if Y\* > 0

Y = 0 otherwise

where Y\* is the latent variable representing the net benefit of attending college; Y is the observed outcome; a0, a1, and a2 are the coefficients to be estimated; and e is a normally-distributed error term. As in (1), the subscripts indicating observation are suppressed.

Table 3A shows the effects of weekly total homework time on high school GPA and college attendance by age 20, for all students and broken down by gender.[[16]](#footnote-16) Estimates provided for the GPA equations are OLS estimates and estimates provided for the college attendance models are average marginal effects. All estimates are weighted using survey weights and standard errors are adjusted for clustering on state because we include some state-level regressors (Cameron and Miller 2015). Given the potential endogeneity of total homework time due to omitted factors such as ability and motivation, the results for five different specifications are shown in the table, with the first a parsimonious specification including only homework time and a constant and each subsequent specification adding an additional group of explanatory variables.

[Table 3A here]

The first specification, which includes only a constant term and the total homework measure, shows that total homework time is positively and statistically significantly correlated with students’ GPA, although the magnitude of the estimated coefficient is very small in absolute value (0.186).[[17]](#footnote-17) This small positive association is primarily driven by girls, with a statistically significant correlation of 0.162. The estimated coefficient on total homework in the boys’ specification is not statistically significantly different from zero. In the college attendance model, total homework is positively and statistically significantly correlated with the probability of college attendance. This association is largely driven by boys, where a one hour per week increase in total homework time is associated with an increase in the probability of college attendance by 0.010. There is no statistically significant association for girls.

One might expect that unobserved ability might be biasing the effects of homework upwards because higher-ability students may take more advanced courses and thus may be assigned more homework. Therefore, in Specification 2, we add standardized pre-high-school test scores as a measure of student ability. Inclusion of these test-score variables increases the adjusted R2 and Pseudo R2 in all specifications and they are jointly significant in all specifications. As expected, the estimated coefficients on total homework time in both the GPA and college attendance models all diminish in magnitude when these test scores are added to the models. The overall association of total homework with GPA falls to 0.151 percentage points and is still statistically significant; however, the estimated associations using the separate girl and boy samples are not statistically significant. For the college attendance models, the association with total homework becomes statistically insignificant for the full sample with the inclusion of test scores but the effect is still statistically significant for boys at 0.008. There is little change in the effect for boys when we include additional control variables.

Omitting variables representing demographic and family background might also bias the association with total homework time. For example, different cohorts of students in the sample may have been assigned different levels of homework. In addition, students with better family backgrounds may do more homework due to better parental supervision and emphasis on education. Adding these variables in Specification 3 further significantly diminishes the association of total homework with GPA and the coefficient becomes statistically insignificant for the full sample and remains statistically insignificant for the boy and girl subsamples. However, the estimated association of total homework with the probability of college attendance increases slightly for boys from 0.008 to 0.009. Again, the adjusted R2 and Pseudo R2 increase when these variables are added, and the additional variables are jointly significant in each specification.

Upward bias may still remain, however, if better schools assign more homework. When we add school-level controls in Specification 4, the estimated associations with total homework remain statistically insignificant for all GPA specifications and for the college attendance specifications for the full sample and for the female sample. The estimated association for boys in the college attendance specification falls slightly from 0.009 to 0.008. Including the school-level control variables does increase the adjusted R2 and Pseudo R2, but the school-level variables are only jointly statistically significant at conventional levels in the GPA specifications for males.

Finally, Specification 5 includes indicators for region and whether or not the state of residence requires high school students to take a college-entrance exam in order to control for geographic differences in cultural attitudes toward education, which may affect both the amount of time spent on homework and long-term academic performance. Given the group of variables included, it is not clear a priori whether the suspected bias is upward or downward. However, while the estimated effects of total homework time that were insignificant in the previous specification remain insignificant, the effect of total homework time for males on the probability of college attendance remains statistically significant but falls from 0.008 to 0.007. A one standard deviation increase in total weekly homework time (7.62 hours per week) would increase the probability of college attendance by 0.056. The adjusted R2 increases in the all-student- and male-student-GPA specifications and the Pseudo R2 increases in all specifications when this additional group of variables is included. The additional variables are jointly significant in all college attendance specifications.

[Table 3B here]

Table 3B reports results for specifications similar to those in Table 3A but the homework measure is now primary homework time. As additional controls are added to the model in each specification, the estimated associations of primary homework time with GPA and college attendance diminish for girls. For boys, however, an additional hour of homework performed as a primary activity is estimated to increase the probability of college attendance by 0.007, which is similar to the effect of an additional hour of total homework time, which is not surprising given how little homework is reported to be done as a secondary activity.

[Table 3C here]

Table 3C reports the effects of homework performed as a sole activity on the outcome measures. Unlike the results we obtained for the previous two homework measures that we examined, the positive association of GPA with sole-tasked homework time is driven by boys, not girls, though still small in magnitude. When only time spent in homework as a sole activity and a constant are included in the GPA regression (Specification 1), an increase of one hour per week is associated with an increase in boys’ GPA by 0.278 percentage points on average. Adding test scores decreases this association as expected due to the upward bias caused by omitting ability measures in the prior specification. However, adding in the remaining controls increases the effect of sole-tasked homework on boys’ GPA to 0.358 percentage points (Specification 5). A one-standard-deviation increase in sole-tasked homework time (4.29 hours per week or almost one additional hour per school night) will increase a boy’s GPA by only 1.537 percentage points. Given that we find no effect of homework time on GPA for either total homework or primary homework, this strong and statistically significant result for sole-tasked homework suggests that boys’ GPAs benefit from time spent doing homework without any other distractions. Distractions appear to negate the positive effect of doing homework. The effects of sole-tasked homework on college attendance are similar to those in the previous two tables, however, with an increase of an additional hour of sole-tasked homework increasing the probability of college attendance for boys by 0.008. A one-standard-deviation increase in sole-tasked homework time will increase a boy’s probability of college attendance by 0.034.

[Table 3D here]

Table 3D reports results using an indicator for “any homework” as the homework measure. In specification, we find a positive and significant correlation between doing “any homework” and our outcomes for males. However, once test scores and demographic and family background variables are included, no statistically significant effects remain and further adding variables to the regression does not change the result that homework time measured in this way does not affect either GPA or college attendance for either boys or girls.

Even though we have included numerous control variables which have reduced the size of our estimates substantially, omitted variable bias may remain. In addition, measurement error may still exist, which would bias our estimates towards zero. In order to explore these biases, we treat the homework as endogenous and use an instrumental variables strategy. We do this by adding the following homework equation to each of the previous models:

H = d0 + d1X + d2W + γ (3)

where W is our instrumental variable, an indicator variable for whether the student was older than the state minimum driving age, to identify homework in the outcome equation, d0, d1 and d2 are the coefficients to be estimated, and γ is an error term. Joint estimation of the outcome equation (either [1] or [2]) and the homework equation (3) is achieved via limited information maximum likelihood using the cmp command in Stata and assumes that the error terms in the outcome and homework equations are jointly normally distributed. We use this method of estimation because joint estimation of the homework equations is more efficient than two-stage estimation such as two-stage least squares (2SLS) because it allows the error terms in the homework and outcome equations to be correlated.

Table 4 presents the effects of time spent on homework on our long-term achievement measures when we control for endogeneity. The model can be estimated for boys only and for the total homework and primary homework measures only given that the instrument is only statistically significant at conventional levels for these specifications.[[18]](#footnote-18) In these instrumental variable specifications, the effects of homework time on the probability of college attendance for boys is not statistically significant as it was in Tables 3A and 3B. However, the estimated marginal effects are similar.

[Table 4 here]

1. **Conclusion**

In this paper, we use time-diary data to examine the effects of high school homework time (measured in four different ways) on two long-term academic outcomes, high school GPA and college attendance by age 20. These data may be more accurate and less subject to social desirability bias than data from retrospective survey questions, and they allow us to examine several different measures of homework. We control for a rich set of variables that includes students’ characteristics, such as early test scores to control for ability, demographic and family background variables, school-level characteristics, and other external factors. Once we do this, all positive associations of homework time with the long-run academic achievement of girls disappear. However, we find that total homework time, time spent in homework as a primary activity, and sole-tasked homework time all substantially increase the probability of college attendance for boys, perhaps because they do significantly less homework than girls on average. In addition, homework time experienced without any distractions has a small positive effect on high-school boys’ GPAs. For some specifications, we used an instrumental variables strategy to control for potential endogeneity bias and measurement error bias, which resulted in no change in the point estimates. If measurement error still exists, these estimates represent a lower bound. However, we have shown that the simple positive correlation between homework and achievement significantly decreases once we control for factors that might reflect students’ ability and motivation.

Other aspects of homework, such as the quality of the assignments, have not been examined in this paper. Studies that examine specific types of homework assignments (reading, writing, etc.) and how they are graded (carefully or points just for turning it in) are needed to discover what types of homework assignments may improve students’ long-run academic outcomes.

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|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Table 1. Weighted Means and Standard Deviations for High School Graduates Sample** | | | | | | |
|  | All  (N =817) | | Females  (N=440) | | Males  (N=377) | |
|  | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| *Dependent Variables* |  |  |  |  |  |  |
| High-school GPA (percent) | 81.25 | 12.51 | 83.36 | 11.47 | 78.84 | 13.16 |
| College attendance by age 20 | 0.88 |  | 0.89 |  | 0.88 |  |
| *Homework Variables* |  |  |  |  |  |  |
| Total homework (primary + secondary activity) | 6.44 | 7.88 | 7.55 | 7.94 | 5.18 | 7.62 |
| Homework as a primary activity | 6.05 | 7.66 | 7.02 | 7.76 | 4.96 | 7.40 |
| Homework as a sole activity | 3.03 | 5.17 | 3.58 | 5.78 | 2.42 | 4.29 |
| Any homework | 0.66 |  | 0.72 |  | 0.58 |  |
| *Test Score Variables* |  |  |  |  |  |  |
| WJ-R broad-reading score 5 years before HS | 108.75 | 15.78 | 109.01 | 15.75 | 108.46 | 15.81 |
| WJ-R applied-problems score 5 years before HS | 111.22 | 15.22 | 108.59 | 14.14 | 114.20 | 15.81 |
| Missing a WJ-R score | 0.13 |  | 0.12 |  | 0.14 |  |
| *Cohort Variables* |  |  |  |  |  |  |
| Year before graduate HS - 2002/2003 | 0.25 |  | 0.24 |  | 0.27 |  |
| Year before graduate HS - 2004 | 0.12 |  | 0.13 |  | 0.11 |  |
| Year before graduate HS - 2005 | 0.13 |  | 0.13 |  | 0.14 |  |
| Year before graduate HS - 2007/2008 | 0.27 |  | 0.27 |  | 0.26 |  |
| *Family Background Variables* |  |  |  |  |  |  |
| Female | 0.53 |  |  |  |  |  |
| Black/Hispanic ethnicity | 0.28 |  | 0.29 |  | 0.27 |  |
| Single mother | 0.20 |  | 0.21 |  | 0.20 |  |
| Other family arrangement | 0.04 |  | 0.03 |  | 0.06 |  |
| Mother college degree (non-missing) | 0.27 |  | 0.28 |  | 0.26 |  |
| Mother education missing | 0.08 |  | 0.06 |  | 0.10 |  |
| Number of other household children < age 20 | 1.13 | 1.11 | 1.21 | 1.14 | 1.04 | 1.05 |
| Average real family income over last 5 years  (in 2006 $1,000s) | 99.08 | 115.54 | 97.52 | 100.66 | 100.85 | 130.05 |
| *School-level Control Variables* |  |  |  |  |  |  |
| Fraction white (average while in high school) | 0.61 |  | 0.60 |  | 0.62 |  |
| Fraction free-or-reduced-price lunch eligible (average while in high school) | 0.37 |  | 0.37 |  | 0.38 |  |
| Student-teacher ratio (average while in high school) | 17.57 | 5.14 | 17.73 | 4.65 | 17.38 | 5.64 |
| Missing school | 0.09 |  | 0.09 |  | 0.08 |  |
| *External Controls* |  |  |  |  |  |  |
| Lived in North Central region in HS | 0.24 |  | 0.25 |  | 0.22 |  |
| Lived in South region in HS | 0.30 |  | 0.32 |  | 0.28 |  |
| Lived in West region in HS | 0.31 |  | 0.29 |  | 0.35 |  |
| State-mandated college entrance exam | 0.08 |  | 0.08 |  | 0.09 |  |
| *Instrument* |  |  |  |  |  |  |
| Older than state minimum driving age | 0.56 |  | 0.53 |  | 0.58 |  |
| Note: These results use CDS child weights. | | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Table 2. Differences in Time Spent on Homework by GPA and College Attendance by Age 20** | | | | | | |
| *Panel A. Total Homework* | | | | |  |  |
|  | GPA bottom quartile | GPA 2nd quartile | GPA 3rd quartile | GPA top quartile  (comparison) | Attend College | Not Attend College |
| All | 5.32\*\*\* | 6.28\*\* | 5.53\*\*\* | 8.53 | 6.68\*\* | 4.60 |
| (N=817) | (8.69) | (8.25) | (6.44) | (7.67) | (7.92) | (6.71) |
| Female | 5.71\*\*\* | 8.10 | 6.48\*\* | 9.16 | 7.63 | 6.88 |
| (N=440) | (7.25) | (8.99) | (6.71) | (7.60) | (7.94) | (7.66) |
| Male | 5.10 | 4.84 | 3.95\* | 6.23 | 5.58\*\*\* | 2.36 |
| (N=377) | (9.99) | (6.72) | (6.69) | (7.03) | (7.76) | (4.17) |
| *Panel B. Homework as a Primary Activity* | | | | |  |  |
|  | GPA bottom quartile | GPA 2nd quartile | GPA 3rd quartile | GPA top quartile  (comparison) | Attend College | Not Attend College |
| All | 5.07\*\* | 5.81\*\* | 5.34\*\*\* | 7.91 | 6.27\*\* | 4.37 |
| (N=817) | (8.67) | (7.99) | (6.17) | (7.44) | (7.72) | (6.25) |
| Female | 5.26\*\* | 7.37 | 6.30\* | 8.47 | 7.09 | 6.43 |
| (N=440) | (7.31) | (8.70) | (6.45) | (7.53) | (7.80) | (7.03) |
| Male | 4.89 | 4.84 | 3.66\* | 5.88 | 5.33\*\*\* | 2.36 |
| (N=377) | (9.92) | (6.72) | (6.28) | (6.64) | (7.53) | (4.17) |
| *Panel C. Homework as a Sole Activity* | | | | |  |  |
|  | GPA bottom quartile | GPA 2nd quartile | GPA 3rd quartile | GPA top quartile  (comparison) | Attend College | Not Attend College |
| All | 2.34\*\* | 2.79 | 3.04 | 3.89 | 3.14 | 2.20 |
| (N=817) | (4.29) | (5.36) | (4.85) | (5.45) | (5.20) | (4.46) |
| Female | 2.77\* | 3.71 | 3.02 | 4.46 | 3.64 | 3.02 |
| (N=440) | (4.66) | (6.62) | (4.51) | (6.08) | (5.79) | (5.51) |
| Male | 1.59\* | 2.42 | 2.48 | 2.95 | 2.56\*\* | 1.39 |
| (N=377) | (3.70) | (3.56) | (4.93) | (4.47) | (4.38) | (2.66) |
| *Panel D. Any Homework* | | | | |  |  |
|  | GPA bottom quartile | GPA 2nd quartile | GPA 3rd quartile | GPA top quartile  (comparison) | Attend College | Not Attend College |
| All (N=817) | 0.64\* | 0.63\* | 0.63\* | 0.74 | 0.67 | 0.60 |
| Female  (N=440) | 0.74 | 0.73 | 0.68 | 0.74 | 0.72 | 0.74 |
| Male  (N=377) | 0.57 | 0.55 | 0.57 | 0.64 | 0.60 | 0.46 |

Notes: Standard deviations are in parentheses. These results use CDS child weights. Significant difference from top GPA quartile or not attend college: \*\*\*p<0.01; \*\*p<0.05; \*p<0.10.

**Table 3A. The Effects of Total Homework Time on Achievement**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **GPA** | | | **College Attendance by Age 20 (Probit)** | | |
|  | **All** | **Female** | **Male** | **All** | **Female** | **Male** |
|  | **(N = 817)** | **(N=440)** | **(N=377)** | **(N = 817)** | **(N=440)** | **(N=377)** |
| ***Specification 1: Constant*** | | | | | | |
| Total Homework | 0.1859\*\* | 0.1618\* | 0.1271 | 0.004\*\* | 0.0012 | 0.0101\*\* |
|  | (0.0878) | (0.0832) | (0.1611) | (0.0017) | (0.0025) | (0.0050) |
| Adjusted R2 | 0.013 | 0.010 | 0.003 |  |  |  |
| Pseudo R2 |  |  |  | 0.012 | 0.001 | 0.037 |
| ***Specification 2: Constant, test scores*** | | | | | | |
| Total Homework | 0.1512\* | 0.1146 | 0.0967 | 0.0031 | -0.0004 | 0.0076\*\* |
|  | (0.0870) | (0.0762) | (0.1607) | (0.0018) | (0.0023) | (0.0033) |
| P-value for joint significance of test score variables | 0.0384 | 0.0001 | 0.0975 | 0.0000 | 0.0000 | 0.0021 |
| Adjusted R2 | 0.049 | 0.085 | 0.029 |  |  |  |
| Pseudo R2 |  |  |  | 0.138 | 0.142 | 0.173 |
| ***Specification 3: Constant, test scores, gender, demographic and family background*** | | | | | | |
| Total Homework | 0.0633 | 0.0818 | 0.0707 | 0.0013 | -0.0020 | 0.0087\*\* |
|  | (0.0734) | (0.0809) | (0.1342) | (0.0016) | (0.0021) | (0.0037) |
| P-value for joint significance of cohort and family background variables | 0.0000 | 0.0517 | 0.0076 | 0.0001 | 0.0000 | 0.0000 |
| Adjusted R2 | 0.126 | 0.092 | 0.098 |  |  |  |
| Pseudo R2 |  |  |  | 0.241 | 0.371 | 0.238 |
| ***Specification 4: Constant, test scores, gender, demographic and family background, school characteristics*** | | | | | | |
| Total Homework | 0.0612 | 0.0770 | 0.0689 | 0.0010 | -0.0019 | 0.0080\*\* |
|  | (0.0706) | (0.0808) | (0.1375) | (0.0017) | (0.0020) | (0.0036) |
| P-value for joint significance of school characteristics | 0.0058 | 0.7232 | 0.0006 | 0.3253 | 0.6587 | 0.2079 |
| Adjusted R2 | 0.137 | 0.090 | 0.126 |  |  |  |
| Pseudo R2 |  |  |  | 0.247 | 0.378 | 0.266 |
| ***Specification 5: Constant, test scores, gender, demographic and family background, school characteristics, external controls*** | | | | | | |
| Total Homework | 0.0426 | 0.0630 | 0.0506 | 0.0004 | -0.0021 | 0.0073\*\* |
|  | (0.0738) | (0.0824) | (0.1420) | (0.0018) | (0.0019) | (0.0035) |
| P-value for joint significance of external controls | 0.2437 | 0.7090 | 0.1833 | 0.0000 | 0.0936 | 0.0025 |
| Adjusted R2 | 0.141 | 0.086 | 0.134 |  |  |  |
| Pseudo R2 |  |  |  | 0.269 | 0.392 | 0.291 |

Note: Survey weights are used. Average marginal effects are presented for probit models. Standard errors are in parentheses and are adjusted for clustering on state. Specification 2 includes WJ-R reading and applied-problems scores and indicators for WJ-R score missing and a constant. Specification 3 also includes the number of household children under age 20, family income and its square, and indicators for gender, race, year prior to the student graduating from high school, lives with single mother, lives in other family arrangement, mother college degree, and mother college degree missing. Specification 4 also includes the fraction of the respondent’s high school that was white, the fraction of the respondent’s high school that was free-or-reduced-price-lunch eligible, the respondent’s high school’s student-teacher ratio, and an indicator for high school missing. Specification 5 also includes indicators for Census region and living in a state that requires college entrance exam. Significance levels: \*\*\* p<0.01; \*\* p<0.05; \* p<0.10.

**Table 3B. The Effects of Homework as a Primary Activity on Achievement**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **GPA** | | | **College Attendance by Age 20 (Probit)** | | |
|  | **All** | **Female** | **Male** | **All** | **Female** | **Male** |
|  | **(N = 817)** | **(N=440)** | **(N=377)** | **(N = 817)** | **(N=440)** | **(N=377)** |
| ***Specification 1: Constant*** | | | | | | |
| Homework as a Primary Activity | 0.1806\*\* | 0.1743\* | 0.1062 | 0.0040\*\* | 0.0011 | 0.0098\* |
|  | (0.0848) | (0.0864) | (0.1583) | (0.0017) | (0.0024) | (0.0052) |
| Adjusted R2 | 0.011 | 0.012 | 0.001 |  |  |  |
| Pseudo R2 |  |  |  | 0.010 | 0.001 | 0.034 |
| ***Specification 2: Constant, test scores*** | | | | | | |
| Homework as a Primary Activity | 0.1448\* | 0.1215 | 0.0789 | 0.0030 | -0.0006 | 0.0074\*\* |
|  | (0.0850) | (0.0799) | (0.1601) | (0.0018) | (0.0024) | (0.0034) |
| P-value for joint significance of test score variables | 0.0378 | 0.0001 | 0.1042 | 0.0000 | 0.0000 | 0.0019 |
| Adjusted R2 | 0.048 | 0.085 | 0.027 |  |  |  |
| Pseudo R2 |  |  |  | 0.137 | 0.142 | 0.171 |
| ***Specification 3: Constant, test scores, gender, demographic and family background*** | | | | | | |
| Homework as a Primary Activity | 0.0641 | 0.0946 | 0.0606 | 0.0012 | -0.0022 | 0.0087\*\* |
|  | (0.0678) | (0.0865) | (0.1345) | (0.0017) | (0.0022) | (0.0037) |
| P-value for joint significance of cohort and family background variables | 0.0000 | 0.0531 | 0.0059 | 0.0001 | 0.0000 | 0.0000 |
| Adjusted R2 | 0.126 | 0.093 | 0.097 |  |  |  |
| Pseudo R2 |  |  |  | 0.241 | 0.372 | 0.237 |
| ***Specification 4: Constant, test scores, gender, demographic and family background, school characteristics*** | | | | | | |
| Homework as a Primary Activity | 0.0586 | 0.0880 | 0.0526 | 0.0009 | -0.0023 | 0.0080\*\* |
|  | (0.0636) | (0.0858) | (0.1348) | (0.0018) | (0.0020) | (0.0036) |
| P-value for joint significance of school characteristics | 0.0058 | 0.7382 | 0.0006 | 0.3163 | 0.6591 | 0.2060 |
| Adjusted R2 | 0.136 | 0.090 | 0.125 |  |  |  |
| Pseudo R2 |  |  |  | 0.247 | 0.379 | 0.265 |
| ***Specification 5: Constant, test scores, gender, demographic and family background, school characteristics, external controls*** | | | | | | |
| Homework as a Primary Activity | 0.0390 | 0.0762 | 0.0313 | 0.0003 | -0.0024 | 0.0072\*\* |
|  | (0.0665) | (0.0873) | (0.1396) | (0.0018) | (0.0020) | (0.0035) |
| P-value for joint significance of external controls | 0.2452 | 0.7211 | 0.1821 | 0.0000 | 0.0962 | 0.0027 |
| Adjusted R2 | 0.141 | 0.087 | 0.133 |  |  |  |
| Pseudo R2 |  |  |  | 0.269 | 0.393 | 0.290 |

Note: Survey weights are used. Average marginal effects are presented for probit models. Standard errors are in parentheses and are adjusted for clustering on state. See Table 3A for list of controls. Significance levels: \*\*\* p<0.01; \*\* p<0.05; \* p<0.10.

**Table 3C. The Effects of Homework as a Sole Activity on Achievement**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **GPA** | | | **College Attendance by Age 20 (Probit)** | | |
|  | **All** | **Female** | **Male** | **All** | **Female** | **Male** |
|  | **(N = 817)** | **(N=440)** | **(N=377)** | **(N = 817)** | **(N=440)** | **(N=377)** |
| ***Specification 1: Constant*** | | | | | | |
| Homework as a Sole Activity | 0.2361\*\*\* | 0.1454 | 0.2784\*\* | 0.0043 | 0.0020 | 0.0098\*\* |
|  | (0.0788) | (0.1196) | (0.1262) | (0.0027) | (0.0034) | (0.0042) |
| Adjusted R2 | 0.008 | 0.003 | 0.006 |  |  |  |
| Pseudo R2 |  |  |  | 0.006 | 0.002 | 0.014 |
| ***Specification 2: Constant, test scores*** | | | | | | |
| Homework as a Sole Activity | 0.1801\*\* | 0.0553 | 0.2408 | 0.0017 | -0.0018 | 0.0060 |
|  | (0.0807) | (0.1108) | (0.1438) | (0.0025) | (0.0033) | (0.0038) |
| P-value for joint significance of test score variables | 0.0382 | 0.0001 | 0.1265 | 0.0000 | 0.0000 | 0.0005 |
| Adjusted R2 | 0.045 | 0.079 | 0.032 |  |  |  |
| Pseudo R2 |  |  |  | 0.132 | 0.144 | 0.158 |
| ***Specification 3: Constant, test scores, gender, demographic and family background*** | | | | | | |
| Homework as a Sole Activity | 0.1036 | 0.0130 | 0.3387\*\* | 0.0014 | -0.0033 | 0.0100\*\* |
|  | (0.0821) | (0.1168) | (0.1341) | (0.0026) | (0.0033) | (0.0042) |
| P-value for joint significance of cohort family background variables | 0.0000 | 0.0257 | 0.0037 | 0.0001 | 0.0000 | 0.0000 |
| Adjusted R2 | 0.126 | 0.089 | 0.108 |  |  |  |
| Pseudo R2 |  |  |  | 0.241 | 0.372 | 0.230 |
| ***Specification 4: Constant, test scores, gender, demographic and family background, school characteristics*** | | | | | | |
| Homework as a Sole Activity | 0.1020 | 0.0013 | 0.3630\*\*\* | 0.0011 | -0.0029 | 0.0093\*\* |
|  | (0.0769) | (0.1109) | (0.1315) | (0.0026) | (0.0031) | (0.0039) |
| P-value for joint significance of school characteristics | 0.0064 | 0.7330 | 0.0004 | 0.3087 | 0.6861 | 0.219 |
| Adjusted R2 | 0.137 | 0.087 | 0.138 |  |  |  |
| Pseudo R2 |  |  |  | 0.246 | 0.378 | 0.260 |
| ***Specification 5: Constant, test scores, gender, demographic and family background, school characteristics, external controls*** | | | | | | |
| Homework as a Sole Activity | 0.0931 | -0.0120 | 0.3583\*\*\* | 0.0005 | -0.0034 | 0.0080\*\* |
|  | (0.0786) | (0.1133) | (0.1288) | (0.0024) | (0.0029) | (0.0035) |
| P-value for joint significance of external controls | 0.2221 | 0.6188 | 0.1401 | 0.0001 | 0.0230 | 0.0061 |
| Adjusted R2 | 0.142 | 0.084 | 0.146 |  |  |  |
| Pseudo R2 |  |  |  | 0.269 | 0.393 | 0.285 |

Note: Survey weights are used. Average marginal effects are presented for probit models. Standard errors are in parentheses and are adjusted for clustering on state. See Table 3A for list of controls. Significance levels: \*\*\* p<0.01; \*\* p<0.05; \* p<0.10.

**Table 3D. The Effects of Any Homework on Achievement**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **GPA** | | | **College Attendance by Age 20 (Probit)** | | |
|  | **All** | **Female** | **Male** | **All** | **Female** | **Male** |
|  | **(N = 817)** | **(N=440)** | **(N=377)** | **(N = 817)** | **(N=440)** | **(N=377)** |
| ***Specification 1: Constant*** | | | | | | |
| Any Homework | 1.8998\* | -0.2230 | 2.5938\* | 0.0315 | -0.0077 | 0.0642\* |
|  | (0.9491) | (1.2092) | (1.5220) | (0.0252) | (0.0373) | (0.0367) |
| Adjusted R2 | 0.004 | -0.002 | 0.007 |  |  |  |
| Pseudo R2 |  |  |  | 0.003 | 0.000 | 0.013 |
| ***Specification 2: Constant, test scores*** | | | | | | |
| Any Homework | 1.6544\* | -0.1978 | 2.1170 | 0.0245 | -0.0109 | 0.0348 |
|  | (0.9106) | (1.0531) | (1.5503) | (0.0262) | (0.0402) | (0.0305) |
| P-value for joint significance of test score variables | 0.0308 | 0.0001 | 0.1392 | 0.0000 | 0.0000 | 0.0008 |
| Adjusted R2 | 0.044 | 0.079 | 0.032 |  |  |  |
| Pseudo R2 |  |  |  | 0.133 | 0.143 | 0.156 |
| ***Specification 3: Constant, test scores, gender, demographic and family background*** | | | | | | |
| Any Homework | 0.6364 | -0.5681 | 1.9482 | 0.0110 | -0.0096 | 0.0484 |
|  | (1.0257) | (1.1525) | (1.5317) | (0.0243) | (0.0322) | (0.0318) |
| P-value for joint significance of cohort and family background variables | 0.0000 | 0.0146 | 0.0068 | 0.0000 | 0.0000 | 0.0000 |
| Adjusted R2 | 0.125 | 0.090 | 0.101 |  |  |  |
| Pseudo R2 |  |  |  | 0.241 | 0.367 | 0.222 |
| ***Specification 4: Constant, test scores, gender, demographic and family background, school characteristics*** | | | | | | |
| Any Homework | 0.6941 | -0.5826 | 2.1374 | 0.0065 | -0.0075 | 0.0418 |
|  | (1.0691) | (1.1695) | (1.6855) | (0.0232) | (0.0281) | (0.0311) |
| P-value for joint significance of school characteristics | 0.0045 | 0.742 | 0.0003 | 0.2955 | 0.654 | 0.2270 |
| Adjusted R2 | 0.136 | 0.088 | 0.130 |  |  |  |
| Pseudo R2 |  |  |  | 0.246 | 0.374 | 0.251 |
| ***Specification 5: Constant, test scores, gender, demographic and family background, school characteristics, external controls*** | | | | | | |
| Any Homework | 0.4569 | -0.8734 | 2.1203 | -0.0009 | -0.0111 | 0.0337 |
|  | (1.1968) | (1.1811) | (1.8046) | (0.0238) | (0.0282) | (0.0317) |
| P-value for joint significance of external controls | 0.2366 | 0.5849 | 0.1214 | 0.0000 | 0.0719 | 0.0040 |
| Adjusted R2 | 0.141 | 0.086 | 0.139 |  |  |  |
| Pseudo R2 |  |  |  | 0.269 | 0.388 | 0.278 |

Note: Survey weights are used. Average marginal effects are presented for probit models. Standard errors are in parentheses and are adjusted for clustering on state. See Table 3A for list of controls. Significance levels: \*\*\* p<0.01; \*\* p<0.05; \* p<0.10.

**Table 4. The Effects of Homework on Achievement with Controls for Endogeneity (LIML) (Males only, N = 377)**

|  |  |  |
| --- | --- | --- |
|  | **GPA** | **College by Age 20** |
| ***Panel A. Total Homework*** |  |  |
| Homework | -1.0201 | 0.0074 |
|  | (0.8069) | (0.0161) |
| *Exclusion restriction:* |  |  |
| Older than state minimum driving age | 3.3160\* | 3.3160\* |
|  | (1.8875) | (1.8875) |
| ρ, correlation coefficient | 0.5382\*\* | -0.0040 |
|  | (0.2972) | (0.6917) |
| ***Panel B. Homework as a Primary Activity*** | |  |
| Homework | -1.0247 | 0.0069 |
|  | (0.8021) | (0.0164) |
| *Exclusion restriction:* |  |  |
| Older than state minimum driving age | 3.3011\* | 3.3011\* |
|  | (1.9668) | (1.8588) |
| ρ, correlation coefficient | 0.5225 | 0.0133 |
|  | (0.3026) | (0.6841) |

Note: Survey weights are used. Average marginal effects are presented for the probit models. Robust standard errors are in parentheses and are adjusted for clustering on state. Regressions include all control variables listed in specification of Table 3A and Table 3B. Significance levels: \*\*\* p<0.01; \*\* p<0.05; \* p<0.10.

**Online Appendix**

**Appendix Table A1. Sample Selection**

|  |  |
| --- | --- |
|  | **Number of Observations** |
| Attend high school in CDS2 or CDS3 (27 dropouts prior to interview) | 1,648 |
| Drop those who didn’t complete both a weekday and weekend day diary | 1,429 |
| Drop those interviewed during winter break and in June when they do not attend school on diary day | 1,287 |
| Drop those missing child interview in 2007 | 1,270 |
| Drop if missing race | 1,266 |
| Drop if family income is negative (1 case) | 1,265 |
| Drop if missing follow-up TA information on education (including high school completion, college attendance by age 20 – but not GPA) | 1,073 |
| Drop those with missing diary date | 1,027 |
| Drop private high school students | 953 |
| Drop if no 2003 main family interview | 949 |
| Drop if did not graduate from high school | 817 |
| **Analysis Sample** | **817** |
| **Females** | **440** |
| **Males** | **377** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table A2. GPA Regressions (Exogenous Homework): Other Coefficient Estimates** | | | | | | | | | |  |  |  |
|  | Total Homework | | | Homework as a Primary Activity | | | Homework as a Sole Activity | | | Any Homework | | |
|  | All | Female | Male | All | Female | Male | All | Female | Male | All | Female | Male |
| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Homework time | 0.0426 | 0.0630 | 0.0506 | 0.0390 | 0.0762 | 0.0313 | 0.0931 | -0.0120 | 0.3583\*\*\* | 0.4569 | -0.8734 | 2.1203 |
|  | (0.0738) | (0.0824) | (0.1420) | (0.0665) | (0.0873) | (0.1396) | (0.0786) | (0.1133) | (0.1288) | (1.1968) | (1.1811) | (1.8046) |
| Female | 4.8981\*\*\* |  |  | 4.9177\*\*\* |  |  | 4.8831\*\*\* |  |  | 4.9425\*\*\* |  |  |
|  | (0.8510) |  |  | (0.8431) |  |  | (0.8188) |  |  | (0.8175) |  |  |
| Black/Hispanic | -2.7302\* | -2.0452 | -2.3435 | -2.7286\* | -2.0377 | -2.3587 | -2.7822\*\* | -2.1244 | -2.8361 | -2.7756\*\* | -2.1287 | -2.5491 |
|  | (1.3731) | (1.8915) | (2.1180) | (1.3714) | (1.9112) | (2.1027) | (1.3644) | (1.8668) | (2.0705) | (1.3304) | (1.8963) | (2.0801) |
| Reading score | 0.0412 | 0.0412 | 0.0593 | 0.0412 | 0.0411 | 0.0588 | 0.0413 | 0.0428 | 0.0648 | 0.0418 | 0.0424 | 0.0560 |
|  | (0.0510) | (0.0499) | (0.0796) | (0.0509) | (0.0498) | (0.0793) | (0.0508) | (0.0500) | (0.0840) | (0.0510) | (0.0496) | (0.0811) |
| Applied-problems score | 0.1073\*\* | 0.1482\*\* | 0.0752 | 0.1073\*\* | 0.1473\*\* | 0.0764 | 0.1055\*\* | 0.1480\*\* | 0.0583 | 0.1073\*\* | 0.1457\*\* | 0.0720 |
|  | (0.0473) | (0.0713) | (0.0598) | (0.0475) | (0.0710) | (0.0606) | (0.0476) | (0.0711) | (0.0637) | (0.0473) | (0.0710) | (0.0637) |
| State-mandated college exam | 1.7116 | -0.1747 | 3.1830 | 1.7185 | -0.1595 | 3.1337 | 1.6570 | -0.2184 | 3.1464 | 1.6562 | -0.1935 | 3.3024 |
|  | (1.4302) | (2.5799) | (2.0212) | (1.4263) | (2.5771) | (2.0364) | (1.4428) | (2.5618) | (1.8854) | (1.4566) | (2.5384) | (2.0141) |
| Lives with single mother | -3.8879\*\* | -1.9082 | -5.9215 | -3.8896\*\* | -1.9210 | -5.8977 | -3.8725\*\* | -1.8387 | -5.7527 | -3.8797\*\* | -1.7505 | -5.8060 |
|  | (1.8660) | (1.4654) | (3.7263) | (1.8597) | (1.4566) | (3.7243) | (1.8856) | (1.4685) | (3.5777) | (1.8960) | (1.5021) | (3.6165) |
| Lives in other family arrangement | -6.3249\* | -6.9019\* | -6.4842 | -6.3805\* | -7.0472\* | -6.5338 | -6.3629\* | -7.0778\* | -6.6707 | -6.3517\* | -7.1710\* | -6.1271 |
|  | (3.6842) | (4.0608) | (8.0359) | (3.6440) | (4.0667) | (7.9687) | (3.6030) | (3.9577) | (7.4621) | (3.5215) | (3.8788) | (7.6314) |
| Number of household children | 0.6396 | 0.6441 | 0.9462 | 0.6409 | 0.6529 | 0.9511 | 0.6216 | 0.6370 | 0.7906 | 0.6349 | 0.6449 | 0.9267 |
|  | (0.4662) | (0.5400) | (0.6914) | (0.4659) | (0.5353) | (0.6934) | (0.4680) | (0.5532) | (0.6770) | (0.4660) | (0.5592) | (0.6659) |
| Household income (in $1,000s) | -0.0059 | -0.0056 | -0.0010 | -0.0058 | -0.0058 | -0.0009 | -0.0066 | -0.0039 | -0.0020 | -0.0056 | -0.0037 | -0.0026 |
|  | (0.0128) | (0.0154) | (0.0200) | (0.0129) | (0.0153) | (0.0201) | (0.0133) | (0.0160) | (0.0199) | (0.0135) | (0.0160) | (0.0207) |
| Household income squared (in $1,000s) | 0.0000 | 0.0000 | -0.0000 | 0.0000 | 0.0000 | -0.0000 | 0.0000 | -0.0000 | -0.0000 | 0.0000 | -0.0000 | -0.0000 |
|  | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Mother college | 4.4694\*\*\* | 2.5755 | 6.2024\*\*\* | 4.4881\*\*\* | 2.5310 | 6.2700\*\*\* | 4.5851\*\*\* | 2.7678 | 6.5372\*\*\* | 4.5478\*\*\* | 2.8717\* | 6.0318\*\*\* |
|  | (1.3180) | (1.7476) | (1.6422) | (1.3137) | (1.7559) | (1.6576) | (1.3250) | (1.6904) | (1.7264) | (1.3482) | (1.6657) | (1.7536) |
| Fraction free/reduced-price lunch | 5.6881\*\*\* | 3.8198 | 8.3175\*\* | 5.6748\*\*\* | 3.7855 | 8.3191\*\* | 5.6723\*\*\* | 3.8678 | 8.4436\*\* | 5.7494\*\*\* | 3.8097 | 8.6652\*\* |
|  | (1.7153) | (2.9270) | (3.9629) | (1.7095) | (2.9524) | (3.9796) | (1.7311) | (2.9734) | (3.9226) | (1.7386) | (2.9792) | (4.1341) |
| Student-teacher ratio | -0.1235 | 0.0453 | -0.2717 | -0.1234 | 0.0457 | -0.2700 | -0.1289 | 0.0348 | -0.2564 | -0.1249 | 0.0323 | -0.2643 |
|  | (0.1054) | (0.1948) | (0.1687) | (0.1051) | (0.1940) | (0.1670) | (0.1021) | (0.1962) | (0.1585) | (0.1043) | (0.1945) | (0.1616) |
| Fraction white | 0.4921 | 1.5152 | 0.6297 | 0.4920 | 1.5480 | 0.5688 | 0.4658 | 1.4628 | 0.6803 | 0.5150 | 1.4264 | 1.2288 |
|  | (2.1275) | (2.0378) | (3.5316) | (2.1303) | (2.0334) | (3.5152) | (2.1582) | (2.0522) | (3.7366) | (2.2091) | (2.0955) | (3.8237) |
| Observations | 817 | 440 | 377 | 817 | 440 | 377 | 817 | 440 | 377 | 817 | 440 | 377 |

Notes: Survey weights are used. Standard errors clustered on state are in parentheses. All regressions also include indicators for Census region, year effects, missing WJ-R score, missing mother’s education, missing school, and a constant. Significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table A3. College by Age 20 Probits (Exogenous Homework): Other Marginal Effects** | | | | | | | | | | |  |  |  |
|  | Total Homework | | | | Homework as a Primary Activity | | | Homework as a Sole Activity | | | Any Homework | | |
|  | All | | Female | Male | All | Female | Male | All | Female | Male | All | Female | Male |
| Variables | (1) | | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Homework time | | 0.0004 | -0.0021 | 0.0073\*\* | 0.0003 | -0.0024 | 0.0072\*\* | 0.0005 | -0.0034 | 0.0080\*\* | -0.0009 | -0.0111 | 0.0337 |
|  | | (0.0018) | (0.0019) | (0.0035) | (0.0018) | (0.0020) | (0.0035) | (0.0024) | (0.0029) | (0.0035) | (0.0238) | (0.0282) | (0.0317) |
| Female | | 0.0312 |  |  | 0.0316 |  |  | 0.0321 |  |  | 0.0327 |  |  |
|  | | (0.0235) |  |  | (0.0232) |  |  | (0.0237) |  |  | (0.0238) |  |  |
| Black/Hispanic | | 0.0585\* | 0.1008\*\* | 0.0027 | 0.0584\* | 0.1008\*\* | 0.0030 | 0.0580\* | 0.1036\*\* | -0.0037 | 0.0580\* | 0.1030\*\* | -0.0008 |
|  | | (0.0310) | (0.0436) | (0.0466) | (0.0309) | (0.0436) | (0.0466) | (0.0319) | (0.0447) | (0.0459) | (0.0310) | (0.0454) | (0.0438) |
| Reading score | | 0.0020\*\* | 0.0020\* | 0.0014 | 0.0020\*\* | 0.0020\* | 0.0014 | 0.0020\*\* | 0.0020\* | 0.0013 | 0.0020\*\* | 0.0019\* | 0.0012 |
|  | | (0.0009) | (0.0011) | (0.0016) | (0.0009) | (0.0011) | (0.0016) | (0.0009) | (0.0012) | (0.0016) | (0.0009) | (0.0011) | (0.0015) |
| Applied-problems score | | 0.0038\*\*\* | 0.0044\*\*\* | 0.0036\* | 0.0038\*\*\* | 0.0044\*\*\* | 0.0036\* | 0.0037\*\*\* | 0.0046\*\*\* | 0.0034\* | 0.0038\*\*\* | 0.0044\*\*\* | 0.0037\* |
|  | | (0.0012) | (0.0011) | (0.0019) | (0.0012) | (0.0011) | (0.0019) | (0.0013) | (0.0012) | (0.0020) | (0.0012) | (0.0011) | (0.0020) |
| State-mandated college exam | | 0.1357\*\*\* | 0.0887\*\* | 0.1558\*\*\* | 0.1355\*\*\* | 0.0889\*\* | 0.1557\*\*\* | 0.1345\*\*\* | 0.1019\*\*\* | 0.1480\*\*\* | 0.1350\*\*\* | 0.0918\*\* | 0.1566\*\*\* |
|  | | (0.0355) | (0.0390) | (0.0498) | (0.0357) | (0.0390) | (0.0496) | (0.0364) | (0.0356) | (0.0488) | (0.0360) | (0.0369) | (0.0491) |
| Lives with single mother | | -0.0469 | -0.0414 | -0.0100 | -0.0468 | -0.0416 | -0.0110 | -0.0469 | -0.0398 | -0.0134 | -0.0466 | -0.0428 | -0.0139 |
|  | | (0.0334) | (0.0310) | (0.0434) | (0.0334) | (0.0313) | (0.0432) | (0.0337) | (0.0305) | (0.0430) | (0.0335) | (0.0305) | (0.0429) |
| Lives in other family arrangement | | -0.0069 | -0.0246 | 0.0672 | -0.0069 | -0.0236 | 0.0663 | -0.0066 | -0.0301 | 0.0523 | -0.0069 | -0.0329 | 0.0598 |
|  | | (0.0623) | (0.0655) | (0.0854) | (0.0624) | (0.0656) | (0.0850) | (0.0621) | (0.0638) | (0.0882) | (0.0620) | (0.0661) | (0.0863) |
| Number of household children | | -0.0015 | 0.0190\* | -0.0112 | -0.0015 | 0.0184\* | -0.0116 | -0.0017 | 0.0199\*\* | -0.0130 | -0.0015 | 0.0192\* | -0.0111 |
|  | | (0.0115) | (0.0102) | (0.0192) | (0.0115) | (0.0106) | (0.0190) | (0.0116) | (0.0097) | (0.0193) | (0.0114) | (0.0098) | (0.0196) |
| Household income (in $1,000s) | | 0.0007\* | 0.0019\*\*\* | -0.0002 | 0.0007\* | 0.0019\*\*\* | -0.0002 | 0.0007\* | 0.0018 | -0.0002 | 0.0007\* | 0.0017 | -0.0002 |
|  | | (0.0004) | (0.0006) | (0.0006) | (0.0004) | (0.0006) | (0.0006) | (0.0004) | (0.0012) | (0.0006) | (0.0004) | (0.0013) | (0.0006) |
| Household income squared (in $1,000s) | | -0.0000 | -0.0000 | 0.0000 | -0.0000 | -0.0000 | 0.0000 | -0.0000 | -0.0000 | 0.0000 | -0.0000 | -0.0000 | 0.0000 |
|  | | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Mother college | | 0.1119\*\* | 0.0995\*\* | 0.0827 | 0.1122\*\* | 0.1001\*\* | 0.0834 | 0.1127\*\*\* | 0.1029\*\* | 0.0973 | 0.1131\*\*\* | 0.1040\*\* | 0.0919 |
|  | | (0.0457) | (0.0456) | (0.0613) | (0.0456) | (0.0455) | (0.0614) | (0.0435) | (0.0468) | (0.0595) | (0.0433) | (0.0478) | (0.0604) |
| Fraction free/reduced-price lunch | | -0.0737 | 0.0725 | -0.1944\*\* | -0.0740 | 0.0747 | -0.1952\*\* | -0.0740 | 0.0725 | -0.1914\*\* | -0.0747 | 0.0761 | -0.1961\*\* |
|  | | (0.0554) | (0.0475) | (0.0828) | (0.0556) | (0.0489) | (0.0830) | (0.0561) | (0.0514) | (0.0834) | (0.0558) | (0.0508) | (0.0880) |
| Student-teacher ratio | | -0.0015 | 0.0007 | -0.0029 | -0.0016 | 0.0007 | -0.0028 | -0.0016 | 0.0008 | -0.0019 | -0.0016 | 0.0010 | -0.0023 |
|  | | (0.0020) | (0.0025) | (0.0036) | (0.0020) | (0.0025) | (0.0036) | (0.0020) | (0.0027) | (0.0037) | (0.0020) | (0.0028) | (0.0038) |
| Fraction white | | -0.0067 | 0.0199 | -0.0100 | -0.0069 | 0.0190 | -0.0113 | -0.0074 | 0.0261 | -0.0169 | -0.0082 | 0.0265 | -0.0183 |
|  | | (0.0460) | (0.0482) | (0.0728) | (0.0461) | (0.0478) | (0.0728) | (0.0471) | (0.0509) | (0.0712) | (0.0461) | (0.0502) | (0.0700) |
| Observations | | 817 | 440 | 377 | 817 | 440 | 377 | 817 | 440 | 377 | 817 | 440 | 377 |

Notes: Survey weights are used. Standard errors clustered on state are in parentheses. All regressions also include indicators for Census region, year effects, missing WJ-R score, missing mother’s education, missing school, and a constant. Significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table A4. The Effects of Homework on Academic Achievement (Endogenous Homework): Other Coefficient Estimates (Males Only, N=377)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | GPA | | College by Age 20 (Probit) | |
| Variables | (1) | (2) | (3) | (4) |
| Total homework | -1.0201 |  | 0.0074 |  |
|  | (0.8069) |  | (0.0161) |  |
| Homework at a primary activity |  | -1.0247 |  | 0.0069 |
|  |  | (0.8021) |  | (0.0164) |
| Black/Hispanic | -3.4737 | -3.6427 | 0.0027 | 0.0027 |
|  | (2.5370) | (2.6313) | (0.0511) | (0.0521) |
| Reading score | 0.0462 | 0.0543 | 0.0014 | 0.0014 |
|  | (0.0686) | (0.0698) | (0.0016) | (0.0016) |
| Applied-problems score | 0.1246 | 0.1138 | 0.0036\* | 0.0037\* |
|  | (0.0876) | (0.0828) | (0.0021) | (0.0020) |
| State-mandated college exam | -0.1680 | -0.5399 | 0.1561\*\* | 0.1548\*\* |
|  | (3.8810) | (4.1481) | (0.0655) | (0.0683) |
| Lives with single mother | -4.5324 | -4.4880 | -0.0101 | -0.0106 |
|  | (3.4464) | (3.5067) | (0.0492) | (0.0495) |
| Lives in other family arrangement | -8.9859 | -8.8430 | 0.0674 | 0.0655 |
|  | (5.8320) | (5.7295) | (0.0888) | (0.0877) |
| Number of household children | 1.3111\* | 1.3678\* | -0.0112 | -0.0115 |
|  | (0.7628) | (0.7737) | (0.0204) | (0.0206) |
| Household income (in $1,000s) | 0.0019 | -0.0000 | -0.0002 | -0.0002 |
|  | (0.0252) | (0.0244) | (0.0006) | (0.0006) |
| Household income squared (in $1,000s) | -0.0000 | -0.0000 | 0.0000 | 0.0000 |
|  | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Mother college | 9.1474\*\*\* | 8.6789\*\*\* | 0.0825 | 0.0840 |
|  | (2.3608) | (2.1522) | (0.0780) | (0.0748) |
| Fraction free/reduced-price lunch | 9.2067\*\* | 9.6822\*\* | -0.1945\*\* | -0.1946\*\* |
|  | (4.6037) | (4.5886) | (0.0833) | (0.0847) |
| Student-teacher ratio | -0.2136 | -0.2347 | -0.0029 | -0.0028 |
|  | (0.1752) | (0.1698) | (0.0037) | (0.0037) |
| Fraction white | -2.4474 | -2.2768 | -0.0098 | -0.0121 |
|  | (4.2677) | (4.2358) | (0.0919) | (0.0906) |

Notes: Survey weights are used. Standard errors clustered on state are in parentheses. All regressions also include indicators for Census region, year effects, missing WJ-R score, missing mother’s education, missing school, and a constant. Significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table A5. First-stage Homework Equations (Endogenous Homework): Other Coefficient Estimates (Males Only, N=377)**

|  |  |  |
| --- | --- | --- |
| Variables | Total homework | Homework as a Primary Activity |
| Older than state minimum driving age | 3.3160\* | 3.3011\* |
|  | (1.8875) | (1.9668) |
| Black/Hispanic | -1.2289 | -1.3883 |
|  | (1.9297) | (1.9341) |
| Reading score | -0.0055 | 0.0025 |
|  | (0.0286) | (0.0291) |
| Applied-problems score | 0.0470 | 0.0362 |
|  | (0.0441) | (0.0476) |
| State-mandated college exam | -2.0109 | -2.3648 |
|  | (1.7510) | (1.8032) |
| Lives with single mother | 1.0253 | 1.0639 |
|  | (0.9710) | (0.8459) |
| Lives in other family arrangement | -2.4751 | -2.3245 |
|  | (2.9957) | (3.1189) |
| Number of household children | 0.3376 | 0.3914 |
|  | (0.2844) | (0.2737) |
| Household income (in $1,000s) | 0.0024 | 0.0006 |
|  | (0.0095) | (0.0089) |
| Household income squared (in $1,000s) | -0.0000 | 0.0000 |
|  | (0.0000) | (0.0000) |
| Mother college | 2.7702\*\* | 2.3005\* |
|  | (1.2593) | (1.2872) |
| Fraction free/reduced-price lunch | 1.1124 | 1.5715 |
|  | (1.7364) | (1.7316) |
| Student-teacher ratio | 0.0680 | 0.0471 |
|  | (0.1005) | (0.0949) |
| Fraction white | -3.5332 | -3.3507 |
|  | (2.3267) | (2.4410) |

Notes: Survey weights are used. Standard errors clustered on state are in parentheses. All regressions also include indicators for Census region, year effects, missing WJ-R score, missing mother’s education, missing school, and a constant. Significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

1. Cooper, Robinson, and Patall (2006) provide a nice overview of the effects of homework on academic achievement in the education, psychology, and sociology literatures. In general, small positive effects have been found. More recently, using 1990 data from National Education Longitudinal Study (NELS) and 2002 data from Education Longitudinal Study (ELS), Maltese, Tai, and Fan (2012) found no effect of math and science homework on final course grades, but a significant positive association between homework time and the SAT-Mathematics subscore. [↑](#footnote-ref-1)
2. Stinebrickner and Stinebrickner (2008) is the exception that uses time-diary data to examine outcomes. However, their sample is a small, non-representative one. They sample students from one college only. [↑](#footnote-ref-2)
3. Our measure of family income comes from the main PSID interviews. It is constructed to be the average of yearly family income reported in the three PSID main interviews prior to completing the CDS high school diary, in 2006 dollars. If one or more years is missing, then the remaining values are used to create the average. Family structure and parental education are obtained from 2003 and 2007 main PSID surveys. [↑](#footnote-ref-3)
4. High school GPA and information on college attendance are available only for high school graduates. In the PSID-CDS, ninety-two percent of high school students graduated, which is close to the graduation rate reported by the U.S. Department of Education (2013) for 2011. [↑](#footnote-ref-4)
5. We defined winter break to be an approximately two-week period around Christmas and New Year’s Day. [↑](#footnote-ref-5)
6. GPA scales vary by school. Because we have only the reported GPA and the maximum possible GPA for each observation, we created this variable by dividing the reported GPA by the maximum possible and multiplying by 100. [↑](#footnote-ref-6)
7. In each TA, the student reported the first enrollment date for “current / last college attended” and then the first enrollment date for one additional prior college attended. We compare the first reported enrollment date in months with the month that the student would have turned age 20 to determine college attendance by age 20. [↑](#footnote-ref-7)
8. Some years had to be combined in order to achieve convergence – specifically, 2002 was combined with 2003, 2007 was combined with 2008, and 2009 was combined with 2010. [↑](#footnote-ref-8)
9. We also include an indicator for missing scores and assign the average score to those missing scores. [↑](#footnote-ref-9)
10. Parents in two-parent families could be biological, adoptive, or step parents. [↑](#footnote-ref-10)
11. If a year is missing, then the average over the non-missing years is used. [↑](#footnote-ref-11)
12. The student-teacher ratio in each year is the total number of students in the school divided by the number of full-time-equivalent classroom teachers. [↑](#footnote-ref-12)
13. We also include an indicator for missing school characteristics variables. Some of these are due to a missing school-level identifier in the PSID-CDS and some are simply missing values. We assign the average of the non-missing values to those with a missing value. [↑](#footnote-ref-13)
14. See Eren and Henderson (2011) for a review of the historical debate about the merits of assigning homework over the last century. [↑](#footnote-ref-14)
15. These weekly homework averages were calculated from a series of categories. [↑](#footnote-ref-15)
16. Results for the other marginal effects in these models are in online appendix Tables A2 and A3. For females, the applied-problems score has a positive significant effect on GPA and living in a family arrangement other than a two-parent family has a negative significant effect on GPA. For males, having a mother with a college degree and the fraction free-or-reduced-price-lunch eligible in high school have positive significant effects on GPA. For females, being black or Hispanic, the reading score, the applied-problems score, living in a state that mandates a college-entrance exam, the number of household children, having a mother with a college degree, and household income all have positive effects on attending college by age 20. For males, the applied-problems score and living in a state that mandates a college-entrance exam have positive effects on college attendance by age 20 while the fraction free-or-reduced-price-lunch eligible in high school has a negative significant effect on attending college by age 20. [↑](#footnote-ref-16)
17. Note that GPA is measured on a scale of 0-100. [↑](#footnote-ref-17)
18. Results for the other coefficients in these models are available in online appendix Tables A4-A5. [↑](#footnote-ref-18)