# USE OF TIME AND ACADEMIC PERFORMANCE OF COLLEGE STUDENTS: DOES STUDYING MATTER?

by

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Paper selected for presentation
American Agricultural Economics Association
Annual Meeting, August 8-11, 1999

Abstract: Recursive regression analysis revealed time management skills and study time were positively related with quarter GPA for 93 students in three agricultural economics courses at Ohio State University. GPA increased only 0.04 points [4.0 scale] per additional study hour, suggesting substantial improvements in GPA require substantial increases in study time.

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# USE OF TIME AND ACADEMIC PERFORMANCE OF COLLEGE STUDENTS: DOES STUDYING MATTER?

A commonly accepted principle of economics is that, over a reasonable range of output, a positive link should exist between input and output. Furthermore, within the U.S, it is considered only fair that a positive link exist between effort and performance. Thus, it is somewhat disconcerting that a review of the literature review finds mixed results with regard to the link between amount of time spent studying and academic performance. Frisbee (1984), Pappalardo (1986), and Schmidt (1983) find a positive and significant relationship, although the relationship is not large in terms of its magnitude. In contrast, Kember, Jamieson, Pomfret, and Wong (1995) and Schuman, Walsh, Olson, and Etheridge (1985) find little to no relationship. Earlier literature cited in Pappalardo and Schuman *et al*. also generally find little to no relationship.

One explanation postulated to explain these mixed findings is the lack of a measure of quality of study time. Omission of a key variable leads to a misspecified analysis, limiting the ability to discover underlying relationships. Quality of study time is a multi-attribute variable and thus is difficult to measure; however, one important component is likely to be the ability to manage time skillfully. Time management ability includes setting goals and priorities, using time management mechanics (such as making lists), and being organized in using time (Macan, Shahani, Dipboye, and Phillips, 1990).

Macan *et al*. (1990), Britton and Tesser (1991), and Tureman and Hartley (1996) find that time management skills and academic performance are positively related. In contrast, Long, Gaynor, Erwin, and Williams (1994) finds no relationship. However,

none of these studies included quantity of study time, thus again raising the question of a misspecified analysis.

This study includes both variables, thus potentially providing additional insights into the relationship between effort and grade performance. Specifically, a recursive model of academic performance is proposed, wherein amount of time spent studying is determined first, and then becomes an input into the determination of grade point average. The data used to analyze this model was collected via a time diary survey completed by students enrolled in three agricultural economics classes offered Fall Quarter 1997 at The Ohio State University. The students also completed Macan *et al.*'s *Time Management Behavior Scale*, which measures the ability to use time skillfully.

The recursive model is discussed in the next section, followed by a discussion of the data collection procedures and characteristics of the surveyed students. Next, the regression analysis is presented. Conclusions and implications are then drawn.

## Model

Academic performance, as measured by quarterly GPA, can be viewed as involving the following production function:

$$\text{Quarterly GPA}_i = f(I_i, L_i)$$

where $I_i$, is the $i^{th}$ student's input and $L_i$ is a set of attributes of the $i^{th}$ student that are related to the student's ability to manage effectively this production function or personal attributes that may affect the input-output relationship.

Previous studies have documented extensively that scholastic aptitude is a key input into determining academic performance. Specifically, a positive relationship exists. In this study ACT score measures scholastic aptitude. As mentioned previously, amount of time spent studying also is considered a key input, even though past studies have yielded mixed findings regarding its statistical significance. Following conventional wisdom, time spent studying is expected to be positively related to academic performance. Time management skills also are expected to positively influence academic performance because a student with better time management skills should be more effective and efficient while studying. Last, attendance is often cited as a key input because it reflects participation in the class and is a measure of enthusiasm (e.g., Devadoss and Foltz, 1996). Gender and cumulative credit hours are analyzed because of their prominence in the education literature. Gender is defined as a dummy variable, with males coded 1 and females coded 0. Cumulative hours represent the number of credit hours completed at the end of Summer Quarter 1997.

Frisbee (1984), Pappalardo (1986), and Schmidt (1983) argue that one reason earlier studies did not find a relationship between amount of study time and GPA is that they ignored the simultaneous equation problem. Students jointly determined their GPA, study time, as well as key factors as they sought to maximize their utility. We agree that a multiple equation issue exists, but propose that the correct model is recursive as opposed to simultaneous. We observe that students determine the amount of study time before the quarter begins, as they consider such factors as how many course hours to sign up for, how many, if any hours they will work, and what their target GPA is for the

quarter. Once determined, these variables are then used to determine the number of hours they will have to study. ACT score or scholastic aptitude is likely to be a substitute input for study time; the greater the student's aptitude, the less time the student will need to study. Last, consistent with the regression on GPA, gender and cumulative hours of course work completed are included because of their common use in the educational literature.

## DATA COLLECTION PROCEDURES

A time diary was collected for a period of one week from students enrolled in three classes at Ohio State University during Autumn Quarter 1997. Previous research and experience suggest that a time diary provides accurate, useable information (Robinson and Godbey, 1997, p. 289-290 and Reed *et al*., 1984, p. 1035). Based on their 30-year study of how Americans use time, Robinson and Godbey recommend a one-week survey period.

The time diary survey instrument used in this study had been used for several years as part of a class assignment, and thus, was field tested. It had the following pre-assigned categories: in-class, studying, eating, sleeping, job, travel time, telephone, television, planned recreation/leisure, student organization/activities, personal hygiene, and other. Respondents were instructed to report only their primary use of time for each half-hour time block. Multiple uses of time can occur during a half-hour block and two or more activities may occur at the same time. Post-survey conversations with the students revealed that these situations caused few reporting problems.

The three courses surveyed were: an introductory course in agricultural economics, which draws freshman through seniors; an introductory course in agribusiness management, which draws sophomores through seniors; and a senior-level policy course in agricultural economics. To standardize the collection of data among the three classes, the time diaries were collected during the week of the first midterm. This week was selected because it avoids the start-up period during the first one to three weeks of the quarter when study time is probably less than normal, and the end of the quarter rush when time devoted to class work is probably greater than normal. Because more studying than normal may occur during a midterm week, the students were asked how many more or fewer hours than normal they studied during the survey week.

Students were asked several questions about their personal situation, such as their marital status. They also were asked for permission to obtain data from their college record. If permission was given, the following variables were collected: age, gender, hours taken and completed during the quarter, ACT score, cumulative grade point average at the end of Autumn Quarter, and Autumn Quarter grade point average.

In addition to the time diary, students completed a 34-item questionnaire designed to measure individual time management behaviors. This questionnaire, the *Time Management Behavior Scale (TMB*), was obtained from Therese Hoff Macan, of the University of Missouri - St. Louis. The questionnaire focuses on four different attributes of time management behavior: (1) preference for organization in completing tasks, (2) setting goals and priorities, (3) perceived control over time, and (4) use of time management techniques, such as making lists. Each question is scored on a five-point

scale, with five indicating a strong preference for the item and one indicating a weak preference for the item.

One hundred forty students completed time diaries. Students who did not complete the *TMB*, those that did not give permission to obtain data from the college office, and those with incomplete data in the college office were eliminated from the study. First quarter freshmen were eliminated, because they are in a transition period during which many adjustments, both academic and non-academic, are occurring. All first quarter transfer students were eliminated because of incomplete data in the college office. After eliminating these students, 93 useable observations remained. Comparing the time diary data from these 93 students with the time diary data from the 47 students that were eliminated revealed no statistically significant differences in the average uses of time.

## DESCRIPTION OF SAMPLE

The 93 respondents who comprise the data set were distributed as follows: freshmen, four percent; sophomores, twenty-four percent; juniors, thirty-four percent; and seniors, thirty-seven percent. Sixty-three percent of the respondents were male (see Table 1). The average age was 20.9 years, with the oldest being 29. No respondent reported being the primary care giver of another person. Four percent were engaged, none were married, and two percent had children.

Table 1 also presents a comparison of the respondents with students enrolled in the College of Food, Agricultural, and Environmental Sciences and Ohio State. Though

**Table 1: Comparison of Selected Characteristics of Students, Autumn Quarter 1997**

| Characteristic | Survey Respondents | College of Food, Agricultural, and Environmental Sciences | Ohio State University |
|---|---|---|---|
| Number of students | 193 | 1,370 | 35,647 |
| Percent of students Who are male | 63.44 | 54.53 | 52.07 |
| ACT Score | 22.58 | 22.90 | 23.60 |
| Age | 21.90 | 21.16 | 21.81 |
| Fall Quarter GPA | 2.82 | 2.79 | 2.77 |
| Cumulative GPA | 2.80 | 2.67 | 2.78 |

SOURCES: Original Survey Data; Linda S. Katunich, Statistical Information Specialist, Office of the University Registrar, The Ohio State University

not selected via a random sample, the respondents were similar to students in the College and University with regard to average age, ACT score, Fall Quarter GPA, and cumulative GPA. In contrast, a much higher percent of the respondents were males. This gender difference should be kept in mind when interpreting the results.

Average hourly use of time by these 93 students during the survey week was: sleep (55.3), study (20.3), planned recreation/leisure (19.5), in-class (16.8), job (12.3), travel time (10.4), T.V. (10.1), eating (8.0), personal hygiene (7.3), student organizations (4.2), other (2.3), and phone (1.5). This use of time is similar to that of the average American (Robinson and Godbey, 1997), except that “being a student” is the primary job.

Table 2 presents descriptive statistics for variables used in the regression analysis. The average respondent had a fall quarter GPA of 2.8, compared with a hoped for GPA of 3.3. They had completed 114 quarter hours prior to Fall Quarter 1997. During the survey week, they spent 20 hours studying and 12 hours working. They had 19 hours of class meeting times. They attended class for 89% of the class meeting time. Because of extra-class events, such as field trips, the student may have spent more than 100% of class meeting time on in-class activities. Average score on Macan's time management scale was 3.2. The range was 2.0 to 4.6. Standard deviation of this variable relative to its mean was 16%, which is comparable to the coefficient of variation for hoped for GPA, ACT score, and attendance.

## ANALYSIS

The recursive regression results are presented in Table 3. Both equations were examined for heteroskedasticity using the battery of eight test contained in SHAZAM (White, 1997). None of the tests indicted the presence of heteroskedasticity. Examination of the Jarque-Bera test did not reject the hypothesis that the regression equation residuals were normal. Outlier tests revealed that most of the coefficients were stable, except that the coefficients on time management and gender in the GPA equation became insignificant when the outlier test was conducted. Last, because previous studies have argued for a simultaneous equation approach, tests for simultaneity between the two equations were conducted. Specifically, the regression residuals and independent

**Table 2: Descriptive Statistics for Variables Used in the Regression Equation**

| Variable | Units | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| Fall Quarter GPA | Number | 2.8 | 0.7 | 0.9 | 4.0 |
| Time Management Score | Number | 3.2 | 0.5 | 2.0 | 4.7 |
| Time Spent Studying | Hours | 20.3 | 8.9 | 1.0 | 42.0 |
| Time Spent on Job | Hours | 12.3 | 11.8 | 0.0 | 50.0 |
| Class Meeting Time | Hours | 18.9 | 3.8 | 5.0 | 31.0 |
| Hoped for GPA | Number | 3.3 | 0.4 | 2.5 | 4.0 |
| ACT Score | Number | 22.6 | 4.2 | 8.0 | 31.0 |
| Gender | % Male | 63.4 | 48.4 | --* | --* |
| Attendance: share of potential time spent in class | Percent | 89.7 | 14.5 | 47.6 | 133.3 |
| Cumulative Credit Hours at the beginning of Fall Quarter | Hours | 114.4 | 44.2 | 40.0 | 203.0 |

*Not Applicable

SOURCE: Original Survey Data

variables were correlated and an exogeneity test was conducted (Maddala, 1992, p. 395). Neither test revealed that a simultaneous equation bias existed.

Factors that positively influenced the amount of study time are hoped for GPA and class meeting time. The latter's coefficient is 0.75, implying that for each hour of class meeting time students spend three quarters of an hour studying. This is well below

**Table 3: Regression Results for Amount of Study Time and Quarterly GPA**

| | Dependent Variable | | | |
|---|---|---|---|---|
| | Study Time | | Quarterly GPA | |
| Variable | Coef. | Std. Error | Coef | Std. Error |
| Time Spent Studying | | | 0.04* | 0.01 |
| Time Spent on Job | -0.20* | 0.08 | | |
| Class Meeting Time | 0.75* | 0.23 | | |
| Hoped for GPA | 5.59* | 2.26 | | |
| ACT Score | -0.44* | 0.23 | 0.11* | 0.01 |
| Gender | -2.02 | 1.77 | 0.26* | 0.13 |
| Cumulative Credit Hours at the beginning of Fall Quarter | 0.009 | 0.019 | 0.0008 | 0.001 |
| Time Management Score | | | 0.27* | 0.12 |
| Attendance: share of potential time spent in class | | | 0.21 | 0.40 |
| Adjusted $R^2$ | 0.23 | | 0.41 | |

* Significant at the five percent test level.

SOURCE: Original Calculations

the commonly quoted 2-to-1 ratio. Holding a job reduces study time, but only by 0.2 hours for each additional hour. This finding implies that students who work adjust other time uses in addition to study time. As expected a statistically significant relationship

exists between scholastic aptitude and study time, indicating that they are substitute inputs. The sign on each of these coefficients was consistent with the expected sign.

Turning to the quarterly GPA equation, the study time variable estimated from equation one is statistically significant. However, every additional hour of study time increases GPA by only 0.04 points (four-point scale). Thus, the marginal impact of additional studying is small. As expected, ACT score (scholastic aptitude) affects GPA. The sign on each of these coefficients is consistent with the expected sign. In this study, attendance does not have a statistically significant impact on GPA.

Both gender and time management are statistically related to GPA. The better the students' time management skill, the higher the students' GPA. In addition, males had a 0.26 higher GPA, after controlling for all other variables. Schmidt reported a similar finding in one of his analyses. As a comparison, the unconditional GPA for male respondents in this study was 2.82 while the unconditional GPA for females was 2.86. However, in considering both the gender and time management findings, it is important to remember that when outliers are eliminated both of these variables become insignificant. Thus, it is best to be cautious regarding these results.

## CONCLUSIONS AND IMPLICATIONS

Amount of time spent studying is positively related to amount of class meeting time, however, the ratio is 0.75 hours of study time for every one hour of class time. This is substantially less than the conventional advice of 2 hours of study time for every one

hour of class time. Robinson and Godby (p. 175) also find a 1-to-1 ratio between study time and time spent in class based on their time diaries collected from college students. This finding obviously raises the question of whether students are spending enough time studying or are being "forced" to study enough by instructors. On the other hand, adding together time spent studying and in-class during the survey week, yields an amount of time close to the amount of time the average American spent working.

Time management skills positively impacted quarterly GPA. This finding suggests that improved time management skills may enhance academic performance, however, it is important to remember that this finding was fragile with respect to the outlier analysis. Furthermore, the limited evidence that is available suggests that it is not easy to change time management behavior (for example, see Macan *et al*.). Thus, while this result is suggestive, it needs additional study.

The good news is that the amount of time spent studying positively impacts quarterly GPA. The bad news is that the marginal impact is very small. For the average student in this study to raise his or her quarterly GPA by one letter grade, the estimated coefficient implies that study time would need to be increased by 26 hours. Such an increase is clearly beyond the willingness or ability of most students, and can only be accomplished if the student reprioritizes his or her goals. Unfortunately, the finding is consistent with the few other studies that exist. Thus, in conclusion, we are left with this question which we submit needs intense scrutiny: "Should we be resigned to this low relationship between effort and reward, or should we strive for a change in the educational process that better matches effort and reward?"

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