# The Falling Time Cost of College:
## Evidence from Half a Century of Time Use Data*

Philip Babcock
University of California, Santa Barbara

Mindy Marks
University of California, Riverside

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ABSTRACT

Using multiple datasets from four different time periods, we document declines in academic time investment by full-time college students in the United States between 1961 and 2004. Full-time students allocated 40 hours per week toward class and studying in 1961, whereas by 2004 they were investing about 26 to 28 hours per week. Declines were extremely broad-based, and are not easily accounted for by compositional changes or framing effects. In addition to posing a new puzzle, findings suggest that previous research may have underestimated recent increases in the rate of return to postsecondary education by as much as 50 percent.

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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. In particular, there has been little or no investigation of trends over time in the actual time investment associated with a "year" of post-secondary schooling. Because time is the choice variable in models of human capital investment and production, this is potentially a serious omission. Our research documents and quantifies changes in time use by full-time college students at four-year institutions in the United States between 1961 and 2004. We find dramatic declines in academic time investment over this period. Full-time college students in 1961 allocated about 40 hours per week to academics, whereas full-time students in 2004 invested 26-28 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. A "year" of college, then, would seem a nominal measure of time. It is a currency whose face value has eroded more or less continuously for over 40 years.

The relevance of this research is threefold. Firstly, obvious problems arise when a nominal measure is treated as real. We highlight a primary implication—that increases in the rate of return to postsecondary education since 1980 may have been greatly underestimated. Secondly, the observed decline in academic time use—in conjunction with increased student work hours and increased leisure—appears difficult to explain using standard economic theory. We investigate a number of potential mechanisms, but submit that it remains an open question—a new puzzle. Lastly, if student effort is an input to the education production process, then declining time investment could signify declining production of human capital. To the extent that educators at post-secondary institutions are actively seeking ways to impart more human capital, the magnitude of the decrease over time in this fundamental input is worth knowing.

The remainder of the paper is structured as follows. Section II reviews the relevant literature and articulates a theoretical framework. Section III describes the datasets used in the analysis. Section IV documents the time trend in academic time investment and parses out competing explanations. Section V explores the implications of these results. Section VI concludes.

## II. Previous Research and Conceptual Framework

### A. Previous Empirical Research

We have found little previous research investigating the academic time use trend we study here. In the popular press, a number of educators have expressed concern about a perceived decrease in student engagement.[1] But perceptions of engagement are subjective. Evidence in the education literature has been incomplete, anecdotal, has covered short time periods, or has lacked strategies to account for composition bias and other confounding factors. Kuh (1999), for example, finds that "time spent on school work" by college students fell between the mid-1980s and the mid-1990s. But the dataset was not nationally representative or a random sample, and the set of schools sampled in the 1980s was not the same as the set sampled in the 1990s. Astin, Keup, and Lindholm (2002), analyzing a consistent set of schools between 1989 and 1998, find that time spent studying fell by about .41 hours per week. Evidence in the education literature, then, is limited to a brief period between the 1980s and 1990s.

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. In economics, Stinebrickner and Stinebrickner (2004) is the only work we know of that uses study-time measures—and we concur with the authors' assessment on the

[1] See Hersch and Merrow(2005), Bok(2005), Nathan (2005).

dearth of existing research: “Knowledge of the relationship between educational outcomes and perhaps the most basic input in the education production process—student study time and effort—has remained virtually non-existent.” The authors find study time to be positively associated with student GPAs at Berea College. To further motivate our empirical investigation of college time use, we pause to determine whether there exists broader evidence that increased study time is associated with increased marginal product later in life.

The National Longitudinal Survey of Youth, 1979, includes data on time use in college and long-run wages. Data on study time are available for students who were in college in 1981. To construct Figure 1, we combined time use data from students who were in college in 1981 full time with subsequent wage data for these students at two-year intervals from 1986 to 2004. We regress log hourly wage from each of these years on hours studied per week in 1981, and then plot the coefficient on “hours studied” against the year referenced by the wage. All regressions also include controls for gender, AFQT score, and year in college in 1981 (i.e., dummies for freshman, sophomore, and junior year) and recommended weightings. Though it remains difficult to separate the effect of pre-existing ability from acquired human capital in this simple OLS setting, we find a positive association between weekly study time in college and future wages. The estimates are not statistically distinguishable from zero in early post-college years, but the increase in wages associated with studying grows larger over time and becomes statistically significant in later samples.[2] By 2004, a student who had studied an hour more per week in 1981 earned a wage premium of about .6%. The standard deviation of hours studied in the NLSY79 is 14.6. Thus, a standard deviation change in hours studied in 1981 is associated with a wage gain of 8.8 log points in 2004. We do not claim to have proven a causal effect, but conclude that—consistent with most human capital models and the intuitions of educators—increased effort in college is associated with increased marginal product later in the lifecycle.

[2] If productivity-enhancing characteristics that are difficult to observe by employers exert a stronger influence on wages as individuals spend more time in the workforce, then this would be the expected pattern. See Altonji and Pierret (2001), Farber and Gibbons (1996).

Study time would appear to be a meaningful component of college time use, largely unstudied. While there is little work on study times in the economics literature, there is a growing body of research in economics investigating employment during college and rising time to completion.[3] Consistent with this research, we find students to be working more. However, in addition, we find students to be studying much less and taking more leisure. These changes are difficult to explain, and we will argue that they constitute a new puzzle.

B. Time Use and Human Capital Models

The theoretical literature on human capital investment provides a point of departure. In early models (e.g., Becker (1962)), periods of schooling is the choice variable. Agents acquire schooling until the cost of additional schooling, including forgone wages and direct costs, equals the discounted gain in future income made possible by the marginal human capital acquired. In the solution, all schooling takes place at the beginning of the lifecycle, prior to the agent's entry into the workplace, as this allows wage benefits of schooling to accrue over a longer period of time. Students do not "mix" work with schooling in this setting. Ben-Porath (1967) permits agents to choose the fraction of time they will spend on schooling relative to work at each point in time, and well-known solutions to the model yield a mix of working and investing in schooling during some spans. Given diminishing marginal gains in human capital from school time invested within period, agents specialize in schooling during the first phase of the lifecycle, gradually reduce time invested in schooling and increase time in the workplace over a second phase, and choose no schooling and full-time employment for the third phase. This class of wealth-maximizing models abstracts from the leisure-schooling trade off entirely, taking the total amount of non-leisure time as predetermined. A finding of increases over time in college students' consumption of leisure motivates including leisure.

[3] Examples include Ehrenbeg and Sherman (1997), Orzsag, Orzsag, and Whitemore (2001), Scott-Clayton (2007), and Stinebrickner and Stinebrickner (2003) and Turner (2004).

In Section IV, we will document concurrent increases in leisure and work hours and decreases in study hours. Here, we present a simple two-period model to illustrate the puzzling nature of the empirical results. Utility in the first stage of life is a function of consumption *c* and leisure *l*, and is represented by the function *U(c,l)*. Utility in the second stage is a function of only consumption *c'*, and is represented by *V(c'). β* is the discount factor or other weighting for period 2. Investing a fraction of time *s* in schooling during period 1 produces *f(s)* units of human capital in period 2. Time fraction *h* allocated to work in period 1 produces consumption according to the unskilled wage, with *l+h+s=1*. The functions *U()* and *V()*, and *f()* are assumed continuously differentiable, strictly increasing, and strictly concave in all their arguments. Given parental income transfer *I*, unskilled wage rate *w,* and return to investment in human capital *r*, the agent's problem is to allocate time between leisure, work, and study to maximize utility:

$$\max_{l,h} U\left(wh + I, l\right) + \beta V\left[w + rf\left(1 - l - h\right)\right] \qquad 1)$$

s.t. $0 \le l \le 1,\ 0 \le h \le 1$.

First order conditions for an interior solution are:

$$U_L\left(wh + I, l\right) = \beta V_C\left[w + rf\left(1 - l - h\right)\right] rf'\left(1 - l - h\right) \qquad 2)$$

$$U_C\left(wh + I, l\right) w = \beta V_C\left[w + rf\left(1 - l - h\right)\right] rf'\left(1 - l - h\right) \qquad 3)$$

Both expressions have clear intuitive interpretations. The left side of 2) is the marginal benefit of a unit of leisure in period 1 and the right side is the marginal benefit of a unit of schooling. Similarly, the left side of 3) is the marginal benefit of additional work in period 1 and the right side is the marginal benefit of schooling. Combining 2) and 3) yields the trade-off equating marginal benefits of leisure and work: $U_L(c,l) = wU_C(c,l)$.

We assume log utility ($U(c,l) = \alpha \ln(c) + \ln(l+1)$ and $V(c') = \ln(c')$). This assumption makes it possible to sign partial derivatives of the endogenous variables with respect to the exogenous variables. In particular, application of the Implicit Function Theorem and Cramer's Rule yields:

$$\frac{\partial l}{\partial r} = -\frac{\beta f'(1-l-h)wc^2}{c'^2[w^2 a + \phi c^2 + \phi w^2 \alpha (l+1)^2]}, \qquad 4)$$

where $\phi = \frac{\beta r^2 f'(1-l-h)^2}{c'^2} - \frac{\beta r f''(1-l-h)}{c'}$ >0 by concavity of *f*. The denominator of 4) is thus positive and the partial derivative is negative. This, together with a similar derivation for hours worked, produces a set of intuitive results:

$$\frac{\partial l}{\partial r} < 0, \ \frac{\partial h}{\partial r} < 0, \ \frac{\partial s}{\partial r} > 0$$

When the return to studying rises, agents substitute into studying, taking time away from both leisure and work. Because the recent return to schooling is higher than in previous decades, the model predicts declines over time in both leisure and work hours, rather than the increases we document in Section IV.

Calculation of the remaining partial derivatives is straightforward[4] and yields several other intuitive results:

$$\frac{\partial l}{\partial I} > 0, \ \frac{\partial h}{\partial I} < 0, \ \frac{\partial s}{\partial I} > 0$$

Agents with higher non-wage income work less and take more leisure, as expected given that leisure is a normal good. Credit constraints are built into this model, because assets cannot be transferred between periods.[5] An increase in tuition mimics falling non-wage income here, causing hours worked to rise but hours of leisure to fall. Neither change would cause leisure hours and work hours to move in the same direction. Thus, changes of this type would not seem to explain the empirical findings.

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[4] All derivations in this section rely on application of the Implicit Function Theorem and Cramer's Rule, and are available from the authors upon request.
[5] We exclude asset transfers primarily to simplify the signing of partial derivatives. However, incomplete capital markets could also be a salient factor in time allocation decisions of college students.

Lastly, we have $\frac{\partial h}{\partial w}>0$. Increases in the unskilled wage, w, generate an upward movement in hours worked. The signs on other partials with respect to the unskilled wage are ambiguous. They depend on the relative size of income and substitution effects, leisure having become more expensive and agents having come to feel richer. Upward movements in the unskilled wage, however, do not likely explain the increase in work hours by students, let alone a simultaneous increase in work and leisure: Work hours by students appear to have increased as much during periods when student wages were rising as they did during periods when student wages were falling.[6]

Though by no means exhaustive, the discussion above sketches the outlines of a puzzle. A simple human capital model has difficulty explaining rising student work, rising leisure and falling academic time investment, during a period when returns to postsecondary education increased.

## III. Data

Documenting changes in time investment requires pooling a wide range of datasets from multiple sources. We examine data from 4 time periods, 2003-2005, 1987-1989, 1981, and 1961. We restrict our analysis to full-time students at four-year colleges in each of these periods. Data for time use in the earliest time period, 1961, come from Project Talent. For the 1981 sample, we use the 1981 college module from the National Longitudinal Survey of Youth, 1979. The data for recent time periods comes from the Higher Education Research Institute (HERI), based in the Graduate School of Education & Information Studies at the University of California, Los Angeles. We use HERI Follow-up Surveys (FUS) and HERI College Student Surveys (CSS) for the 1987-1989 and 2003-2005 periods. For simplicity here, we will refer to the multiyear samples by their midpoints (e.g., the 1987-1989 dataset is the “1988 sample”). We also obtained data from

[6] Scott-Clayton (2007). See also the model therein, which has been adapted here to include leisure.

an additional source for the most recent time period: the 2003 National Survey of Student Engagement (NSSE). Table 1 displays summary statistics and indicates how the samples differ from one another. We address concerns about survey differences in Section IV and Appendix A. Here, we briefly describe the data.

*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 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. The survey also includes recommended weightings to account for survey design and attrition. We use the recommended weightings in all displayed tables and figures.[7]

*1981(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 also elicits responses in hours, rather than ranges, and includes recommended weightings. We use recommended weightings in all displayed tables and figures.

[7] It is worth commenting on the Project Talent survey methodology and response rates. Project Talent randomized at the high school level, then tracked respondents with 1-year, 5-year and 15-year follow-ups. The original samples were saturation samples, with all students in the given high school and year completing the survey. The later follow-ups had high attrition rates, which could raise concern. However, we use data from the 1-year follow-up only, which had high response rates. The response rate for students in college for the 1-year follow-up was 74.7%.

*1988, 2004 (HERI)*

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."* For the 1988 and 2004 HERI samples, the survey question (and allowed response ranges) remained the same. However, the data are not a random sample of institutions, so it is important that we construct consistent sets of schools. To obtain sufficiently large consistent sets of schools, we pool three years of data for each time period. 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 (2001), we weight individual observations by the inverse of the student population at the school multiplied by the number of observations for that school. Thus, if the universe of schools were those with data in the 1988 and 2004 samples, summary statistics, regression coefficients and confidence intervals calculated using the given weighting would be representative of this universe.[8]

*2003 (NSSE)*

The National Survey of Student Engagement 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* ." As was the case for the HERI sample, we weight

[8] We also drop schools for which there are less than 10 individual observations. Results change very little when these schools are included. We also have HERI data for 1996, which allows us to assess changes in a consistent 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.

individual observations by the inverse of the student population at the school multiplied by the number of observations for that school.

## IV. Results

### A. Overview

Given that data from later time periods are grouped in bins or ranges, the most straightforward way to compare 1961 and post-2000 study time measures 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, a first pass at the data, shows CDF values (subtracted from 1) at common truncation points of 20 hours a week for all samples. Many colleges set targets for study time, and these targets are higher than 20 hours per week for full time students. (See the discussion in Section V). The second line of Table 1 shows the fraction of students who even come close to the recommended level. 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. This would seem to imply that study times have fallen sharply. However, the use of multiple datasets and surveys gives rise to at least three important concerns about how to interpret the findings. Are the later samples representative? Are the findings driven by framing effects or idiosyncratic characteristics of the survey instruments? Are the findings explained by changes in the composition of the college-going population? We investigate each of these in turn.

### B. Representativeness

A primary concern is the representativeness of the later samples. The 1961 dataset is a national random sample, whereas schools select into the HERI and NSSE samples. It could be that schools surveyed in HERI and NSSE samples are "low-effort" colleges that would have featured low study times in 1961, as well. Is the apparent decline in study times due to non-random selection into the later samples? To address this possibility, we examine 180 schools for which data are available in both the 1961 and post-2000 samples. Data are available in both periods for the 156 NSSE schools and for a core sample of 24 HERI schools, denoted HERI Core.

Table 2 addresses the representativeness of the post-2000 samples. Study time trends for a "typical" student may not be adequately captured by the CDF summary statistics reported in Table 1. Simple assumptions allow the construction of median study times, and with stronger assumptions, study time means for the grouped data samples may be estimated. [9] Mean and median study times are included in Table 2, as well as the fraction of students studying more than 20 hours per week. A comparison of columns 2 and 5 reveals steep declines in all three study time measures between 1961 and 2004 for the 24 colleges represented in both the HERI Core and Project Talent. A comparison of columns 3 and 6 yields the same pattern for the NSSE schools. We also divide schools by Carnegie classification, as reported in the Integrated Postsecondary Education Data System (IPEDS) 2000[10]. 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.

The first line of Table 2 indicates that neither the 24 schools of the HERI Core sample nor the 156 schools of the NSSE sample could be characterized as "low effort" schools in 1961:

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[9] For the grouped data samples, we assume a uniform distribution over the range of values represented by the bin containing the median. Means for the grouped data samples were estimated in two ways: by regressing study time or class time on a constant and no other regressors in a standard 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 the NSSE. Results from these two methods differed only very slightly and we have displayed results from the latter.

[10] We do not know the institutional type in 1961, as this was before IPEDS data was collected.

Columns 1 and 2 show students in the nation at large in 1961 studying slightly less than students in the HERI Core in 1961 for all three study time measures, and columns 1 and 3 show students in the NSSE schools in 1961 studying at about the national average. The institutions in the 2004 HERI Core and 2003 NSSE appear then to be representative in terms of study time choices by students in 1961. The schools for which we have data in both 1961 and the 2000s do not appear to have been "low effort" schools in 1961.[11]

Are the samples representative along other dimensions? The remaining rows of the first panel of Table 2 allow comparisons by work status, race, gender, and parental education. Average characteristics for full-time students in NSSE schools in 1961 (column 3) look almost identical to the average for all full-time students at four-year institutions in 1961 (column 1). Average characteristics for HERI Core institutions in 1961 also look very similar to the overall averages for 1961, except that there were fewer female respondents in the HERI schools.

NSSE and HERI Core institutions also appear broadly representative of all institutions in 2004, except that respondents in these institutions had higher parental education and there were more female respondents. Also, the students at NSSE institutions were less likely to have worked while in school. However, we will show that higher parental education, being female and not working are all associated with higher study times in 2004. If anything, then, characteristics of the HERI core and 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 was larger than indicated in Tables 1 and 2. We conclude that the study time drop is not a byproduct of nonrandom selection by institutions into the later samples.

Students at different levels of seniority may differ in their study patterns. Project Talent respondents were freshmen, whereas HERI respondents were (on-time) seniors and NSSE

[11] There could be an opposite concern: that Project Talent, our only source for 1961, may be somehow idiosyncratic. There is corroborating evidence, however, that early study times were as high as those reported in Project Talent. Lundberg et al. (1934), analyzing time-use diaries, show average weekly academic time investment by college students in 1934 to be almost identical to the levels in Project Talent.

respondents were freshmen and seniors. Datasets with responses from both freshmen and seniors (NSSE and NLSY79), however, show freshmen studying slightly less than seniors. This again implies we have underestimated the study time drop. Specifically, comparing freshmen in 1961 to freshman in NSSE 2003 yields a slightly larger decline in weekly study times than reported above (a decline of 5.2 hours, compared to the reported 4.7 hours.)

The first three columns of Table 3, panel A, summarize findings on average time use. Stylized facts alluded to in Section II become visible: increased work, increased leisure, and decreased academic time investment. Specifically, average academic time investment for the 1961 cohort is 40.3 hours per week, while the estimates for 2003 and 2004 range between 22.8 and 26.1 hours per week.[12] In the 1960s, full-time college attendance entailed a time investment comparable to that of a full-time job. For more recent cohorts, going to college full-time appears to have been, at best, a part time job.

C. Framing Effects and the Long-run Trend in Average Time Use

In addition to the overall change in student time use between 1961 and post-2000, we investigate changes for two sub-periods within that span: 1961-1981 and 1988-2004. These results, reported in the last four columns of Table 3, help flesh out the time trend. Project Talent and the NLSY79 were administered to randomized national samples. We compare findings from these surveys, in columns 4 and 5, respectively, to determine changes in time use between 1961 and 1981. Project Talent respondents were freshmen, whereas students from all college grades responded to the NLSY79 in 1981.[13] Again, though, comparing freshman to freshman yields an even larger drop in study times than indicated. HERI surveys in 1988 and 2004 contained identical questions and allowed response ranges, and were both administered to on-time seniors at

[12] We define total academic time investment to be study time plus class time. Here, we use the 1981 class time estimate for 1961 class time, as this measure is absent in the 1961 dataset. We use HERI 2004 class time for NSSE 2003 class time, for the same reason.
[13] We use students of all levels in the NLSY79 so that sample size is large enough to allow us to disaggregate by subgroups.

an identical set of 46 schools. We compare these surveys, in columns 5 and 6 of Table 3, to discern changes in time use between 1988 and 2004.[14] The same broad changes observed between 1961 and post-2000 eras—increased work, increased leisure, and decreased academic time investment—are also visible within each sub-period.

Framing effects could be distorting the picture of study time declines overall (1961 to pos-2000) and for the 1961-1981 sub-period. As has been well-documented in the psychometric literature, differently worded questions yield different responses (Sudman, et al. (1996)). For example, in grouped data responses, lower numeric values for the allowed response bins appear to yield systematically lower responses. To account for this, we estimate reduced-form effects of framing experimentally. The experiment is documented in some detail in Appendix A. Here, we summarize briefly the design and findings.

Surveys were administered to 4 large classes of students at a major public university in California. 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. In a given class, students were randomly assigned to the different survey instruments. Given random assignment, robust and significant differences in sample means of student responses to different surveys are attributable to idiosyncratic characteristics of the survey. A full-scale analysis of why responses differ between survey instruments is beyond the scope of this paper. We note that the bins for the grouped data responses are lower in the HERI survey than in the NSSE survey and this could induce lower responses. We note also that the NLSY79 survey sums on-campus and off-campus study times, and this could generate higher responses. We emphasize also that the experimental design does not allow us to identify the survey instrument that elicits the most accurate response.

[14] The 1981-1988 comparison does not use a consistent set of schools. Thus, we refrain from interpreting changes over this 7 year sub-period.

Rather, it lets us compare surveys to each other, and we summarize main results of this exercise in Figure 2.

Unadjusted study time means from Table 3 are plotted as diamonds in Figure 2. 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 response to the HERI survey question was significantly lower than the mean response to the Project Talent question. Thus, the square in 2004 is plotted higher 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 HERI survey in 2004, had they been administered the Project Talent survey instead.*

For the unadjusted measure, there is an apparent sharp decline between 1981 and 1988. When framing effects are accounted for, however, this decline becomes much smaller. The gap between the NSSE and HERI survey responses (in 2003 and 2004, respectively) also appears to go away.[15] Framing effects suggest that the drop between 1961 and 1981 was underestimated in Table 3, Panel A, and that the overall drop between 1961 and the post-2000 samples was overestimated. Study times appear to have dropped by about 10 hours per week between 1961 and 2003-2004, a revision of the 11-13 hours suggested by the unadjusted measure. Table 3, Panel B shows time use means adjusted for framing effects[16] and contains a main result of t he paper: *Overall academic time investment by full time students appears to have dropped from 40 hours per week to 26-28 hours per week between 1961 and 2004.* We conclude that framing accounts for at most a small portion of the observed decline in study times.

D. Composition Effects

[15] We note that this gap may have been a product of the bin-structures of the allowed responses in the two surveys, as the HERI bins are lower.

[16] Work times required no adjustment for framing. Responses to work-hours questions differed only slightly between surveys in the experiment (and differences were statistically insignificant). Framing effects for class time responses were not identified in the experiment. (Class time data is unavailable in the 1961 baseline year. Also, changes in class time account for only a small fraction of overall academic time changes.) See Appendix A.

Demographic characteristic 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 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. We use this method to decompose changes in study time for full-time students between 1961 and 2003-2004 (and for two sub-periods within that span). Table 4, Columns 1 and 2 show coefficients from OLS regressions of study time on student characteristics in 1961 and 2004 for HERI Core schools. Columns 3 and 4 repeat the exercise for NSSE schools, and Columns 5-8 report the results of similar regressions for the sub-periods 1961-1981 and 1988-2004. In addition to demographic traits, we include hours worked as a regressor, because changes in work choices could help explain the time trend in study times.[17] We also include major choice. In Sabot and Wakeman-Linn (1991), college students sort into majors based on major-specific grading standards. It is worth investigating, then, whether sorting into "easier" majors explains the aggregate study-time trend. Signs on the coefficient on hours worked are consistent with intuition: In all the regressions, students study more when they work less. Older students appear to study slightly more than relatively younger students, though in most samples the estimate is not statistically significant.[18] Other coefficients vary with time period and subsample. In all the post-2000 samples, women study more than men.

The results of Oaxaca decompositions of long run changes in study time are reported in Table 5. Column 1 shows a decline in study times of 15.8 hours per week between 1961 and 2004

[17] Work and study are simultaneous determined, but it is not clear how to define a plausible structural model (as argued in Section II). The regressions are reduced form.

[18] In some cases, we compare students at different levels (e.g., freshman to seniors in columns 1 and 2 of Table 4). To avoid confounding levels with ages, we use relative age as a 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 address differences in levels, we restrict the NSSE sample to freshman in Tables 4 and 5 so that results capture a direct freshman-to-freshman comparison.

for HERI Core schools. Changes in observed characteristics (and work and major choices) account for only 1.46 hours of that difference, or 9%, if 1961 coefficients are used. If 2004 coefficients are used, observed characteristics account for -6% of the difference, and would imply that study times should have been higher in 2004 than they were 1961. Column 1 also summarizes decompositions adjusted for framing effects,[19] and results are similar. Column 2 repeats the exercise using the larger sample of NSSE schools. Again, changes in observables explain little of the overall difference in study times (about 1%). Columns 3 and 4 of Table 5 report results from Oaxaca decompositions for the two sub-periods. Changes in observables would appear to explain 9 to 15 percent of the adjusted change in study times between 1961 and 1981, depending on which coefficients are used, and no more than 6% the 1988 to 2004 period. In summary, changes in observed traits explain less than 10% of the adjusted decline in 6 of 8 decompositions (overall and by sub-period); moreover, in none of the decompositions of adjusted declines do changes in observables explain more than 15%.

Regression coefficients used in these decompositions differ by time period and may be difficult to interpret. Also, work choices are endogenous. Because results in Tables 4 and 5 are subject to these criticisms, we include a non-parametric investigation of composition effects. Table 6 displays average adjusted study times for 1961 and 1981 samples and 1988 and 2004 samples broken out by subgroups. It becomes clear why demographic changes 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

[19] Estimated coefficients in Table 4 are the same for adjusted an unadjusted measures of the dependent variable, average study time, except that the (unreported) intercept changes by the amount of the adjustment.

to study about the same amount as men, but study more than men in recent cohorts. Study times fell for all choices of major, overall and within both sub-periods. Engineering students studied more than other students and the gap has widened. 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 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. Rather, the time cost of college appears to have fallen.

E. 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 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*. 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 (i.e., increases in the fraction of part-time and return students), what it means to be a “full-time” student has changed over time. Are we comparing students whose course loads are 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 Survey (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.[20] 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.[21] In particular, full-time students in NSSE and 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.[22]

F. Explaining the Time Use Trend – Human Capital and Institutional Theories

On average, students appear to be working more, studying less, and taking more leisure[23] than they once did. The findings are hard to reconcile in a simple or direct way with human capital theory. As indicated by the model in Section II, rising parental incomes lead to rising

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[20] The vast majority of schools in the sample were on the semester calendar. We restrict to these in the calculations above. However, NPSAS data also show that full-time students on the quarter calendar took courses at a rate sufficient to graduate in four years.

[21] 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 the same time period. One possible explanation is that less time spent in class may not imply lighter course loads. Over time, class attendance patterns may have changed, with attendance becoming less frequent.

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

[23] We note that leisure—defined here as non-work, non-academic activity—could include work-like activities, such as volunteer work. We find no evidence to suggest that work-like activity has become a dominant part of leisure (volunteer work accounted for less than 1.6 hours per week in the HERI samples), but we lack consistent data for a full-scale analysis of changes in leisure subcategories. Main conclusions, however, do not depend on a characterization of leisure: The time cost of college (i.e., of earning college credits) appears to have fallen, and to have done so for reasons that are unclear, regardless of what students have been doing with non-work, non-academic time.

leisure, but falling work hours. Falling parental incomes (or falling non-wage incomes caused by higher tuition) imply rising work hours, but falling leisure. Rising returns to schooling yield falling leisure and falling work hours. If the return to human capital acquired in college has risen, why then do students substitute into leisure and study less? This is a puzzle and we have found no satisfactory explanation.

In addition to the human capital puzzle, the empirical findings generate new and perplexing questions about post-secondary institutions. Colleges elicit less effort from students than they once did. What is the nature of this institutional change, and why have institutions allowed it to occur? We comment briefly on two possibilities: 1) Education production technologies have improved; 2) Standards or requirements have fallen. We emphasize that neither of these addresses the human capital puzzle above. But providing an accurate characterization of what would appear to have been a set of wide-ranging institutional transformations speaks to a different question: Does the long run decrease in academic time investment imply reduced human capital acquisition? We discuss the merits of two theories with conflicting implications.

*Improved instruction technologies*

Information technologies may have reduced time requirements for some study tasks (e.g., term papers may have become less time-consuming to write with the advent of word processors.) If education technology and effectiveness have improved continuously over time, one would expect to see ever greater gains in human capital per unit of student time invested. Decreased inputs of student time might not then yield a decreased output of human capital. Human capital of college graduates is difficult to quantify, but there exist achievement and admissions exams for the subset of college students who pursue post-graduate education or certification. Adelman (1985) finds the performance of college graduates between 1964 and 1982 to have declined on 15 of 23 achievement and graduate admissions examinations, to have remained stable on 4, and to have advanced on 4. We extend Adelman's time trends in Figure 3, which displays average test scores on 7 achievement and graduate admissions examinations through 1999. In recent years, the evidence is much less clear than for 1964-1982. Also, selection into post-graduate training and admissions examinations is a serious confounding factor. Though there is some evidence of declining outputs between 1964 and 1982, it would not appear that improved instructional technology can be ruled out as an explanatory factor.

*Declining standards and/or requirements*

By and large, educators give no indication of having concluded that student effort is of modest or diminishing importance for learning, given new technologies. On the contrary, many colleges explicitly define a unit of course material by the study time required. Bok(2005)—arguing that better pedagogies have been discovered, but have gone unimplemented—finds no evidence of significant changes over time in undergraduate instruction. Another alternative is that standards or effort requirements have fallen, in practice, at four-year colleges. A detailed analysis is beyond the scope of this paper, but we offer two reasons for why such an institutional change might have occurred.

a) Student Empowerment

In Hersch and Merrow(2005), David L. Kirp argues that increased market pressures have caused colleges to cater to students' desires for leisure. (Because leisure is highly valued, colleges that attempt to maintain standards for current cohorts suffer high attrition or lose market share.) Similarly, Murray Sperber (in the same volume) emphasizes a change in faculty incentives: "A non-aggression pact exists between many faculty members and students: Because the former believe that they must spend most of their time doing research and the latter often prefer to pass their time having fun, a mutual non-aggression pact occurs with each side agreeing not to impinge on the other." If the market value of a college degree depends in part on the college's reputation, and if this, in turn, depends on effort invested by previous student cohorts, then current students have an incentive to free-ride on the effort contributions of their predecessors. Over time, mechanisms may have evolved that allow students to pressure educators to reduce effort requirements for their own cohort. Student evaluations of instructors are an obvious mechanism, but we note that other types of student empowerment could have similar effects. There would appear to be some perception among educators that colleges face growing incentives to cater to the leisure preferences of their students.[24]

b) Signaling, sorting, and reduced within-school variance of ability

Hoxby (2000) finds between-college variance in student aptitude to have increased and within-college variance to have decreased over time. In the past, then, some students may have worked hard to signal they were high ability types, relative to their schoolmates. If students within a given college are now of similar ability, grades or rankings may have come to lack content as a signal. The rank of one's college may signal more than one's ranking within that college. Supporting this explanation is the finding that employers in recent years have come to rely less on college grades in their hiring decisions and more on interviews (Rosovsky and Hartley, 2002). Also, students appear to put more time than they once did into preparing for college entrance exams, tailoring their high school resumes for purposes of college admission, hiring college admissions consultants, and filling out their college applications.[25] Students, then, appear to be allocating more time toward distinguishing themselves from their competitors in order get into a good college, but less time distinguishing themselves from their schoolmates academically once they get there. A more detailed theoretical and empirical exploration of this mechanism is a subject for future research.

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[24] Students may have become empowered. Alternatively, their demand for leisure may have risen over time, as incomes have risen. But a first pass (using income data in HERI 2004) yields no evidence that higher parental incomes lead to lower study times: In cross-section, higher parental income is associated with *higher* study times. (Further, as mentioned, rising incomes would imply falling work hours.)

[25] See, for example, Williams, "Lost Summer for the College-Bound," New York Times, June 4, 2006.

# V. IMPLICATIONS

## A. The Rising College Wage Premium

Though the underlying cause is unclear, there would appear to be strong empirical evidence of a falling time cost of college. This, in itself, yields a number of implications for economists. We focus here on wage regressions and the well-known finding of a rising college wage premium. Lemieux (2006a) concludes that a rising return to postsecondary education is the primary explanation for rising wage inequality between 1973 and 2005. We augment a large and vital literature on rising wage inequality by demonstrating that changes in the return to postsecondary education may have been greatly underestimated in previous research.

Typically, the time measure in wage regressions is (or is directly related to) "years of schooling." We argue that a "year" of post-secondary schooling is a nominal measure of time. Assuming it constant (without specifying a reference year) is analogous to ignoring the inflation of a currency. A year of college represents a smaller time investment than it once did, and thus a lower opportunity cost of forgone wages. The exercise we undertake is to calculate changes over time in the wage premium for a year of college after correcting for changes over time in time investment associated with a year of college.

Following methods in Goldin and Katz (2001), we use 1970 to 2000 IPUMS and 2005 American Community Survey data for white male workers in the nonagricultural sector to estimate college wage premia by decade. In Figure 4, we restrict to workers whose (potential) post-college experience is about 10 years (i.e., we follow male workers aged 29-32). The solid line shows the wage premia, by decade, if the "years of college" measure is taken at face value. The calculations underlying the hatched line in Figure 4 take 1961 as the base year to account for changes in the "years of college" measure. A "years of college" index is constructed as follows: The index is 1 for the base year, 1961. Indices for subsequent years are weekly academic time investment (class time plus study time, adjusted for framing effects) for white males *when these workers would have been attending college* divided by weekly academic time investment for white males in college in 1961. Standard wage premia are then divided by the index. (Appendix B contains additional detail on the construction of Figure 4.) Wage premia depicted by the hatched line, then, are increased wages associated with a college time investment equal to a "1961 year." The hatched line in Figure 4.A shows a much greater increase in the college wage premium than the standard calculation yields. While the solid line shows an increase of 7.9 log points in the wage premium for a year of college between 1980 and 2005, the hatched line (for which a year of college is defined as a "1961 year") shows a 50% larger increase of 11.8 log points. In summary, standard methods appear to underestimate the recent increase in the wage premium for a year of college by as much as 50%.

The decline in the wage premium during the 1970s appears to have been lower, and the increase between 1980 and 2005 much higher, than has previously been estimated. In essence, our finding deepens the puzzle of the rising college wage premium. Despite smaller and smaller time commitments allocated toward the acquisition of a "year" of college education, the wage reward for a year of college has continued to rise.

B. Education Policy

A decreased time cost implies increased affordability and access to college. It could also imply reduced human capital acquisition. We will not attempt to estimate net change in social welfare, but note a loose consensus among educators about the optimal time cost. Many postsecondary institutions, having codified the prevailing wisdom, set explicit targets for student effort and define a course "unit" by the study time required. The common requirement is that students put in 2 hours study time per week for every hour of class time (or course unit).[26] This amounts to an expectation or requirement that full-time students invest about 30 hours per week

[26] Regulation 760 from the Academic Senate of the University of California, for example, states: "The value of a course in units shall be reckoned at the rate of one unit for three hours' work per week per term on the part of a student, or the equivalent." This appears to be the common wisdom, not an idiosyncratic standard. See Kuh(1999).

of study time outside of class. Evidence indicates that the average student invests less than half the required amount. If the implied link between student effort and education production has meaning, this finding would seem of interest to educators and accreditation committees. Postsecondary institutions appear to have fallen short of their own standards, and to have done so by ever increasing margins.

## VI. SUMMARY AND CONCLUSION

Using data from multiple datasets and four different time periods, we document changes in time use by full-time college students in the United States between 1961 and 2004. We find large declines in academic time investment over this period, not accounted for by survey framing effects or composition bias. Full-time college students in 1961 appeared to allocate about 40 hours per week toward class and studying, whereas full-time students in 2004 appear to have invested about 26-28 hours per week. 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 at 4-year colleges of every type, size, degree structure, and level of selectivity. In short, evidence indicates that the time cost of college has fallen. We conclude that recent increases in the rate of return to postsecondary education may have been underestimated by as much as 50 percent. Lastly, the decline in academic time investment by full-time college students would appear to be a puzzle in its own right that warrants continued research.

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## Appendix A – The Framing-Effects Experiment

For each historical survey, a questionnaire was created that contained the same study and work questions 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. The 6 surveys were administered to 1,087 students in 4 large classes at a major public university in California. In each of the classes, students were randomly assigned to the survey instruments. Students were instructed that the experiment investigated time use by college students 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 at Circuit City.)

Each panel in the left column of Appendix Table 1 refers to one of the 6 survey instruments. Column 1 shows results of a pooled regression of study time on dummies for Talent, HERI and NSSE survey instruments, with no constant. In each class, each survey was completed by about 1/6 of the participants. However, observations are weighted to account for small random differences in the number of students in each class that filled out each survey.[27] 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 HERI-based surveys averaged 9.07 hours per week. An F-test indicates that the difference is highly significant. The NSSE-based survey also elicited lower responses than the Talent-based survey, but the difference is smaller, with a p-value of .165. Column 2 compares the work responses of students completing these same surveys. In the case of work hours, average responses (by survey) are within .25 hours of one another, and p-values are about .8 or higher (for null hypotheses that HERI or NSSE averages are equal to the Talent average.)

[27] Unweighted regressions, available on request, produced very similar results.

Columns 3 and 4 show the Talent-NLSY regression results. 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. We address these in turn.

To investigate framing, 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. 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. The regression of study time on Talent (Revised) and NLSY79 dummies, with no constant, is summarized in Column 3. The NLSY79 elicits a significantly higher average response. Column 4 shows results of a similar regression for work times.[28] As with the Column 2 comparisons, the difference in work times is small and insignificant.

There remains the question of whether average time use "last week," as calculated from responses to the actual NLSY79 survey, differed from typical time use of the respondents in 1981. 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

[28] Because, unlike the other surveys, the NLSY locates work and study questions in different parts of the survey and is longer than the other surveys, we created a separate survey instrument NLSY (Work) for the work question

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.[29] 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.

Results summarized in Appendix Table 1 were used to create Figure 4 and the "adjusted for framing" measures used in the later tables.[30] Why does the experiment show large framing effects for the study time measure but small insignificant effects for the work measure? A full-scale analysis of possible reasons for the observed framing effects is beyond the scope of this paper. We note only that work hours tend to be dictated by an employer and scheduled in advance. As such, they may be less susceptible to framing than study hours.[31]

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[29] Weeks with less than 10 observations were not used in construction of the weighted estimate. This amounted to about 1% of the sample. Weeks included were the 4th through 16th weeks in 1981.

[30] We caution that the case for a framing adjustment to the NSSE may not be as strong as the case for the other survey instruments. The difference between NSSE and Talent responses in the experiment is of marginally statistical significance (p-value=.16).

[31] For several reasons, we do not include an analysis of framing effects for class time. The Project Talent survey, our baseline, does not include the class time question. Only two surveys do (NLSY and HERI.) Moreover, an additional survey instrument would have been necessary (e.g., a HERI-based questionnaire, revised to refer to last week, rather than a typical week). Finally, main results in the paper are driven by changes in study time, as changes over time in class time appear small by comparison.

## APPENDIX B - Notes on Figures

In all figures, time-use data are for full-time students at four-year colleges.

**Figure 1 -** Dependent variable in all regressions is log hourly wage in the given year. Plotted on vertical axis is the coefficient on hours studied per week in 1981. All regressions also include controls for gender, AFQT score, and year in college in 1981 (i.e., dummies for freshman, sophomore, and junior year) and recommended weightings from the NLSY79. Results are also robust to the inclusion of years of schooling as a control. Not all respondents had wage data available in all years. Dotted lines show 95% confidence interval.

**Figure 2** – 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. These were computed from framing estimates reported in Appendix Table 1. 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.

**Figure 4 -** Source for wage data: IPUMS 1970-2000, American Community Survey, 2005. Following common practice, we discard extreme observations (wages less than $1) and adjust top-coded earnings by a factor of 1.4. As in Goldin and Katz (2001), difference in mean log wage between workers with 12 and 16 years of schooling is calculated, decade by decade and the difference is divided by 4 to get wage gain associated with a year of college. Figure 4 uses white, male workers in the nonagricultural sector whose (potential) post-college experience is about 10 years (i.e., workers aged 29-32). Solid line shows difference in log wages (divided by 4) by decade. Hatched line shows difference in log wages associated with a college time investment equal to a 1961 year. A "years of college" index is constructed as follows: The index is 1 for the base year, 1961. Indices for subsequent years are weekly academic time investment (class time plus study time adjusted for framing effects) for white males in the time period during which they would have been attending college divided by weekly academic time investment for same in 1961. Standard wage premia are then divided by the index. For example, workers with 10 years experience in 1980 are assumed to have attended college in the early 1970s and we interpolate between 1961 and 1981 framing-adjusted academic time investments for white males to estimate their time investment. Indices for other decades are computed similarly.

## APPENDIX C - Defining College Majors

The HERI surveys used for the 1988 and 2004 time periods allowed students to choose one of 83 majors. This survey then aggregated these majors into 16 broad majors (HERI-Agriculture, HERI-Biological Science, HERI-Business, HERI-Education, HERI-Engineering, HERI-English, HERI-Health Professional, HERI-Humanities, HERI-Fine Arts, HERI-Mathematics or Statistics, HERI-Physical Science, HERI-Social Science, HERI-Other Technical, HERI-Other Non-technical, and HERI-Undecided)[32] To ensure adequate sample sizes we further aggregated into nine majors, based in part on comparability of study times. We indicate below the component subjects and share of respondents in each category, and the largest two majors in that category.

***Biology*** (11%): general biology*, biochemistry or biophysics, botany, environment science, marine science, microbiology, zoology, medicine/dentistry/veterinarian*, kinesiology, other biological science

***Business and Communication*** (22%): accounting*, business administration*, finance, international business, marketing, management, secretarial studies, journalism, communication other business

***Education*** (8%): business education, elementary education*, music or art education, physical education, secondary education*, special education, other education

***Engineering*** (4%): aero/astronautical engineering, civil engineering, chemical engineering, electrical engineering*, industrial engineering, mechanical engineering*, architecture, other engineering

***Health*** (4%): health technology, nursing*, pharmacy, therapy (occupation, physical, speech)*, other professional

***Letters*** (16%): art (fine and applied)*, English*, language and literature, music, philosophy, speech, theatre or drama, theology or religion, other humanities

***Physical Science*** (5%): astronomy, atmospheric science, chemistry*, earth science, mathematics*, physics, statistics, other physical science

***Social Science*** (24%): anthropology, economics, ethnic studies, geography, history, political science*, psychology*, sociology, women's studies, other social science

***Technical/Vocational*** (4%) : agriculture, building trades, computer science*, data processing, drafting/design, electronics, forestry, home economics, law enforcement, library science, mechanics, social work*, and other technical

Once these nine broad major categories were defined, the major codes in the NLSY79 and Project Talent were aggregated to create comparable major categories.

[32] Copies of the HERI codebooks which contain a listing of all 83 reported majors can be found at http://www.gseis.ucla.edu/heri/codebooks.html

**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)** | | **HERI Core 2004 (1961 avail) (24 schools)** | | **NSSE 2003 (1961 avail) (156 schools)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Mean** | **St. Dev.** | **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 | **0.673** | 0.469 | **0.442** | 0.497 | **0.191** | 0.393 | **0.133** | 0.340 | **0.101** | 0.302 | **0.198** | 0.399 |
| Study>16 hrs/wk | **0.723** | 0.448 | **0.539** | 0.499 | **0.348** | 0.477 | **0.264** | 0.441 | **0.212** | 0.409 | **0.344** | 0.475 |
| Study<5 hrs/wk | **0.067** | 0.250 | **0.138** | 0.345 | **0.156** | 0.363 | **0.253** | 0.435 | **0.326** | 0.469 | **0.186** | 0.389 |
| Class (hrs/wk) | - | - | **15.84** | 7.61 | - | - | - | - | - | - | - | - |
| Class>20 hrs/wk | - | - | **0.193** | 0.395 | **0.150** | 0.357 | **0.102** | 0.303 | **0.090** | 0.286 | - | - |
| Class>16 hrs/wk | - | - | **0.379** | 0.485 | **0.439** | 0.496 | **0.315** | 0.464 | **0.294** | 0.456 | - | - |
| Class<5 hrs/wk | - | - | **0.075** | 0.263 | **0.085** | 0.278 | **0.103** | 0.304 | **0.112** | 0.315 | - | - |
| Work (hrs/wk) | **4.12** | 8.48 | **8.25** | 11.63 | - | - | - | - | - | - | - | - |
| Work >20 hrs/wk | **0.05** | 0.22 | **0.15** | 0.36 | **0.14** | 0.35 | **0.17** | 0.38 | **0.20** | 0.40 | **0.09** | 0.28 |
| Work <20 hrs/wk | **0.22** | 0.41 | **0.28** | 0.45 | **0.63** | 0.48 | **0.62** | 0.48 | **0.60** | 0.49 | **0.46** | 0.50 |
| Not working | **0.73** | 0.44 | **0.57** | 0.49 | **0.23** | 0.42 | **0.20** | 0.40 | **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 | **0.79** | 0.41 | **0.82** | 0.38 |
| Asian | **0.01** | 0.10 | **0.01** | 0.11 | **0.03** | 0.16 | **0.08** | 0.27 | **0.07** | 0.26 | **0.07** | 0.26 |
| Black | **0.02** | 0.15 | **0.10** | 0.30 | **0.02** | 0.15 | **0.05** | 0.21 | **0.05** | 0.22 | **0.08** | 0.27 |
| Female | **0.46** | 0.50 | **0.48** | 0.50 | **0.55** | 0.50 | **0.61** | 0.49 | **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 | **21.67** | 2.00 | **20.09** | 3.99 |
| Father's Ed < 12 | **0.34** | 0.48 | **0.28** | 0.45 | **0.07** | 0.26 | **0.05** | 0.21 | **0.05** | 0.22 | **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 | **0.33** | 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 | **0.62** | 0.49 | **0.52** | 0.50 |
| SAT Verbal | - | - | - | - | **577.24** | 93.79 | **610.40** | 91.98 | **604.64** | 86.18 | **566.94** | 94.64 |
| Doc/Research[a] | **0.49** | 0.50 | **0.48** | 0.50 | **0.51** | 0.50 | **0.45** | 0.50 | **0.08** | 0.27 | **0.53** | 0.50 |
| Masters[a] | **0.33** | 0.47 | **0.36** | 0.48 | **0.32** | 0.47 | **0.36** | 0.48 | **0.58** | 0.49 | **0.38** | 0.49 |
| Bac/Lib Arts[a] | **0.10** | 0.30 | **0.11** | 0.31 | **0.10** | 0.30 | **0.10** | 0.30 | **0.30** | 0.46 | **0.07** | 0.26 |
| Bac/Other[a] | **0.06** | 0.24 | **0.04** | 0.20 | **0.07** | 0.26 | **0.09** | 0.28 | - | - | **0.02** | 0.14 |
| Obs | 17985 | | 1314 | | 5012 | | 20612 | | 20071 | | 3195 | |
| Notes | Freshmen | | All years | | Seniors[b] | | Seniors[b] | | Seniors[b] | | Fresh/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]The HERI datasets above include only "on time" seniors--that is, seniors who were also in their fourth year.

**Table 2**
**Representativeness of Core Samples - Full Time Students**

| | 1961 | | | 2003-2004 | | |
|---|---|---|---|---|---|---|
| | All[a] | **HERI Core** | **NSSE** | All[b] | **HERI Core** | **NSSE** |
| **A. ALL** | **1** | **2** | **3** | **4** | **5** | **6** |
| Study (Med.,hrs/wk) | 23.62 | **24.58** | **23.70** | - | **8.55** | **11.81** |
| Study (Ave.,hrs/wk)[c] | 24.43 | **25.93** | **24.71** | - | **10.09** | **13.28** |
| Study>20 hrs/wk | 0.67 | **0.74** | **0.68** | - | **0.10** | **0.20** |
| Not working | 0.73 | **0.66** | **0.74** | 0.28 | **0.20** | **0.45** |
| White | 0.97 | **0.99** | **0.98** | 0.77 | **0.79** | **0.82** |
| Black | 0.02 | **0.00** | **0.01** | 0.11 | **0.05** | **0.08** |
| Female | 0.46 | **0.27** | **0.45** | 0.56 | **0.61** | **0.64** |
| Father's Ed >=16 | 0.24 | **0.27** | **0.26** | 0.43 | **0.62** | **0.52** |
| #Institutions | 1214 | **24** | **156** | 1407 | **24** | **156** |
| **B. Doctoral/Research[d]** | | | | | | |
| Study (Med.,hrs/wk) | 24.27 | **24.02** | **24.10** | - | **7.53** | **11.96** |
| Study (Ave.,hrs/wk)[c] | 25.22 | **24.09** | **24.89** | - | **9.37** | **13.30** |
| Study>20 hrs/wk | 0.70 | **0.68** | **0.69** | - | **0.09** | **0.19** |
| Not working | 0.76 | **0.66** | **0.77** | 0.32 | **0.21** | **0.49** |
| White | 0.97 | **0.99** | **0.98** | 0.77 | **0.74** | **0.82** |
| Black | 0.01 | **0.00** | **0.01** | 0.11 | **0.07** | **0.08** |
| Female | 0.42 | **0.15** | **0.41** | 0.56 | **0.59** | **0.62** |
| Father's Ed >=16 | 0.25 | **0.21** | **0.27** | 0.51 | **0.59** | **0.56** |
| #Institutions | 192 | **6** | **52** | 259 | **6** | **52** |
| **C. Masters[d]** | | | | | | |
| Study (Med.,hrs/wk) | 19.84 | **24.29** | **20.62** | - | **9.17** | **10.75** |
| Study (Ave.,hrs/wk)[c] | 22.40 | **25.32** | **23.44** | - | **10.34** | **12.67** |
| Study>20 hrs/wk | 0.61 | **0.76** | **0.64** | - | **0.09** | **0.18** |
| Not working | 0.70 | **0.56** | **0.73** | 0.25 | **0.17** | **0.41** |
| White | 0.96 | **1.00** | **0.97** | 0.78 | **0.84** | **0.81** |
| Black | 0.04 | **0.00** | **0.02** | 0.11 | **0.02** | **0.09** |
| Female | 0.50 | **0.37** | **0.49** | 0.58 | **0.67** | **0.69** |
| Father's Ed >=16 | 0.18 | **0.28** | **0.21** | 0.36 | **0.60** | **0.44** |
| #Institutions | 395 | **10** | **62** | 605 | **10** | **62** |
| **D. Bac/Liberal Arts[d]** | | | | | | |
| Study (Med.,hrs/wk) | 29.07 | **29.37** | **28.50** | - | **11.62** | **15.22** |
| Study (Ave.,hrs/wk)[c] | 28.96 | **30.36** | **29.11** | - | **12.75** | **16.40** |
| Study>20 hrs/wk | 0.79 | **0.83** | **0.81** | - | **0.18** | **0.31** |
| Not working | 0.74 | **0.79** | **0.69** | 0.26 | **0.26** | **0.41** |
| White | 0.97 | **0.98** | **0.99** | 0.82 | **0.88** | **0.88** |
| Black | 0.02 | **0.00** | **0.00** | 0.10 | **0.03** | **0.03** |
| Female | 0.47 | **0.35** | **0.50** | 0.59 | **0.59** | **0.62** |
| Father's Ed >=16 | 0.39 | **0.37** | **0.41** | 0.52 | **0.79** | **0.70** |
| #Institutions | 170 | **8** | **30** | 223 | **8** | **30** |

[a]Source for Column 1: Project Talent.
[b]Source for Column 4: NPSAS 2004, Online Data Cutting Tool.
[c]For grouped data samples, average calculated by assigning bin midpoints to each obs in bin.
[d]Classifications for 1961 based on 2000 Carnegie Code.

**Table 3**
**Average Time Use - Full Time Students (Hrs/Wk)**

| | Talent 1961 | HERI Core 2004 (w/1961) | NSSE 2003 (w/1961) | Talent 1961 | NLSY79 1981 | HERI 1988 (w/2004) | HERI 2004 (w/1988) |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **A. Means** | | | | | | | |
| Study[a] | 24.43 | 10.09 | 13.40 | 24.43 | 19.75 | 12.96 | 11.23 |
| Class[a] | - | 12.68 | - | - | 15.84 | 14.54 | 13.01 |
| Ave Work[a] | 4.12 | 11.04 | 9.47 | 4.12 | 8.25 | 10.15 | 10.42 |
| Leisure Time[b] | 123.62 | 134.20 | 132.46 | 123.62 | 124.16 | 130.36 | 133.35 |
| Academic Time[c] | 40.26 | 22.76 | 26.07 | 40.26 | 35.59 | 27.49 | 24.23 |
| **B. Adj. for Framing** | | | | | | | |
| Study[a] | 24.43 | 13.72 | 14.50 | 24.43 | 16.75 | 16.59 | 14.86 |
| Leisure Time[b] | 123.62 | 130.57 | 131.36 | 123.62 | 127.16 | 125.43 | 129.72 |
| Academic Time[c] | 40.26 | 26.39 | 27.17 | 40.26 | 32.59 | 32.42 | 27.86 |
| Obs | 17986 | 20071 | 3195 | 17986 | 1314 | 5012 | 20612 |

[a]For grouped data samples, average calculated by assigning bin midpoints to each obs in bin.
[b]Leisure is defined as non-work, non-academic acativity.
[c]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 4**
**Time Use Regressions (Dependent Variable: Study Time)**

| | Talent 1961 (w/2004) 1 | HERI Core 2004 (w/1961) 2 | Talent 1961 (w/2003) 3 | NSSE[a] 2003 (w/1961) 4 | Talent 1961 5 | NLSY79 1981 6 | HERI 1988 (w/2004) 7 | HERI 2004 (w/1988) 8 |
|---|---|---|---|---|---|---|---|---|
| Work (hrs) | -.34*** | -.0644*** | -.219*** | -.0385* | -.203*** | -.208*** | -.0334*** | -.0579*** |
| | (.0657) | (.00522) | (.0213) | (.0212) | (.0117) | (.0343) | (.0118) | (.00561) |
| Female | 1.64 | 1.63*** | .0842 | 1.7*** | -.238 | .485 | .69*** | 1.6*** |
| | (1.34) | (.0942) | (.398) | (.407) | (.213) | (.859) | (.202) | (.0988) |
| Rel. Age[b] | .761 | .13*** | .266 | .0181 | .13 | .751* | .0737 | .094*** |
| | (1.3) | (.028) | (.362) | (.0503) | (.193) | (.411) | (.13) | (.0217) |
| Black | 0 | -1.12*** | -6.19*** | -.0182 | -4.53*** | .196 | -2.24*** | -.543** |
| | (0) | (.206) | (1.97) | (.754) | (.796) | (1.38) | (.638) | (.222) |
| Asian | 1.51 | .21 | 4.19* | .736 | .148 | 4.79 | -.489 | .221 |
| | (9.32) | (.455) | (2.32) | (.76) | (1.22) | (3.59) | (.591) | (.172) |
| Father HS Grad | -2.14 | .705*** | .476 | .71 | .419* | .686 | -.753* | .397 |
| | (1.3) | (.265) | (.432) | (.528) | (.233) | (1.08) | (.391) | (.292) |
| Father Col. Grad | -1.6 | 1.67*** | .564 | .625 | 1.4*** | 1.1 | .0824 | .914*** |
| | (1.47) | (.257) | (.489) | (.456) | (.269) | (1.01) | (.383) | (.285) |
| SAT (100s) | | | | | | | .0563 | .826*** |
| | | | | | | | (.135) | (.0811) |
| Obs | 502 | 20071 | 5264 | 1920[a] | 17986 | 1314 | 5012 | 20612 |

Standard errors in parentheses.
* Significant at 10%. ** Significant at 5%. *** Significant at 1%.
Right-hand variables also include college majors and dummies for missng data
[a]NSSE restricted to freshmen respondents (for comparison with Proj.Talent)
[b]Relative age is defined as the number of years older the student is than an on-time student at her level

**Table 5**
**Oaxaca Decompositions - Hours Studied**

| | 1961-2004<br>1 | 1961-2003<br>2 | 1961-1981<br>3 | 1988-2004<br>4 |
|---|---|---|---|---|
| Early period coefficients, means | 25.93 | 24.71 | 24.43 | 12.96 |
| Late period coefficients, means | 10.09 | 13.20 | 19.75 | 11.23 |
| Early period coefficients, late period means | 24.47 | 24.61 | 23.72 | 12.85 |
| Late period coefficients, early period means | 9.14 | 13.31 | 20.58 | 10.82 |
| | | | | |
| Decomposition (Early Period Coefficients) | | | | |
| Total Difference | 15.84 | 11.51 | 4.67 | 1.73 |
| Explained | 1.46 | 0.11 | 0.71 | 0.10 |
| Fraction Explained | **0.09** | **0.01** | **0.15** | **0.06** |
| | | | | |
| Total Difference (adjusted for framing) | 12.21 | 10.41 | 7.67 | - |
| Fraction Explained | **0.12** | **0.01** | **0.09** | - |
| | | | | |
| Decomposition (Late Period Coefficients) | | | | |
| Total Difference | 15.84 | 11.51 | 4.67 | 1.73 |
| Explained | -0.95 | 0.10 | 0.83 | -0.41 |
| Fraction Explained | **-0.06** | **0.01** | **0.18** | **-0.24** |
| | | | | |
| Total Difference (adjusted for framimng) | 12.21 | 10.41 | 7.67 | - |
| Fraction Explained | **-0.08** | **0.01** | **0.11** | - |

No adjustment for framing in Column 4, as same survey instrument was used in both periods.

**Table 6**
**Ave Study Time - Full Time Students by Subgroup**

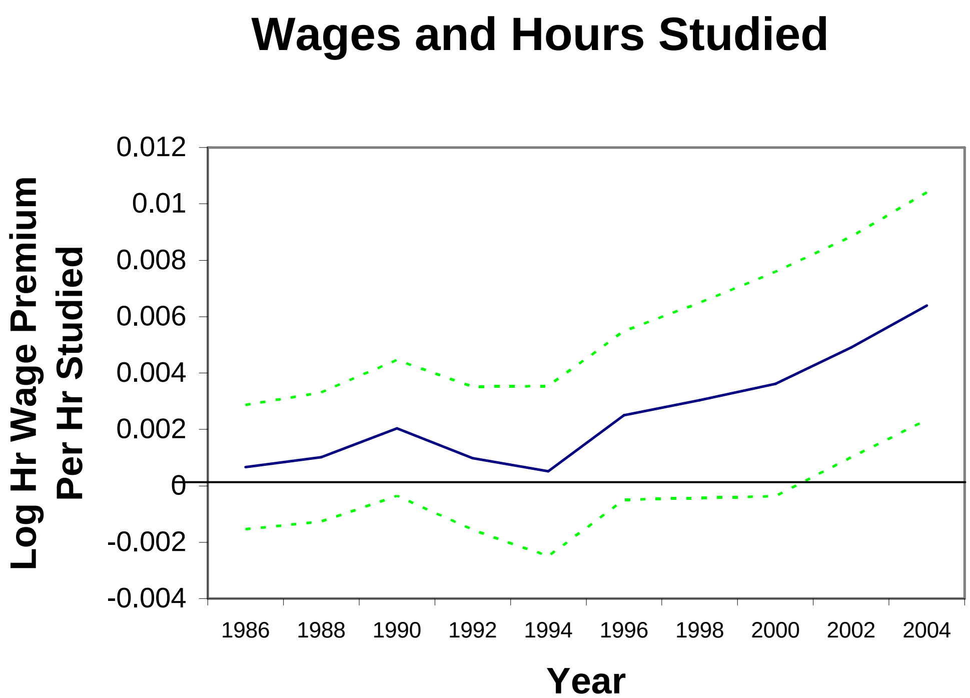
| | | Talent 1961<br>1 | NLSY79 1981<br>2 | HERI 1988<br>3 | HERI 2004 (w/1988)<br>4 |
|---|---|---|---|---|---|
| **All** | | 24.43 | 16.75 | 16.59 | 14.86 |
| **Employment** | Not Working | 25.18 | 18.40 | 17.10 | 15.93 |
| | Work <20 | 23.78 | 17.24 | 16.88 | 14.83 |
| | Work >20 | 18.25 | 11.46 | 14.39 | 13.72 |
| **Father's Ed** | No College | 23.74 | 16.05 | 16.45 | 13.73 |
| | Some College | 24.40 | 16.32 | 15.86 | 14.33 |
| | College Grad | 25.63 | 17.49 | 17.07 | 15.39 |
| **Gender** | Male | 24.54 | 17.24 | 16.60 | 14.28 |
| | Female | 24.30 | 16.24 | 16.57 | 15.22 |
| **Race** | White | 25.08 | 16.72 | 16.63 | 14.91 |
| | Asian | 25.48 | 22.83 | 16.92 | 15.28 |
| | Black | 20.40 | 16.34 | 13.75 | 14.30 |
| **SAT** | SAT verbal<540 | - | - | 16.31 | 13.39 |
| | SAT verbal 540-620 | - | - | 16.34 | 14.79 |
| | SAT verbal>620 | - | - | 17.32 | 16.18 |
| **Major** | Business | 22.32 | 14.50 | 15.02 | 13.12 |
| | Education | 24.33 | 12.91 | 16.28 | 13.88 |
| | Engineering | 27.89 | 22.24 | 22.29 | 18.68 |
| | Biology | 26.03 | 20.39 | 18.97 | 16.32 |
| | Phys Sciences | 27.18 | 23.55 | 17.30 | 16.55 |
| | Letters | 24.69 | 16.14 | 17.13 | 15.56 |
| | Social Sciences | 26.05 | 17.04 | 16.27 | 14.24 |
| | Health | 27.13 | 15.52 | 16.05 | 14.40 |
| **Selectivity** | Ave SAT vrb<550 | - | - | 15.88 | 13.45 |
| **(College)** | Ave SAT vrb 550-600 | - | - | 16.66 | 14.66 |
| | Ave SAT vrb>600 | - | - | 17.56 | 16.47 |
| **Type** | Doc/Res | 24.09 | 18.58 | 16.67 | 14.69 |
| **(College)** | Masters | 25.08 | 14.76 | 16.07 | 14.35 |
| | Bac - Lib Arts | 29.93 | 24.51 | 17.64 | 16.45 |
| | Bac - Other | 24.65 | 13.29 | 16.14 | 14.72 |
| **Size** | <2500 | - | - | 16.26 | 15.04 |
| **(College)** | 2500-7500 | - | - | 16.37 | 14.51 |
| | >7500 | - | - | 16.64 | 14.82 |

Columns 2,3,4 adjusted for framing effects.

**Appendix Table 1**
**Time Use Responses by Survey Instrument**

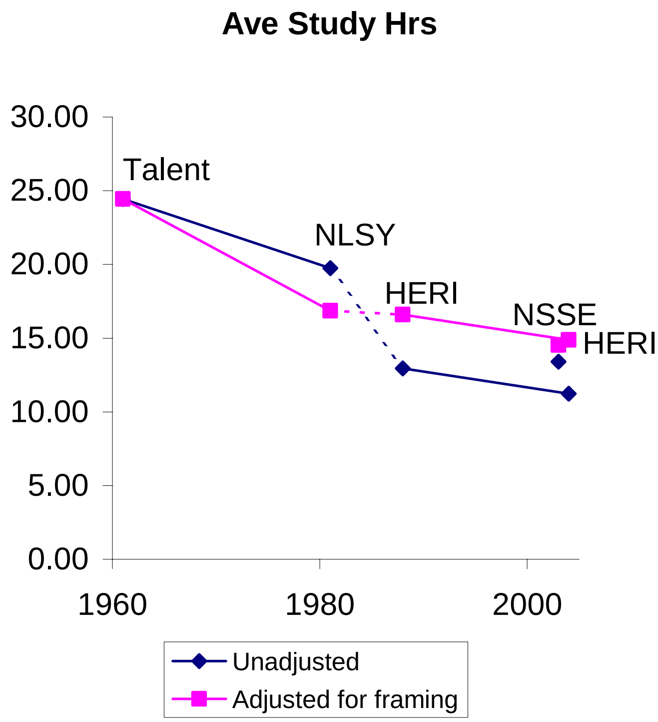
| | Study<br>1 | Work<br>2 | Study<br>3 | Work<br>4 |
|---|---|---|---|---|
| Talent | 12.70 | 6.60 | - | - |
| Std. Dev | (.634) | (.646) | - | - |
| Talent(Rev) | - | - | 10.90 | 5.28 |
| Std. Dev | - | - | (.605) | (.644) |
| NLSY | - | - | 13.90 | - |
| Std. Dev | - | - | (.876) | - |
| P-Value F-Test (=Talent(Rev)) | - | - | .005 | - |
| NLSY(W) | - | - | - | 5.35 |
| Std. Dev | - | - | - | (.641) |
| P-Value F-Test (=Talent(Rev)) | - | - | - | .941 |
| HERI | 9.07 | 6.37 | - | - |
| Std. Dev | (.445) | (.654) | - | - |
| P-Value F-Test(=Talent) | .000 | .798 | - | - |
| NSSE | 11.6 | 6.50 | - | - |
| Std. Dev | (.506) | (.645) | - | - |
| P-Value F-Test(=Talent) | .165 | .910 | - | - |
| Classes | 4 | 4 | 4 | 4 |
| Obs | 540 | 540 | 362 | 368 |

**Figure 1**




Dotted lines show 95% confidence intervals. See Appendix B for additional notes on construction.

**Figure 2**




See Appendix B for notes on construction.

**Figure 3**

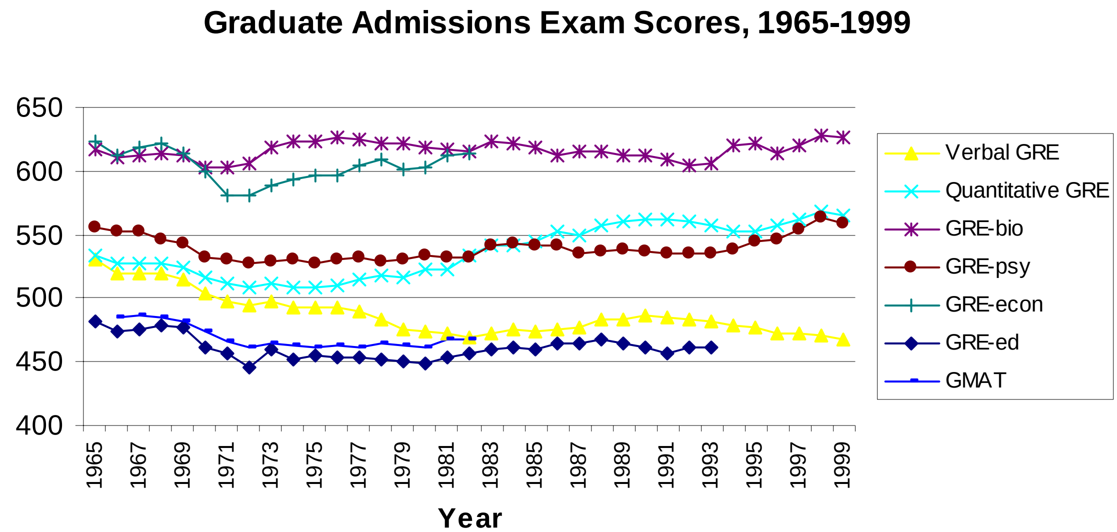
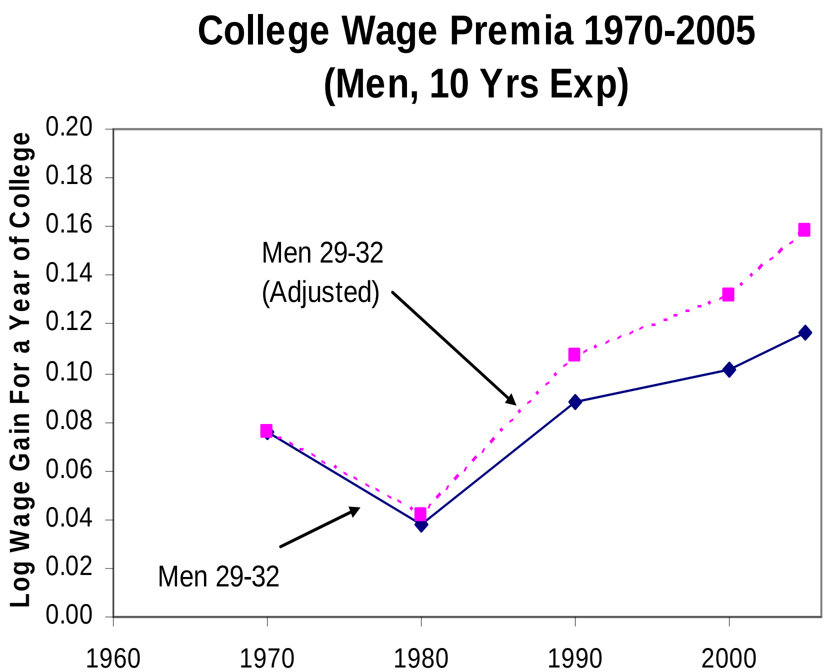

Graduate Admissions Exam Scores, 1965-1999
650
600
550
500
450
400
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
Year
Verbal GRE
Quantitative GRE
GRE-bio
GRE-psy
GRE-econ
GRE-ed
GMAT

**Figure 4**




See Appendix B for notes on construction.