Does Working While in High School Crowd Out Study Time?

******PRELIMINARY: PLEASE DO NOT QUOTE WITHOUT PERMISSION**

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Abstract: Researchers have found that working while in school leads to lower student achievement and that study time increases student achievement. Because student achievement is potentially related to future earnings and labor market outcomes, it is important to analyze whether working in the market crowds out students' study time. In this paper we estimate a simultaneous tobit model using data from the 2003-2006 American Time Use Survey (ATUS) to determine the effect of work time on study time. This approach allows both study time and market work time to be jointly determined, controls for any unobserved person-specific factors such as motivation that affect both uses of time, and accounts for censoring in the data. Results suggest that time spent in market work does crowd out homework time.

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I. Introduction

Recent research has generally found that working while in school has small negative effects on student achievement when controlling for the endogeneity of work. Ruhm (1995, 1997) and Tyler (2003) found that working while in high school reduces 12th grade math achievement and the number of years of schooling completed. Eckstein and Wolpin (1999) also found that working full-time while in high school slightly reduces the grade point average of males. Oettinger (1999) found that working long hours negatively affects the grades of minority high school students. More recently, Rothstein (2007) found small negative effects of hours of work on high school students' GPAs using fixed-effects estimation. However, these effects became insignificant when using instrumental variables. Similarly negative effects have also been found for college students. Stinebrickner and Stinebrickner (2003), Oettinger (2005), and Kalenkoski and Pabilonia (2006) all showed negative effects of working while in school on four-year college students' GPAs. Because lower academic achievement in high school, and consequently lower human capital accumulation, may affect later career earnings, policy makers have been concerned about these potential negative consequences of employment. For example, in 1998 the National Research Council recommended restrictions on 16- and 17-year olds' hours of work while in school and many states have restricted the hours teens may work (Tyler 2003).

Little research has been done to examine the mechanisms through which these negative effects occur. Lillydahl (1990) and Stinebrickner and Stinebrickner (2007) analyzed the relationship between study time and academic achievement. Lillydahl (1990) found that the marginal benefit of at least two hours of homework per night raised

a high school student's GPA by .07 points. Using an instrumental variables approach, Stinebrickner and Stinebrickner (2007) found a much larger positive effect on grade performance in college (.358 for males and .274 for females). Therefore, one possible mechanism for the negative effect of hours of work on grades is the crowding out of study time.

The purpose of this paper is to examine this mechanism. We do so by estimating a simultaneous tobit model for hours per day spent doing homework and paid work. This model allows for the fact that these uses of time may be jointly determined and controls for unobserved person-specific factors, such as motivation, that affect students' desires to both work and do homework. It also accounts for censoring in the data. We use 2003-2006 time-diary data for high school students aged 15-19 from the nationally representative American Time Use Survey (ATUS). Results suggest that time spent in market work does crowd out time spent on homework.

II. Model

The amount of time a student spends doing homework and working in the market are potentially made jointly. To account for this fact, the following system of simultaneous tobit equations is estimated:

$$h^* = \gamma_1 w + \beta_1 \acute{} X_1 + u_1$$

$$w^* = \gamma_2 h + \beta_2 \acute{} X_2 + u_2 \qquad (1)$$

and

$$h = h^* \text{ if } h^* > 0$$

$$h = 0 \text{ otherwise} \qquad (2)$$

$$w = w^* \text{ if } w^* > 0$$

$$w = 0 \text{ otherwise}$$

where h* is the latent variable measuring the amount of time a student desires to spend doing homework; h is the observed amount of time the student spends doing homework; w* is the latent variable measuring the student's desired hours of market work; w is the observed hours worked; X_1 and X_2 are vectors of exogenous explanatory variables; γ_1 and γ_2 are coefficients on the endogenous right-hand-side variables; and β_1 and β_2 are the coefficients on the exogenous explanatory variables. The residuals u_1 and u_2 follow a bivariate normal distribution such that:

$$\begin{bmatrix} u_1 \\ u_2 \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_1^2 & \rho_{12}\sigma_1\sigma_2 \\ \rho_{12}\sigma_1\sigma_2 & \sigma_2^2 \end{bmatrix} \right). \quad (3)$$

A logical consistency condition, $1 - \gamma_1\gamma_2 > 0$, must hold for the model to be estimable (see Maddala 1983). The model is estimated via maximum likelihood using the aML software package.

Identification of the endogenous variables in this model requires at least one variable to be included in X_1 that is not in X_2 and one variable in X_2 that is not in X_1. The state unemployment rate is used to identify market work time in the homework equation. As a measure of labor market conditions, it is likely to affect the amount of time a student spends at a job and whether s/he even has a job but not directly the amount of time s/he spends doing homework. Indicator variables for whether the mother and/or father have a bachelor's degree are used to identify homework time in the market work equation. Parents' education levels partially reflect preferences toward education that are perhaps passed on to children by their parents. They may be excluded from the market

work equation as parents' education level (after controlling for parental income) is not directly related to the amount of time a student spends working in the market.

III. Data

Our data come primarily from the 2003-2006 ATUS. The ATUS is nationally representative of the U.S. civilian non-institutional population aged 15 years and older. One person aged 15 and older in each household from a sample of outgoing CPS households is randomly-selected to participate in the ATUS approximately 2-5 months after their final Current Population Survey (CPS) interview. The key feature of the ATUS survey is its 24-hour retrospective time diary in which the respondent describes how he or she spent her time during the designated 24-hour period. ATUS time-diary records of time spent doing certain activities the previous day should be more accurate than surveys that ask respondents to record time spent on activities over the last week due to the shorter recall period.[1] Each respondent completes only one time diary, but interviews are conducted almost every day of the year (interviews do not occur on significant holidays and thus no diary exists for the day before a significant holiday). Weekends are oversampled to achieve a balance of weekday and weekend days. In addition to the time diary, the survey also collects household roster and demographic information. It is also matched to CPS household data so we can use information about the students' parents.

For our analysis, we use a subsample of high school students aged 15-19 who were interviewed during the academic year (those interviewed in the months of June,

[1] However, Frazis and Stewart (2004) found that CPS-reported hours of work are similar to ATUS hours during CPS reference weeks.

July, and August are excluded).[2] We use academic year interviews only since we are examining the relationship between school work and paid work – most high school students are not attending summer classes. Of these, we exclude those students who have own children living in their household. We also perform separate analyses for respondents interviewed on non-holiday weekdays and those interviewed on weekends or holidays (henceforth referred to as weekends) because mandatory weekday in-class time leads to substantially less discretionary time available to students on weekdays. A likelihood ratio test supports these separate analyses for weekdays and weekends. Our weekday sample consists of 1,166 students and our weekend sample consists of 1,228 students.

In order to analyze hours spent on homework, we aggregated minutes spent on all daily activities coded as research or homework for a class that the respondent is taking for a degree.[3] In order to analyze hours spent on paid work, we aggregated minutes spent working on all jobs.[4] Students were much more likely to do some homework on weekdays (48%) than on weekend days (29%) while 14% of students did market work on any given day (see Table 1). Both samples reveal a large number of zeros among these dependent variables and suggest the use of the simultaneous tobit model described in the previous section. To the extent that these zero values represent no participation in these activities on all days, a simultaneous continuous regression model would give biased results. On the other hand, if zero values represent infrequent activity and the day we observe the student's time use is random, then a simultaneous continuous regression

[2] We also used a slightly smaller sample of traditional-aged students aged 15-18 since students who were aged 19 may have repeated a year of school or started school late due to some underlying difference in ability. Our key results are very similar; however, the magnitude and significance of the effect of homework on work for weekdays is smaller.
[3] Tutiercode = 060301 in the ATUS data dictionary.
[4] Tutiercode = 0501 in the ATUS data dictionary.

model will provide consistent estimates. Other surveys provide evidence for the extent of non-participation in these activities. For example, in the October 2006 CPS, about 69 percent of high school students were not employed in the reference week (Bureau of Labor Statistics 2007). According to the NLSY97, 26 percent of seniors did not work at any point during the school year – even larger percentages did not work in the lower grades (Bureau of Labor Statistics 2005). In addition, in a typical school week in the NLYS97, 11 percent of enrolled students aged 12-16 did not spend any time doing homework (Authors' own calculation).

Among those who do some homework on their diary day, the average hours of homework is 1.65 hours on a weekday and 2.34 hours on a weekend day. Similarly, employed students spend more time working on a weekend day than on a weekday (5.73 versus 4.25 hours, respectively), probably due to the fact that on weekend days they do not have the time constraint of classes. Table 2 shows the difference in homework time by whether or not the student worked on their diary day and the student did any homework. Students who worked did significantly less homework on average on weekdays than students who did not work (both among all students and those with positive homework time). On weekends, only those students with positive homework time did less homework on average if they worked than those who did not work on their diary day.

Each equation in our analysis also includes controls for gender, age and age squared, race/ethnicity (non-Hispanic black, other race, and Hispanic, where non-Hispanic white is the omitted category), whether or not the father is absent from the household, whether or not the mother is absent from the household, household income

indicators ($20,000-$40,000; $40,000-$75,000; over $75,000; with less than $20,000 as the omitted category), whether or not household income is missing, the number of siblings, whether or not the respondent was born in U.S., whether his/her mother was born in U.S., whether his/her father was born in U.S., region of residence, and year of diary completion. The hours of homework equation also includes indicators for whether the mother and/or father have at least a bachelor's degree (measures of strong parental preferences toward education) in order to identify hours of homework in the work equation. We also include state-level unemployment rates from the Bureau of Labor Statistics' Local Area Unemployment Statistics (LAUS) program as a measure of labor market conditions to identify hours of paid work in the homework equation. Unemployment rates been used by other researchers to identify hours worked (e.g. Rothstein 2007; Kalenkoski and Pabilonia 2006; Wolff 2006). Table 1 provides descriptive statistics of all the variables used in our estimation.

IV. Results

Table 3 shows key results from the simultaneous tobit model that we estimated using pooled 2003-2006 data. On weekdays, an increase in hours of paid work reduces time spent on homework by a quarter of an hour, providing evidence that paid work does reduce the amount of time high school students spend on homework. This effect is smaller for weekend days (5 minutes), however, when a student's discretionary time is greater as s/he is not in class. Interestingly, there are even stronger effects going in the opposite direction. On both weekdays and weekend days, an increase in the amount of

time spent doing homework reduces time spent in paid work, with an increase in homework time of an hour reducing hours of work by about a half hour.

Table 3 also shows the estimated correlations between the unobserved determinants of homework and paid work hours on both weekdays and weekend days. They are positive and significant at the 1% level, indicating that there is some unobserved variable, such as student motivation, that positively affects both study time and market work time. Their significance also supports the simultaneous model over the alternative of estimating the equations separately.

As a sensitivity test we also estimated a simultaneous equations model in which continuous regressions rather than censored regressions were specified, though this is not our preferred specification given the large number of zeros for the dependent variables. Estimated effects are similar to our simultaneous Tobit estimates, although the effect of hours worked on homework is insignificant. Results are available upon request from the authors. All of the evidence taken together does suggest, however, that the time constraint is binding, at least on weekdays.

V. Conclusion

This paper uses time diary data for 2003-2006 from the nationally representative ATUS to investigate the relationship between the amounts of time teens in the United States spend on homework and on paid work. Evidence suggests that students' time constraints are binding. An increase in one hour of paid work per weekday reduces the amount of time a student spends on homework by a quarter of an hour on the same day. On weekend days, one hour of paid work only reduces the amount of time a student

spends on homework by 5 minutes. On both weekdays and weekend days the effects in the opposite direction are even stronger, with an increase in an hour of homework reducing the amount of time a student spends doing paid work by about a half hour. In a future version of this paper, we intend to examine this relationship using the NLSY97.

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Table 1. Descriptive Statistics

	Weekdays		Weekend Days	
	Mean	**S.E.**	**Mean**	**S.E.**
Hours of homework	0.798	0.038	0.664	0.043
Hours of homework positive	0.48		0.29	
Hours of homework if positive	1.652	0.057	2.343	0.099
Hours of paid work	0.578	0.055	0.765	0.069
Hours of paid work positive	0.14		0.14	
Hours of paid work if positive	4.247	0.196	5.725	0.226
Female	0.489	0.016	0.486	0.016
Age	16.368	0.036	16.308	0.035
Age squared	0.269	0.001	0.267	0.001
Non-Hispanic white	0.603	0.016	0.620	0.016
Non-Hispanic black	0.153	0.013	0.155	0.013
Other race	0.059	0.007	0.066	0.008
Hispanic	0.185	0.014	0.158	0.013
No mother in household	0.084	0.009	0.072	0.008
No father in household	0.249	0.014	0.247	0.013
Mother has at least bachelor's degree	0.251	0.014	0.258	0.013
Father has at least bachelor's degree	0.248	0.014	0.255	0.014
Household income missing	0.136	0.011	0.133	0.012
Household income < 20K	0.131	0.011	0.108	0.009
Household income 20-40K	0.181	0.013	0.192	0.012
Household income 40-75K	0.248	0.013	0.264	0.014
Household income 75K+	0.303	0.015	0.302	0.015
Number of household siblings	0.995	0.038	0.941	0.038
Born in U.S.	0.910	0.010	0.904	0.010
Mother born in U.S.	0.704	0.015	0.707	0.015
Father born in U.S.	0.570	0.016	0.581	0.016
North	0.179	0.012	0.166	0.012
Midwest	0.249	0.014	0.239	0.013
South	0.327	0.015	0.345	0.016
West	0.245	0.014	0.250	0.012
Year==2003	0.260	0.013	0.245	0.012
Year==2004	0.259	0.015	0.255	0.014
Year==2005	0.230	0.015	0.231	0.015
Year==2005	0.251	0.014	0.269	0.014
Unemployment rate	5.328	0.032	5.31	0.032
Number of observations	1,166		1,228	

Note: Survey weights were used.

Table 2. Teen Hours Spent on Homework, by Daily Working Status						
	Weekday			Weekend Day		
	Working	Not Working	P-value	Working	Not Working	P-value
Hours of Homework	.44 (159)	.86 (1,007)	.00	.62 (176)	.67 (1,052)	.61
Hours of Homework if Homework >0	1.28 (59)	1.69 (503)	.00	1.83 (59)	2.44 (301)	.01
Survey weights were used. The number of observations used are in parentheses.						

Table 3. Key Results from Simultaneous Tobit Model of Hours Spent Doing Homework and Paid Work

	Weekday		Weekend Day	
Independent Variables	Dependent Variable: Homework Hours	Dependent Variable: Paid Work Hours	Dependent Variable: Homework Hours	Dependent Variable: Paid Work Hours
Hours Worked Per Day	-0.498*** (0.082) **-0.258**		-0.190* (0.101) **-0.052**	
Hours of Homework Per Day		-1.635*** (0.363) **-0.466**		-2.492*** (0.677) **-0.569**
ρ	0.913*** (0.092)		0.769*** (0.913)	
Number of Observations	1,166		1,228	

Note: *** indicate significance at 1% level; * indicates significance at 10% level. Standard errors are in parentheses. Marginal effects in bold were calculated for each observation using the unconditional expected value and then averaging across observations. Control variables include gender, a quadratic in age, no father in household, no mother in household, race and ethnicity (non-Hispanic black, other, Hispanic), number of siblings, born in U.S., mother born in U.S., father born in U.S., household income indicators ($20,000-$40,000; $40,000-$75,000; over $75,000), region, and year indicators. The hours of homework equation includes whether the mother and father have at least a bachelor's degree in order to identify hours of homework in the work equation. We also include state-level unemployment rates to identify hours of paid work in the homework equation.