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THE FALLING TIME COST OF COLLEGE: EVIDENCE FROM HALF A CENTURY OF TIME USE DATA

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ABSTRACT

Using multiple datasets from different time periods, we document declines in academic time investment by full-time college students in the United States between 1961 and 2003. Full-time students allocated 40 hours per week toward class and studying in 1961, whereas by 2003 they were investing about 27 hours per week. Declines were extremely broad-based, and are not easily accounted for by framing effects, work or major choices, or compositional changes in students or schools. We conclude that there have been substantial changes over time in the quantity or manner of human capital production on college campuses.

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I. INTRODUCTION

"Hours worked" is recognized as a fundamental measure in applied economics, and trends over time in hours worked by U.S. workers have been carefully documented. Time use associated with education attainment has received less attention. We find that full-time college students in 1961 devoted 40 hours per week to academics, whereas full-time students in 2004 invested about 27 hours per week. Declines were extremely broad-based and are not easily accounted for by framing effects or changes in the composition of students or schools. Study time fell for students from all demographic subgroups, within race, gender, ability, and family background, overall and within major, for students who worked in college and for those who did not, and the declines occurred at 4-year colleges of every type, size, degree structure, and level of selectivity.

The decline in academic time investment we document is relevant to research on human capital in at least two important ways. Firstly, a "year" of college, as commonly used in wage regressions, would appear to be a nominal measure of time, the value of which has eroded. If full-time college attendance requires a smaller time investment than it once did, then the recent increases in the return to college may be larger than was previously thought. Secondly, if student effort is an input to the education production process, as suggested by human capital models, then declining time investment may signify declining production of human capital. To the extent that human capital of the workforce impacts the economy at large, through level or growth rate, the magnitude of the decrease over time in this input to human capital production is worth knowing.

We have found little previous research investigating the academic time use trend we study here. Evidence in the education literature has been incomplete, anecdotal, has

lacked strategies to account for composition bias, or has been limited to a brief period between the 1980s and 1990s.[1] Two recent survey articles in the economics of higher education (Ehrenberg, 2004, Winston, 1999) make no mention of changes over time in academic time investment or of research on this point. Trends in study time, it would appear, have largely gone unstudied.

II. DATA

Documenting changes in academic time investment requires pooling a wide range of datasets from multiple sources. In the main analysis, we examine data from 4 time periods, 2003-2005, 1987-1989, 1981, and 1961, and we restrict the samples to full-time students at four-year colleges in each of these periods. In a secondary analysis, we reproduce the paper's main finding using 8 additional data sources, and these are described in Appendix A. We address concerns about survey differences in some detail in Section III. Here, we briefly describe the data used in the main analysis, summary statistics for which appear in Table 1.

1961 (Project Talent)

Project Talent (1961) is a nationally representative random sample and it elicits time use response in continuous hours, not ranges. The salient survey question is phrased: "*Indicate below how many hours a week, on the average, you spent in each of the following kinds of activities during your first year in college."* We focus here on the

[1] Astin, Keup, and Lindholm (2002) find that study time fell by .41 hours per week between 1989 and 1998 for a consistent set of schools. See also Kuh (1999).

activity *"Studying (Outside of class)."* The question is asked in a one-year follow-up to an earlier survey of students who were high school seniors in 1960.

Project Talent randomized at the high school level, then tracked respondents with 1-year, 5-year and 15-year follow-ups. Data on study time come from the 1-year follow-up. The original samples were saturation samples, with all students in the given high school and year completing the survey. The survey also includes recommended weightings to account for survey design and attrition. We use the recommended weightings in all tables and figures.

1981(The National Longitudinal Survey of Youth, 1979 (NLSY79))

The 1981 college module of the NLSY79 asks current college students at all levels (freshmen through senior) how many hours in the last week they "*spent studying or working on class projects."* They are asked the question in two settings, once in reference to studying "*on campus*" and once in reference to studying *"off-campus,"* and we sum these to obtain weekly study times. This survey elicits responses in hours, rather than ranges, and includes recommended weightings that make the sample nationally representative. We use the recommended weightings in all tables and figures.

The NLSY79 also includes later wages for respondents who were students in 1981. Full-scale analysis of a possible causal relationship between studying in college and marginal product later in life is beyond the scope of this paper. NLSY79 wage data, however, suggest the study time measure does have content: In OLS regressions (available upon request), students who studied more in 1981 earned significantly higher wages in later years.

1988, 2004 (Higher Education Research Institute (HERI))

The Higher Education Research Institute, housed in the Graduate School of Education and Information at the University of California, Los Angeles, designed the College Student Survey (or the Follow-up Survey, as it was called early on) to help postsecondary institutions assess the involvement, interest, and development of their students by senior year. The survey, which includes time allocation questions that have not changed over time, has been administered at various colleges in the U.S. every year since the mid-1980s. Colleges administer the survey to their students, under guidance and instruction from HERI, which also processes the responses.[2] HERI respondents, on-time seniors (in the spring of their fourth year), were asked "*During the past year, how much time did you spend during a typical week doing the following activities?"* One of the activities listed is "*Studying/Homework.*" Allowed responses are as follows: *"None, Less than 1 hour, 1 to 2, 3 to 5, 6 to 10, 11 to 15, 16 to 20, Over 20."*

The specific colleges that elected to use the survey varied from year to year. We construct a consistent set of schools to makes sure that changes in time use are not driven by the mix of schools selecting into samples in different periods. To obtain a large consistent set of schools, we use HERI surveys for the years 1987-1989 and 2003-2005, and pool three years of data for each time period. (For simplicity, we refer to the multiyear samples by their midpoints.) A school with data in both the "1988" and "2004" samples, then, is one for which data is available in one or more of the years 1987, 1988, or 1989, and in one or more of the years 2003, 2004, 2005. Following Dale and Krueger

[2] HERI recommends random sampling (within college) in their guidelines. However, we do not have information on what specific steps colleges may have taken to comply with this.

(2002), we weight individual observations by the student population at the school divided by the number of observations for that school (normalized by the sum of the weights.) Thus, if the universe of schools were those with data in the 1988 and 2004 samples, summary statistics and regression coefficients calculated using the given weighting would be representative of this universe.[3]

2003 (National Survey of Student Engagement (NSSE))

The National Survey of Student Engagement, administered annually by the Indiana University Center for Postsecondary Research since the year 2000, was designed to provide information on student engagement and personal development in college. Participating colleges sent a data file of all first-year and senior students to NSSE, which then selected a random sample of the (first-year and senior) student population. These students were subsequently contacted to take the survey.

The NSSE survey asks students "*About how many hours do you spend in a typical 7-day week doing each of the following*?" One of the activities listed is "*Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities).*" Allowed responses are: *"0 hours/week,1-5 hours/week, 6-10 hours/week, 11-15 hours/week, 16-20 hours/week, 21-25 hours/week, 26-30 hours/week, more than 30 hours/week* ."

We were able to obtain access to NSSE data for the year 2003. There were 156 schools in the 2003 sample that also had data available in 1961, Project Talent. We focus

[3] We also have HERI data for 1996, which allows us to assess changes in a consistent set of schools over the two smaller sub-periods within 1988-2004. Each of these sub-periods within the later period also shows declining study time.

on these schools, as we will be using this sample for comparisons with Project Talent. We create weights in the same manner as for the HERI data.

III. RESULTS

A. Overview

Given that data from later time periods are grouped in bins or ranges, the most straightforward way to compare across periods is to examine study time cumulative distribution values at common truncation points. This requires no assumptions about the underlying distribution for the grouped data samples. The second line of Table 1 shows cumulative distribution function values (subtracted from 1) at common truncation points of 20 hours a week for all samples. In 1961, 67% of full-time students at four-year postsecondary institutions studied more than 20 hours per week. In the 2004 HERI sample, only 13% of students studied 20 hours or more a week, and in the 2003 NSSE sample, only 20% of students studied at least 20 hours a week. Table 1 also includes CDF summary statistics at other truncation points, which together indicate a leftward movement of the distribution.

In Table 2, and for the remainder of the paper, we focus on means.[4] Project Talent and the NLSY79 were administered to randomized national samples. We compare findings from these surveys, in Panel A, columns 1 and 2, to determine changes in time use between 1961 and 1981. HERI surveys in 1988 and 2004 contained identical questions and response bins, and were administered to on-time seniors at an identical set

[4] Means of grouped data samples were estimated 2 ways: by regressing study time or class time on a constant in an interval-coded (ordered probit) regression and by assigning to each observation in a bin the value of the midpoint of the range represented by the bin. For the latter method, values in the top bin (>20 hours/week for the HERI sample and >30 for the NSSE) take on a value of 24 for the HERI sample and 32 for NSSE. Results from the 2 methods differed only slightly and we have displayed results from the latter.

of 46 schools. We compare these surveys, in columns 3 and 4, to discern changes between 1988 and 2004. The 1981-1988 comparison does not use a consistent set of schools, so we refrain from interpreting changes over this 7 year sub-period. In columns 5 and 6, we compare NSSE and Project Talent responses, for the 156 colleges in both, to discern overall changes in time use between 1961 and 2003. We observe statistically significant study time declines of 4.7, 1.7 and 11.1 hours per week for the 1961-1981, 1988-2004, and 1961-2004 periods, respectively.[5]

Table 2, Panel A shows decreases in study time, rising work hours, and rising leisure from 1961 to 1981, from 1988 to 2004, and from 1961 to 2003.[6] However, Panel A is a first pass at the data. The comparison of disparate surveys gives rise to a number of concerns about how to interpret summary statistics. Are the findings driven by framing effects or idiosyncratic characteristics of the survey instruments? Are the later samples nationally representative? Are the findings explained by changes in the composition of the college-going population? Can the findings be duplicated in alternative datasets? We investigate each of these in turn.

B. Framing Effects

As has been well-documented in the psychometric literature, differently worded questions yield different responses (Sudman, et al. (1996)). For example, in grouped data

[5] Project Talent respondents were freshmen, whereas students from all college grades responded to the NLSY79 and freshmen and seniors responded to the NSSE. One might worry that these differences account for the study time decline. However, both NSSE and the NLSY79 indicate that freshmen studied slightly less than seniors. Thus, comparisons of freshmen to freshmen in both periods (1961-1981 and 1961-2003) produce slightly *larger* study time declines than those shown in Table 2.

[6] Previous research also documents increasing work hours (e.g, Ehrenbeg and Sherman (1997), Orzsag, Orzsag, and Whitemore (2001), Scott-Clayton (2007), and Stinebrickner and Stinebrickner (2003). Leisure—defined here as non-work, non-academic activity—could include work-like activities, such as volunteer work. We find no evidence that work-like activity has become a dominant part of leisure. Volunteer work of recent cohorts, for example, was less than 1.6 hours per week (HERI 2004).

responses, lower numeric values for the allowed response bins appear to yield systematically lower responses. In short, framing effects could be driving or distorting the apparent trend in study times suggested by Table 2, Panel A. To account for this, we estimate effects of framing experimentally. Below, we briefly summarize the design of the experiment and our findings.

For each of the surveys referenced in Table 1 (Talent, NLSY79, HERI, and NSSE), we created a survey instrument that contained the same time-use question with the same wording, preceded by the same lead-in question, as was used in its historical counterpart. (The NLSY-Project Talent comparison involved a slightly different design and required the creation of two additional survey instruments, as will be described.) Students in 4 large classes at a major public university in California were randomly assigned to the survey instruments.[7]

Table 3 summarizes main results of the experiment. Columns 1 and 2 compare Project Talent to NSSE survey instruments. The average response of students who completed the survey based on Project Talent was 12.7 hours per week, whereas responses for students who filled out NSSE-based surveys averaged 11.6 hours per week. The difference in means is of modest statistical significance (p-value=.17). The HERI-based survey, which we compare to the Project Talent survey in columns 3 and 4, elicited responses 3.65 hours lower than the Project Talent-based survey. This difference is highly statistically significant.

[7] The six surveys, each on a single page, were ordered in a stack so that every sixth sheet was the same instrument. They were then handed out from the stack, one page to each student. Students were instructed that the experiment investigated time use and that their voluntary, anonymous participation qualified them for a raffle. A raffle was held among the participants after surveys were returned. The winner in each class received an Ipod Nano 4-gig MP3 player (retail value $149.00).

Unlike questions in the other surveys, the NLSY79 questions ask how much time the respondent spent working or studying "last week". The other surveys address time use for a "typical" week. Also, unlike the other surveys, the NLSY79 elicits study time on campus and off campus and sums these to get total study time. There are two distinct ways, then, in which NLSY79 responses may differ systematically from the other surveys. The framing of the questions may elicit different responses, but in addition, last week's time use may in fact differ from "typical" time use.

To address this, we created a survey (Talent (Revised)) that was identical to the Project Talent-based survey except that students were asked about time use *last week* rather than for a typical week.[8] We then compared the NLSY-based survey results with this revised survey (so that all responses refer to the same week.) This addresses the concern that the four classes in the experiment may have been surveyed during atypical weeks.[9] As shown in Columns 5 and 6, the NLSY79 elicits a higher average study time, with the difference in means significant at the 1% level.

Given random assignment, robust and significant differences in sample means of student responses to different surveys are attributable to idiosyncratic characteristics of

[8] We also investigated responses for time spent working for pay. Unlike the other surveys, the NLSY locates work and study questions in different parts of the survey and is longer than the other surveys, so we created a separate survey instrument, NLSY (Work), for its work question. Average work hours (available upon request) for all survey instruments were within .25 hr of each other and statistically indistinguishable, perhaps because work hours are dictated by an employer or scheduled in advance, and may be less susceptible to framing bias. We did not include an analysis of framing effects for class time. (The Project Talent survey, our baseline, does not include the class time question.)

[9] There could also be a concern that the nationwide NLSY79 may have been administered during "atypical" weeks. The college module was administered between January and June of 1981. An effort was made by administrators to survey students while they were attending college. There is little evidence that respondents were on hiatus or break: Only one respondent reported study time and class time to have been zero. But timing of the interviews may still have created a problem, as some weeks featured more interviews than others. To address the possibility that respondents tended to be surveyed during busier or less busy weeks of the term, we tabulated interview dates by week. We then re-weighted the observations so that each week received an identical weighting. The re-weighted mean was 19.50 hours/week compared to the original estimate of 19.75. We find little evidence, then, that the timing of the NLSY79 college module interviews accounts for large systematic differences with the other surveys.

the survey. A full-scale analysis of why responses differ between survey instruments is beyond the scope of this paper. We note that the allowed bins for the grouped data responses are lower in the HERI survey than in the NSSE survey and this could induce lower responses, as observed. We note also that the NLSY79 survey sums on-campus and off-campus study times, and this could generate higher responses. We emphasize that the experimental design does not allow us to identify the survey instrument that elicits the most accurate response. Rather, it lets us compare surveys to each other. Figure 1 shows how the adjustment for framing impacts long-run study time trends.

Unadjusted study time means from Table 2 are plotted as diamonds in Figure 1. The squares show study time responses adjusted for framing effects, taking the Project Talent survey instrument as the baseline. For example, in the experiment, the mean study time of responses to the NLSY survey question was 2.89 hours higher than the mean study time for the Project Talent question. Thus, the square in 1981 is plotted 2.89 hours lower than the diamond. Based on the experiment, the square on the adjusted plot shows *the average response that would have been given by students who took the NLSY survey in 1981, had they been administered the Project Talent survey instead.*

Quantified framing effects suggest that the study time drop between 1961 and 1981 was underestimated in Table 2, Panel A. Also, the post-2000 samples (NSSE 2003 and HERI 2004) agree very closely once framing has been taken into account (14.4 and 14.9 hours, respectively). Table 2, Panel B, the source for the adjusted plot in Figure 1, shows time use means adjusted for framing effects. After accounting for framing, we observe statistically significant declines in study time of about 8 hours per week between 1961 and 1981, about 2 hours per week between 1988 and 2004, and about 10 hours per

week between 1961 and 2003. We conclude that framing effects caused us to underestimate the study time decline in the 1961-1981 period, accounted for none of the decline in the 1988-2004 comparison (because survey questions were identical), and accounted for only a small portion of the observed decline in the 1961-2003 comparison.

C. Representativeness

We have estimated the 8-hour decline in study time between 1961 and 1981 from two national random samples. In this section, we investigate the representativeness of the NSSE schools, in order to discern whether the 10-hour decline observed between 1961 and 2003 is also a plausible measure of nationwide changes in college time use.

In Table 4, we compare NSSE schools to all schools in 1961 and in 2003. A comparison of columns 2 and 4 in row 1 reveals steep declines in (framing-adjusted) study times between 1961 and 2003 for the 156 NSSE schools. We also divide schools by Carnegie classification, as reported in the Integrated Postsecondary Education Data System (IPEDS) 2000. Though students at Liberal Arts colleges appear to study more than students at other types of institutions, the decline in study times is visible for all types of institutions.

One concern is that perhaps schools surveyed in the NSSE sample were atypical colleges in terms of their study time in 1961. Evidence in Table 4, however, indicates that this is not the case. Row 1, columns 1 and 2 show students in the nation at large in 1961 studying about the same as students in the NSSE schools in 1961. NSSE institutions appear to be representative in terms of study time choices by students in 1961.[10] Are they

[10] We have focused here on the representativeness of the larger sample of NSSE schools, but it is worth commenting on the HERI schools, as well. These are private schools with students from a more educated

representative along other dimensions? The remaining rows of the first panel of Table 4 allow comparisons by work status, race, gender, and parental education. Average demographic characteristics for students in NSSE schools in 1961 (column 2) are within 1 percentage point of the averages for all full-time students at four-year institutions in 1961 (column 1).

NSSE institutions also appear broadly representative of all institutions in 2003, except that there were more female respondents than average, more students with college-educated fathers, and more students who did not work while in school (or, to be more precise, the differences in these averages are larger than the 1 percentage point observed in 1961).[11] However, we will show that higher parental education, being female and not working are all associated with higher study times in 2003. If anything, then, characteristics of the NSSE institutions suggest that average study times reported for these institutions in the post-2000 era may be *higher* than the national average—and thus that the overall decline in study times is larger than what was indicated in Table 2.

D. Composition Effects

Demographic characteristics of the college-going population have changed over time. Table 1 indicates, among other changes, that there are more females, more working students, and more students with college-educated fathers in recent cohorts. Because time use varies with demographic characteristics, the decline in academic time investment may

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demographic. However, study hours for the HERI (2004) and NSSE (2003) samples are similar, when adjusted for framing (14.9 and 14.4 respectively.) Moreover, there are 24 HERI schools for which data are available in 1961 (Project Talent). An analysis of these 24 HERI Schools (available from the authors upon request) shows study hours that were close to, but a bit higher than, the national average in 1961 (25.9 and 24.4, respectively), and shows large declines between 1961 and 2004.

[11]The National Postsecondary Student Aid Study (2003), administered by the National Center for Education Statistics, U.S. Department of Education, provides a nationally representative sample of postsecondary institutions and students. This is our source for 2003 national averages reported in Table 4.

simply be the result of long term changes in the mix of students at postsecondary institutions. A well-known way to account for such composition effects is Oaxaca's (1973) method. This method allows us to decompose the change in sample study time averages over time using the following equality:

$$1) \qquad \bar{Y}_{early} - \bar{Y}_{late} = (X_{early} - \bar{X}_{late})' \hat{\beta}_{early} + \bar{X}_{late} (\hat{\beta}_{early} - \hat{\beta}_{late}) ,$$

where $\bar{Y}$ is mean study time for a given time period, $\bar{X}$ is average student characteristics and the $\hat{\beta}$s are coefficients from OLS regressions of study time on student characteristics. The first term on the right-hand side of the equation is commonly referred to as the "explained" portion of the decomposition. This is typically interpreted as the difference in study time across cohorts attributable to differences in average student characteristics. The second term is the difference in study time across cohorts associated with differences in the relationship between student attributes and study time. In essence, it expresses how much more a student with average characteristics in the later period would study were she held to the relationship between attributes and study time that existed in the early period. This is the "unexplained" portion of the Oaxaca decomposition. In 1), the assumption is that the early structure is the norm, i.e., that the coefficients in the early period OLS regression express the appropriate baseline association between attributes and outcomes. An alternative formulation with the later structure as the norm is the following:

$$2) \qquad \bar{Y}_{early} - \bar{Y}_{late} = (\bar{X}_{early} - \bar{X}_{late})' \hat{\beta}_{late} + \bar{X}_{early} (\hat{\beta}_{early} - \hat{\beta}_{late})$$

The separately calculated explained and unexplained components will in general differ depending on which structure is assumed to be the norm.

We use this method to determine the portion of the difference over time in study times explained by changes in demographic characteristics of the college-going

population. Explanatory variables include gender, race, age, and parental education for all time-period comparisons, along with verbal SAT score for the 1988-2004 comparison.[12] In Table 5, we report results of both decompositions, 1) and 2), as is standard in the literature.[13] Column 1 shows a decline in study times of 4.67 hours per week nationwide between 1961 and 1981. If 1961 coefficients are used, observed characteristics account for -3% of this study time difference. The negative sign would suggest that study times should have been *higher* in 1981 than they were 1961, based on observables. The explained portion of the study time difference is likewise negative if coefficients for the later period are used. Column 1 also summarizes decompositions adjusted for framing effects, and results are similar. Column 2 repeats the exercise for the 1988-2004 period, using the HERI schools. Here, changes in observables explain 18% of the overall difference in study times if 1998 coefficients are used, and -20% if 2004 coefficients are taken as the norm. Column 3 reports results of Oaxaca decompositions for the NSSE schools between 1961 and 2003, and again, the explained portion of the total decline is negative.[14]

[12] Summaries of the OLS regressions used to generate decompositions in Table 5 are available from the authors upon request. These show students with more-educated fathers and students with higher SAT scores studying more than others. They also show women studying more than men in the post-2000 samples.

[13] The age regressor in these decompositions warrants comment. In one time period, we compare students at different levels of advancement (freshman to students at all levels in columns 1 and 2 of Table 5). To avoid confounding levels with ages, we use *relative* age as the age regressor. This is a measure of how many years older the student is than an on-time student at her level (e.g., relative age is 0 for a 21-year-old senior, 1 for a 22-year-old senior.) To further address any concerns about comparisons across levels, we restrict the NSSE sample to freshman in Tables 5 and 6 so that results capture a direct freshman-to-freshman comparison.

[14] Elder, Goddeeris and Haider (2009) suggest the use of pooled regressions that include a time period indicator variable to obtain estimates of the unexplained gap, and emphasize that this method can generate estimates for the unexplained gap that lie outside the estimates obtained from a traditional Oaxaca-Blinder decomposition. Regressions using this approach (available from the authors upon request) also show large and statistically significant unexplained study time declines for all time period comparisons.

In summary, changes in observables explain none of the change in framing-adjusted study times between 1961 and 1981, none of the decline from 1961 to 2003, and at most 18% of the decline from 1988 to 2004.[15]

Regression coefficients used in Oaxaca decompositions differ by time period and may be difficult to interpret. Because results in Tables 5 are subject to these and other criticisms, we include a non-parametric investigation of composition effects. Table 6 displays average adjusted study times for 1961 and 1981 periods, 1988 and 2004 periods, and the 1961 and 2003 periods, broken out by subgroups, including work and major choices. It becomes clear why Oaxaca decompositions explained so little of the change in study times: No group appears to have bucked the trend. Study times declined overall and within both sub-periods for every subgroup. Working students studied less than others, but study hours fell for students in each category of work intensity, including those who did not work at all. Students with more educated fathers studied more than others; however, study times declined for students in all parental education categories. Similarly, study times declined for all race and gender categories, overall and within both sub-periods. Interestingly, women used to study about the same amount as men, but study more than men in recent cohorts. Engineering students studied more than other students and the gap has widened. Study times fell for all choices of major, overall and within both sub-periods. Students at liberal arts colleges studied more than other students, but study times fell at all types of colleges, overall and within both sub-periods. Lastly, data on SAT scores and school size, available for the later sub-period, show declines in study

[15] Changes in work choices (as students engage in more paid work over time) and choice of college major (as students shift into less demanding majors) could potentially account for a portion of the study time decline. These (endogenous) regressors were not included as explanatory variables in Table 5. However, decompositions that include hours worked and major dummies as explanatory variables yield very similar results, with at most 18% of the study time decline explained.

time for students of all ability levels, and at universities of all sizes and levels of selectivity.

Compositional changes do not appear to explain a large portion of the long-rum trend in study times by full-time students.

E. Comparisons with Alternative Datasets

Because the largest decline in study time appears to have occurred in the 1961-1981 period, findings rely sensitively on Project Talent. Data from Project Talent has been used in previous work by economists, and summary statistics for college students in 1961 Project Talent appear to match the 1960 U.S. Census.[16] One might still wonder whether students in the past studied as much as Project Talent suggests. Are the Project Talent study time responses in some way idiosyncratic or unrealistic? Historical evidence suggests not, as other time use datasets also show very high levels of academic time investment in early eras. Moreover, alternative datasets may be used to replicate the long-run decline in academic time investment.

Appendix A investigates 8 additional time use studies to check the robustness of the findings above. Seven of these are based on daily time diaries, a methodology discussed in more detail in Appendix A. Here, we briefly summarize results. Three very early sources date to the 1920s and 1930s. All three studies show academic time investment of 38 to 39 hours per week, very close to the Project Talent estimate.

[16] The 1960 Census includes part-time students and community college students. We add these back in to the Project Talent, so that it may be compared to the Census. This exercise yields the following: 33% of students reported working positive hours in Project Talent compared to 32% in the Census, 46% were female, compared to 47% in the Census, 96% were white, compared to 94% in the Census.

Commonly referenced time use datasets[17] from 1965, 1975, 1985, and 2003 (Americans' Use of Time, Time Use in Economic and Social Accounts, Americans' Use of Time, and U.S. Bureau of Labor Statistics' American Time Use Survey, respectively) show successive decreases in academic time investment. These data show declines in study time between the 1960s and the 2000s that are larger than what we have reported above.

The time diary datasets have limitations detailed in Appendix A. They often have very small sample sizes of college students, often lack important control variables (such as full-time enrollment status), are based on a completely different survey methodology with different framing biases, and often do not identify clearly whether college was in session when the surveys were completed. We are thus reluctant to push comparisons between these datasets and datasets used in the main analysis. Appendix A does not supersede the main analysis, in our view, but offers independent evidence. We summarize as follows: 12 separate data sources, 4 in the main body of the paper and 8 in the appendix, paint a fairly consistent picture of long-run changes in time use. Sources for 1961 or earlier all show 38 to 41 hours per week academic time invested by college students, whereas sources for the post-2000 era produce estimates of 24 to 28 hours per week.

F. Rising Time to Completion and Course-taking Intensity

A possible alternative conclusion (to falling college time costs) is falling intensity of course taking. Undergraduates have been requiring more years to complete college (Turner, 2004). If students are taking fewer courses per term, then declining study times are to be expected, even if the time cost of college remained the same. The key question

[17] E.g., Aguiar and Hurst, 2007.

in the context of the present analysis, is not whether course-taking intensity has decreased in general (as suggested by increasing time to completion), but whether it has decreased *for full-time students at four-year colleges*. Students with longer time to completion are apt to have been part-time students or to have been students who left college and then returned. But it remains possible that in addition to these factors, what it means to be a "full-time" student has changed over time. Are we comparing students with course loads of the same intensity? Specifically, in the later surveys, are so-called "full-time" students taking courses at a rate that would allow them to graduate in four years?

Respondents in the HERI samples included only **on-time seniors in their fourth year**. In effect, time to completion is held constant at four years in the HERI samples. Findings indicate, then, that full-time students on track to complete in four years studied less in recent cohorts. NSSE respondents may or may not be on-time, so we take the analysis a step further. The National Postsecondary Student Aid Study (NPSAS) contains data on course loads at four-year colleges in 2003-2004. Average yearly credits (in semester units, and weighted to account for the NPSAS survey design) earned by full-time students in 2003-2004 are: 30.7 for all four-year colleges, 31.0 for NSSE schools, and 31.3 for HERI schools. Given that graduation requirements are generally 120 semester units, the evidence from NPSAS indicates that full-time students in 2003-2004 were taking full course loads. Further, NPSAS data for 1987 show full-time course loads that were slightly *lower* than these figures. Though we lack data for 1961, "full-time" status appears neither to have eroded in intensity since 1987, nor to have been a misleading term in the post-2000 era.[18] In particular, full-time students in NSSE and

[18] HERI data show a modest decline in the class times of full-time students between 1988 and 2004. This may seem to be in conflict with the NPSAS finding of no erosion in course loads of full-time students over

HERI schools in 2003-2004 were taking courses at a rate sufficient for graduation in four years.

We conclude that rising time to completion is not driving (or significantly inflating) the long run study time trend among full-time students.[19]

IV. CONCLUSION

In this paper, we have documented that full-time students at four-year colleges in the U.S. are investing much less time in academics than they once did. Full-time college students in 1961 allocated about 40 hours per week toward class and studying, whereas full-time students in 2003 invested about 27 hours per week. Decreased academic time investment is observable in a wide range of subsamples—across all observable demographic groups and all types of four-year colleges. The declines are visible in the main analysis and in an alternative analysis relying on different data, and are not accounted for by survey framing effects.

Why have such declines occurred? Speculation yields a number of potential causes and explanations, including but not limited to the following: Education production technologies may have improved[20], institutional standards may have evolved to meet an evolving market for college students[21], or incomes, wage premia, or tuition and other costs may have changed in ways that altered human capital decisions. Some evidence and

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the same time period. A possible explanation is, class attendance patterns may have changed over time, with attendance becoming less frequent.

[19] Our results, however, are compatible with the findings in Turner (2004). Rising time to completion may be driven by increases in part-time students, community college students, and students interrupting college and returning.

[20] For example, term papers may have become less time-consuming to write with the advent of word processors.

[21] David L. Kirp makes this point in Hersch and Merrow(2005), arguing that increased market pressures have caused colleges to cater to students' desires for leisure.

analysis can be brought to bear on these and other explanations, but time use data alone do not allow us to draw strong conclusions. The large decline in academic time investment is an important pattern its own right, and one that motivates future research into underlying causes.

We highlight two important implications of the finding. Firstly, falling academic time investment by full-time students suggests that the opportunity cost of a year of college (or, more precisely, the time component thereof) has declined over the years. This change appears substantial, and may not have been fully understood or appreciated in previous work on changes over time in the wage return to college. Secondly, if student effort is a meaningful input to the education production process, then declining time investment may signify declining production of human capital—or a dramatic and heretofore undocumented change in the way human capital is being produced on college campuses.

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APPENDIX A – Additional Time Use Datasets

This appendix highlights 8 additional studies from which academic time use by college students may be estimated. Seven of the studies, which we summarize in Appendix Table A.1, are based on daily time diaries. Columns 1 through 3 reference very early studies. Column 1 summarizes results from a 1925 study of 503 Vassar college students (roughly half the student body). Column 2 (1928) reports on University of Idaho students from two education classes, augmented by students from a sorority and a fraternity. Column 3 shows results of a 1932 study of time use by residents of Westchester County, New York in which 53 of 2460 respondents were in college. The three studies, on diverse pools of students, show similar average academic time use: 38.3, 38.5 and 39.2 hrs/wk for students in 1925, 1928, and 1933, respectively.[22] Academic time use in the 1920s and 1930s, then, appears close to the Project Talent 1961 estimate.

Columns 4 through 7 report summary statistics from Americans' Use of Time (1965-1966), Time Use in Economic and Social Accounts (1975-1976), both conducted by the Survey Research Center at the University of Michigan, Americans' Use of Time (1985), conducted by Survey Research Center at the University of Maryland, and The American Time Use Survey (2003), conducted by U.S. Bureau of Labor Statistics.[23] One advantage of these surveys is their national scope. These data suggest that academic time use, nationwide, declined sharply between 1965 and 2003. However, several important caveats apply. We note first the small sample sizes, particularly for 1965. Secondly, it is not possible to separate full time from part time students (except in the 2003 sample).

[22] See Hutchinson and Connard, 1926, Goldsmith and Crawford, 1928, and Lundberg et al., 1934 for accounts of these studies. Hutchinson and Connard also cite other studies showing academic time use of 36 and 42.5 hrs/wk at the University of Chicago and Bryn Mawr, respectively. (We could not locate these.)

[23] Some commonly used time diary datasets do not clearly identify college students and could not be used here (e.g., The United States Environmental Protection Agency Time Use Study (1993)).

Thirdly, the 1965-2003 surveys did not focus on college students and it is not always clear whether college was in session on the day referenced by the time diary. Specifically, respondents may have classified themselves as "enrolled" in college even if they completed the diary during a break. This is salient in the 1985 and 2003 samples, in which students were sampled year round. In the ATUS 2003, for example, about 90% of "students" who completed time diaries in the summer months reported spending zero minutes attending classes. This issue, along with the issue of part-time students, is addressed in Panel B.

The ATUS 2003 reports time diary dates and whether the student is part-time or full time. In Panel B, we exclude part-time students and students whose time diary date was likely to have been during a summer break (defined as June through August) or a winter break (defined as December 15-January 8). Average academic time investment for this sample is 23.7 hrs/wk. This would appear reasonably close to the HERI and NSSE estimates (about 27 hrs/wk). It is not possible to include the 1965, 1975, and 1985 datasets in Panel B, as these sources lack information on time diary dates (1985) or full time status of students (1965, 1975). We include results from 1925 and 1928 data in Panel B, because these surveys were administered only to college students (and the students were not on break.)[24] Estimates in Panel B appear broadly consistent with results in the main body of the paper.

One additional study, The University of California Undergraduate Experience Survey (UCUES, 2003), may also be relevant here. (We do not include this study in Appendix Table A.1 because it is based on a retrospective survey, not on daily time

[24] Further, we assume that the vast majority of students in the 1920s were full time.

diaries.) UCUES reports an average of 27.4 hrs/wk academic time use by students in 7 colleges in the University of California system in 2003.

We have noted limitations of the time diary datasets discussed above. They do not supersede the main analysis, in our view, but offer independent evidence. In summary, we find that 12 separate data sources, 4 in the main body of the paper and 8 in this appendix, paint a fairly consistent picture of the long run trend in college time use. Sources for 1961 or earlier all show 38 to 40 hrs/wk academic time invested by college students, whereas sources for the post-2000 era produce estimates of 24 to 28 hrs/wk.

Table 1
Descriptive Statistics - Full-Time Students at Four-Year Postsecondary Institutions

	Project Talent 1961 (National Sample)		**NLSY79 1981 (National Sample)**		**HERI 1988 (46 schools)**		**HERI 2004 (1988 avail) (46 schools)**		**NSSE 2003 (1961 avail) (156 schools)**	
	Mean	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**
Study (hrs/wk)	**24.43**	13.44	**19.75**	14.59	-	-	-	-	-	-
Study>20 hrs/wk	**0.67**	0.47	**0.44**	0.50	**0.19**	0.39	**0.13**	0.34	**0.20**	0.40
Study>16 hrs/wk	**0.72**	0.45	**0.54**	0.50	**0.35**	0.48	**0.26**	0.44	**0.34**	0.47
Study<5 hrs/wk	**0.07**	0.25	**0.14**	0.34	**0.16**	0.36	**0.25**	0.43	**0.19**	0.39
Class (hrs/wk)	-	-	**15.84**	7.61	-	-	-	-	-	-
Class>20 hrs/wk	-	-	**0.19**	0.39	**0.15**	0.36	**0.10**	0.30	-	-
Class>16 hrs/wk	-	-	**0.38**	0.49	**0.44**	0.50	**0.31**	0.46	-	-
Class<5 hrs/wk	-	-	**0.07**	0.26	**0.08**	0.28	**0.10**	0.30	-	-
Work (hrs/wk)	**4.12**	8.48	**8.25**	11.63	-	-	-	-	-	-
Work >20 hrs/wk	**0.05**	0.22	**0.14**	0.35	**0.14**	0.35	**0.17**	0.38	**0.17**	0.37
Work <20 hrs/wk	**0.22**	0.41	**0.31**	0.46	**0.63**	0.48	**0.62**	0.48	**0.38**	0.49
Not working	**0.73**	0.44	**0.54**	0.50	**0.23**	0.42	**0.20**	0.40	**0.45**	0.50
White	**0.97**	0.20	**0.74**	0.44	**0.93**	0.25	**0.81**	0.40	**0.82**	0.39
Asian	**0.01**	0.10	**0.01**	0.11	**0.03**	0.16	**0.08**	0.27	**0.06**	0.24
Black	**0.02**	0.15	**0.10**	0.30	**0.02**	0.15	**0.05**	0.21	**0.07**	0.26
Female	**0.46**	0.50	**0.48**	0.50	**0.55**	0.50	**0.61**	0.49	**0.64**	0.48
Age	**18.12**	0.52	**20.18**	1.54	**21.16**	0.73	**21.96**	2.97	**20.09**	3.99
Father's Ed < 12	**0.34**	0.48	**0.28**	0.45	**0.07**	0.26	**0.05**	0.21	**0.26**	0.44
12<Father's Ed<16	**0.42**	0.49	**0.28**	0.45	**0.35**	0.48	**0.32**	0.47	**0.22**	0.41
Father's Ed >=16	**0.24**	0.43	**0.44**	0.50	**0.58**	0.49	**0.63**	0.48	**0.52**	0.50
SAT Verbal	-	-	-	-	**577.24**	93.79	**610.40**	91.98	**566.29**	95.25
Doc/Research[a]	**0.50**	0.50	**0.48**	0.50	**0.51**	0.50	**0.46**	0.50	**0.52**	0.50
Masters[a]	**0.32**	0.47	**0.36**	0.48	**0.30**	0.46	**0.33**	0.47	**0.38**	0.49
Bac/Lib Arts[a]	**0.10**	0.30	**0.11**	0.31	**0.13**	0.33	**0.13**	0.34	**0.07**	0.26
Bac/Other[a]	**0.06**	0.24	**0.04**	0.20	**0.07**	0.25	**0.08**	0.27	**0.02**	0.14
Obs	17985		1314		5012		20612		3195	
Notes	Freshmen		All years		Seniors[b]		Seniors[b]		Freshmen/Seniors	

[a]Colleges in 1961, 1981 samples assigned IPEDS 2000 Carnegie codes. Data is missing for the small fraction of colleges that had ceased to exist.
[b]HERI datasets include only "on time" seniors--that is, seniors who were also in their fourth year.

Table 2
Average Time Use - Full Time Students (Hrs/Wk)

	Talent 1961	NLSY79 1981	HERI 1988 (w/2004)	HERI 2004 (w/1988)	Talent 1961 (w/2003)	NSSE 2003 (w/1961)
	1	2	3	4	5	6
A. Means						
Study[a,b]	24.43	19.75	12.96	11.23	24.38	13.28
[Dif]	4.67		1.73		11.10	
	(.41)		(.11)		(.24)	
Class[a]	-	15.84	14.54	13.01	-	-
Ave Work[a]	4.12	8.25	10.15	10.42	4.19	9.47
Leisure Time[c]	123.62	124.16	130.36	133.35	123.59	132.24
Academic Time[d]	40.26	35.59	27.49	24.23	40.22	26.29
B. Adj. for Framing						
Study[a,b]	24.43	16.86	16.61	14.88	24.38	14.40
[Dif]	7.56		1.73		9.98	
	(.56)		(.11)		(.31)	
Academic Time[d]	40.26	32.70	31.14	27.88	40.22	27.41
Obs	17985	1314	5012	20612	4665	3195

[a]For grouped data samples, average calculated by assigning bin midpoints to each obs in bin.
[b]Standard errors of differences in means (from Two-sample t-test) in parentheses.
[c]Leisure is defined as non-work, non-academic acativity.
[d]Academic time is sum of study time and class time. (1981 class time is used for 1961 class time and HERI 2004 class time estimate is used for NSSE 2003 class time.)

Table 3
Study Time Responses by Survey Instrument

	Talent 1	NSSE 2	Talent 3	HERI 4	Talent(R) 5	NLSY79 6
Study Hours	12.71	11.59	12.71	9.06	10.91	13.80
	(.632)	(.50)	(.64)	(.44)	(.61)	(.84)
[Dif]	1.12		3.65		-2.89	
	(.81)		(.78)		(1.04)	
Classes	4	4	4	4	4	4
Obs	181	182	181	177	183	179

Standard errors of differences in means (from Two-sample t-test) in parentheses

Table 4
Representativeness of NSSE Schools (1961 and 2003)

	1961		2003	
	All[a]	NSSE[a]	All[a]	NSSE[a]
A. ALL	1	2	3	4
Study (Ave.,hrs/wk)[b]	24.43	24.38	-	14.40
Not working	0.73	0.74	0.28	0.45
White	0.97	0.98	0.77	0.82
Black	0.02	0.01	0.11	0.08
Female	0.46	0.45	0.56	0.64
Father's Ed >=16	0.24	0.25	0.43	0.52
#Institutions	1213	156	1407	156
B. Doctoral/Research[c]				
Study (Ave.,hrs/wk)[b]	25.31	24.61	-	14.42
Not working	0.76	0.77	0.32	0.49
White	0.98	0.98	0.77	0.82
Black	0.01	0.01	0.11	0.08
Female	0.42	0.41	0.56	0.62
Father's Ed >=16	0.26	0.27	0.51	0.56
#Institutions	191	49	259	49
C. Masters[c]				
Study (Ave.,hrs/wk)[b]	22.15	22.76	-	13.79
Not working	0.70	0.72	0.25	0.41
White	0.95	0.96	0.78	0.81
Black	0.04	0.02	0.11	0.09
Female	0.50	0.50	0.58	0.69
Father's Ed >=16	0.17	0.18	0.36	0.44
#Institutions	391	61	605	61
D. Bac/Liberal Arts[c]				
Study (Ave.,hrs/wk)[b]	28.96	29.11	-	17.52
Not working	0.74	0.69	0.26	0.41
White	0.97	0.99	0.82	0.88
Black	0.02	0.00	0.10	0.03
Female	0.47	0.50	0.59	0.62
Father's Ed >=16	0.39	0.41	0.52	0.70
#Institutions	167	29	223	29

[a]Sources: Project Talent (columns 1 and 2), NPSAS (column 3), and NSSE (column 4).

[b]Adjusted for framing in columns 2 and 4. For grouped data samples, average calculated by assigning bin midpoints to each obs in bin.

[c]Classifications for 1961 based on 2000 Carnegie Code. To save space, we have not displayed the Bac\Other category (12 schools).

Table 5
Oaxaca Decompositions - Hours Studied

	Talent 1961	NLSY79 1981	HERI 1988 (w/2004)	HERI 2004 (w/1988)	Talent 1961 (w/2003)	NSSE 2003 (w/1961)
	1		2		3	
Early period coefficients, means	24.43		12.96		24.38	
Late period coefficients, means	19.75		11.23		13.20	
Early period coefficients, late period means	24.56		12.64		25.07	
Late period coefficients, early period means	19.16		10.89		12.83	
Decomposition (Early Period Coefficients)						
Total Difference	4.67		1.73		11.18	
Explained	-0.13		0.32		-0.69	
Fraction Explained	**-0.03**		**0.18**		**-0.06**	
Total Difference (adjusted for framing)[a]	7.56		1.73		10.06	
Fraction Explained	**-0.02**		**0.18**		**-0.07**	
Decomposition (Late Period Coefficients)						
Total Difference	4.67		1.73		11.18	
Explained	-0.59		-0.34		-0.37	
Fraction Explained	**-0.13**		**-0.20**		**-0.03**	
Total Difference (adjusted for framing)[a]	7.56		1.73		10.06	
Fraction Explained	**-0.08**		**-0.20**		**-0.04**	

[a]No adjustment for framing in Column 2, as same survey instrument was used in both periods.
Decompositions in columns 1 and 3 include expanatory variables for gender, race, relative age, and father's education. Decompositions in Column 2 augment these explanatory variables with verbal SAT scores. NSSE data in column 3 are restricted to freshmen (to allow freshmen to freshmen comparison with Project Talent.)

Table 6
Average Study Time - Full Time Students by Subgroup

		Talent 1961	NLSY79 1981	HERI 1988 (w/2004)	HERI 2004 (w/1988)	Talent 1961 (w/2003)	NSSE 2003 (w/1961)
		1	2	3	4	5	6
All		24.43	16.86	16.61	14.88	24.38	14.40
Employment	Not Working	25.18	18.51	17.12	15.95	25.22	14.84
	Work <20	23.78	17.35	16.90	14.85	23.58	14.42
	Work >20	18.25	11.57	14.41	13.74	17.80	13.19
Father's Ed	No College	23.74	16.16	16.47	13.75	23.72	13.68
	Some College	24.40	16.43	15.88	14.35	24.67	14.29
	College Grad	25.63	17.60	17.09	15.41	24.87	14.79
Gender	Male	24.54	17.35	16.62	14.30	24.13	13.64
	Female	24.30	16.35	16.59	15.24	24.70	14.82
Race	White	25.08	16.83	16.65	14.93	25.06	14.41
	Asian	25.48	22.94	16.94	15.30	29.52	14.31
	Black	20.40	16.45	13.77	14.32	18.56	14.04
SAT	SAT verbal<540	-	-	16.33	13.41	-	13.62
	SAT verbal 540-620	-	-	16.46	14.78	-	14.81
	SAT verbal>620	-	-	17.34	16.37	-	14.51
Major	Business	22.32	14.61	15.04	13.14	22.23	13.33
	Education	24.33	13.02	16.30	13.90	24.35	14.11
	Engineering	27.89	22.35	22.31	18.70	27.03	18.46
	Biology	26.03	20.50	18.99	16.34	27.16	15.58
	Phys Sciences	27.18	23.66	17.32	16.57	26.96	16.42
	Letters	24.69	16.25	17.15	15.58	24.69	15.38
	Social Sciences	26.05	17.15	16.29	14.26	25.62	14.56
	Health	27.13	15.63	16.07	14.42	29.78	15.02
Type (College)	Doc/Res	25.31	18.69	16.72	14.84	24.61	14.42
	Masters	22.15	14.87	16.09	14.37	22.76	13.79
	Bac - Lib Arts	28.96	24.62	17.49	16.34	29.11	17.52
	Bac - Other	22.73	13.40	16.16	14.74	23.43	13.74
Selectivity (College)	High	-	-	15.90	13.47	-	13.06
	Medium	-	-	16.68	14.68	-	15.14
	Low	-	-	17.58	16.49	-	16.34
Size (College)	<2500	-	-	16.39	15.20	-	15.70
	2500-7500	-	-	16.50	15.76	-	14.23
	>7500	-	-	16.72	14.78	-	14.09

Columns 2,3,4, and 6 adjusted for framing effects (relative to Project Talent baseline)

Appendix Table A.1
Average Weekly Time Use - Time Diary Surveys

	1925[a]	1928[b]	1933[c]	1965[d]	1975[e]	1985[f]	2003[g]
	1	2	3	4	5	6	7
A. All Students							
Acadmic Time	38.3	38.5	39.2	34.1	23.6	18.0	14.2
Study Time	-	21	-	18.2	11.1	8.9	7.2
Class Time	-	17.5	-	15.9	12.5	9.2	7.0
Obs	503	100	53	18	58	163	862
B. Full-Time Students[h]							
Summer-Winter Break Excluded[i]							
Acadmic Time Use	*38.3*	*38.5*	-	-	-	-	23.7
Study Time	-	*21*	-	-	-	-	12.1
Class Time	-	*17.5*	-	-	-	-	11.6
Obs	*503*	*100*	-	-	-	-	363

[a]Respondents from Vassar College, time diaries (complete semester) February to June.

[b]Respondents from University of Idaho, time diaries (7 consecutive days).

[c]Westechester County, New York, time diaries (3 or 7 consecutive days).

[d]Americans' Use of Time, 1/3 of repondents in Jackson, MI, 2/3 in other cities, time diaries (single day).

[e]Time Use in Economic and Social Accounts, national sample, time diaries (4 days spaced over a year)

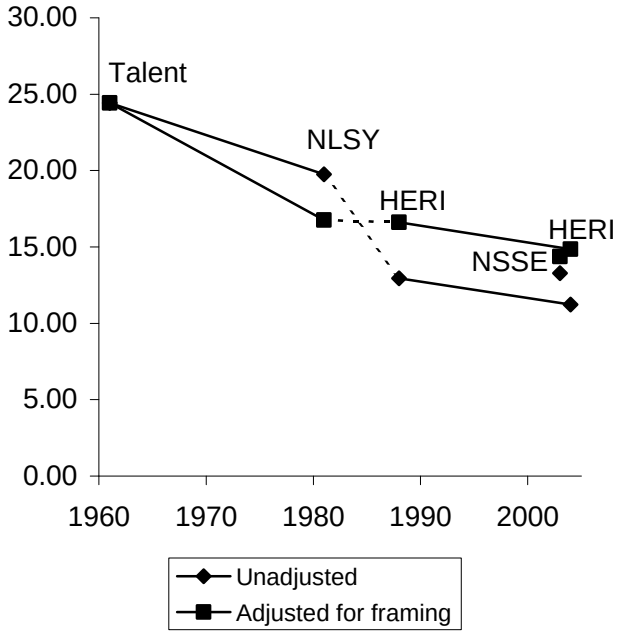
[f]Americans' Use of Time, national sample, time diaries (single day)

[g]Americans Time Use Survey, U.S. Bureau of Labor Statistics, national sample, time diaries (single day)

[h]It is not always possible to distinguish full time from part time students in Panel A. This distinctionis is possible in 2003 sample. Students in 1920s are assumed to have been full time - results in italics.

[i]In 1965-2003 surveys, some "students" may have completed the time diary during a break. Panel B excludes winter break and summer months.

Figure 1
Average Study Hours



Notes: Average study hours per week from Project Talent(1961), NLSY79(1981), HERI(1988), NSSE(2003), and HERI(2004) samples are plotted as diamonds. Squares show average study time responses from these surveys adjusted for estimated framing effects, with Project Talent as the baseline. A solid line between two plotted points indicates either that the two samples were both nationally representative or that they relied on a consistent set of schools. A dotted line between points indicates that this was not the case.