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A Panel-Data Study of the Effect of Student Attendance on University Performance*

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Abstract

The literature indicates that absenteeism from university classes is a common phenomenon in Australia and North America. Whether this constitutes a problem from society's point of view depends upon whether absenteeism has a detrimental effect on student learning. Several authors in the economics discipline have argued the affirmative although none has established a causal linkage using experimental data and appropriate statistical analysis. The study reported here used panel data on business and economics students in an introductory statistics class at an Australian university to estimate the effect of attendance on performance. The methodology takes account of unobserved heterogeneity among students and in so doing constitutes an improvement over cross-section regression results reported previously. Attendance is found to have a small, but statistically significant, effect of on performance.

Key words: class attendance, class absenteeism, academic performance
JEL codes: A22, I21

I. Introduction

Absenteeism from university classes is not a new phenomenon. The historian, Barbara W. Tuckman (1979, p.119) states that in the fourteenth century “dwindling attendance at Oxford was deplored in sermons by the masters”. In fourteenth-century England low attendance might reasonably have been attributed to war and pestilence; today the reasons are less obvious. For whatever reason both in North America and Australia, substantial numbers of university students regularly skip classes. Romer (1993, p. 167) described absenteeism in economics subjects at three “relatively elite” U.S. universities as “rampant”, having found that approximately one third of students were absent from class on a given day. Rodgers and Rodgers (2000, p. 17), report attendance rates in an Intermediate Microeconomic Theory class at an Australian university that range from 68.4% in the first half of the semester to 54.5% in the second half of the semester.

Several analyses of cross-section data have found a strong association between students’ attendance and performance. Devadoss and Foltz (1996), Durden and Ellis (1995), Romer (1993), Park and Kerr (1990) and Schmidt (1983) report strong correlations in classes as diverse as agricultural economics and agribusiness, microeconomic principles, macroeconomic principles, intermediate macroeconomics, and money and banking. No study has established a *causal* relationship between attendance and performance using *experimental* data and sound statistical methodology. A very recent paper by Marburger (2001) addressed the issue of absenteeism using a panel of observations on 60 students in an introductory microeconomics class at a medium-sized, state-funded, regional university in the United States. He estimated a probit model in which the probability of a student responding incorrectly to each question in a set of multiple-choice questions was related to the student's attendance at the lecture when the relevant material was covered. Marburger found that absenteeism increased the probability of an incorrect response by as much as 14 percent.

My study is also based on observational data but, like Marburger's study, it employs panel data: observations were collected on each student's performance on several tests and his or her attendance at classes covering the material examined on those tests. [1] The availability of panel data allows the use of methodology that takes account of heterogeneity among students in unobservable variables that affect both attendance and performance, such as intelligence and motivation. Estimates of the effect of attendance on performance so obtained are free of some of the bias that is present in estimates based on cross-section regression studies.[2]

The remainder of the paper is organized as follows. In Section II the model of the relationship between attendance and performance is presented. The data used to estimate the model are described in Section III. In Section IV the results of the estimation are presented and interpreted. Finally, Section V summarizes the conclusions of the study.

II. The Model

Academic performance is hypothesized to be a function of the student's class attendance and other variables some of which are unobservable, such as the student's motivation and aptitude for the subject matter. These same variables are also likely to affect the student's propensity to attend class leading to an upward bias in estimates of the effect of attendance on performance obtained from regression analyses of cross-section observations. If each student's attendance could be determined randomly then a regression of performance on attendance (and other relevant variables) would be able to detect a causal relationship, if one exists, and accurately estimate its magnitude. Experimental data of this type is difficult to obtain because of the requirement that students be treated equally. An alternative approach is to observe attendance rates that are self chosen and to model the unobserved heterogeneity among students using fixed-effects and random-effects regressions in which the dependent variable is performance by student i on assessment task t (P_{it}) and the independent variable is attendance by student i at classes on which assessment task t is based (A_{it}).

The models estimated in this paper include as independent variables dummy variables for all but one of T assessment tasks, $TEST_1$, $TEST_2$ …$TEST_T$.

The fixed-effects model is:

$$P_{it} = \alpha_i + \beta A_{it} + \gamma_1 TEST_1 + \gamma_2 TEST_2 + \ldots + \gamma_{T-1} TEST_{T-1} + \varepsilon_{it} \quad (1)$$

where i=1,2, .. n; t=1,2, .. T. ε_{it} is an error term that is identically and independently distributed with $E(\varepsilon_{it}) = 0$, $Var(\varepsilon_{it}) = \sigma_{\varepsilon}^2$. The coefficient, β, reflects the impact of attendance on performance in any given assessment task.[3] The random-effects model is:

$$P_{it} = \alpha + \beta A_{it} + \gamma_1 TEST_1 + \gamma_2 TEST_2 + \ldots + \gamma_{T-1} TEST_{T-1} + \delta \mathbf{X}_i + \varepsilon_{it} + u_i \quad (2)$$

where i=1,2, .. n; t=1,2, .. T and $\mathbf{X}_i$ is a vector of time-invariant observable characteristics of student i. $\varepsilon_{it} + u_i$ is an error term with $E(\varepsilon_{it}) = E(u_i) = 0$; $Var(\varepsilon_{it} + u_i) = \sigma^2 = \sigma_{\varepsilon}^2 + \sigma_{\upsilon}^2$; $Cov(\varepsilon_{it}, u_j) = 0$ for all i, t and j; $Cov(\varepsilon_{it}, \varepsilon_{js}) = 0$ for $t \neq s$ or $i \neq j$; and $Cov(u_i, u_j) = 0$ for $i \neq j$. $Cov(\varepsilon_{it} + u_i, \varepsilon_{is} + u_i) = \rho = \sigma_{\upsilon}^2 / \sigma^2$ for $t \neq s$, that is, for a given student the errors on different assessment tasks are correlated because of their common component, u.

The time-invariant control variables included in the random-effects model are those suggested by other studies and those that seem intuitively plausible to experienced teachers of the subject matter. The first control variable is the student's average mark (out of 100) on other subjects taken during the same semester. It is a proxy for ability but it probably also reflects attendance in those other subjects. Assuming attendance is correlated across subjects, the inclusion of this variable is likely to result in an under-estimate of the effect of attendance on performance in my class.[4] The second control is a dummy variable for students in their first year at university. Assuming the transition from high school to university requires some adjustment it was hypothesized that first-year students would perform at a lower level than later-year students. Also, the less able students tend to drop out after the first year of university studies so that those who remain tend to be better academic performers. The third control is a dummy variable for students who are part-time. Many part-time students are mature-age, full-time workers with heavy demands on their time. The opportunity cost of time spent in class and in private study is higher for part-time students than for full-time students. Part-time students are likely, therefore, both to attend fewer classes and to perform at lower levels, than full-time students. The fourth control is a dummy variable for students who pay full fees. Other studies have found that private students perform better than students who are on scholarships or are supported by their parents, possibly because they are more motivated than students whose tuition is subsidized. The fifth control variable is a dummy variable for gender. Two dummy variables are included to reflect the type of degree undertaken by the student: a single degree, other than a Bachelor of Commerce, or a double degree. The omitted category is a Bachelor of Commerce degree. Finally, the method of entry into the university is represented by six dummy variables, the omitted category being standard matriculation from an Australian secondary school. The included categories are (a) entry via another Australian university, (b) entry via an overseas tertiary educational institution, (c) articulation from an Australian TAFE (technical or advanced further education) college, (d) special entry, such as mature age, (e) entry via a professional qualification or an institutional assessment or examination, and (f) entry according to "other" criteria.

III. The Data

The data used in this study were collected in a one-semester, introductory statistics subject taught to undergraduates at a medium size Australian university. There were three 50-minute lectures per week for 13 weeks delivered to the class of approximately 200 students using PowerPoint presentations. Printed Power Point slides, with certain key words, calculations and diagrams omitted, were made available in the library and could be purchased at a modest price from the university bookshop. Each student was also required to attend one 50-minute tutorial in each of Weeks 2 through 13. Tutorial groups consisted of 20 or fewer students. As tutorial preparation students were instructed to attempt a problem set involving the application of material covered in lectures in the preceding week. Eight of the 12 tutorial meetings were held in a regular classroom where a tutor presented the answers to as many of the problems as time permitted and responded to students' questions. Students could mark their own work using an answer key, which was made available in the library at the beginning of the week following the tutorial in which the problem set was discussed. The remaining four tutorial meetings were held in a computer laboratory where students, with the help of their tutor, used a statistical package to generate output with which to solve statistical problems. Attendance was recorded at all tutorials.

There were three tests during the semester. The mid-semester test was based on the first six weeks of lectures and was held on Saturday at the end of Week 7. It was multiple-choice, and contributed 15 percent of the total score.

The tutorial test was worth 10 percent and consisted of problems similar to those assigned as tutorial preparation. The computer test was worth 15 percent and examined knowledge of the output generated by the statistical package used in the subject. The tutorial and computer tests were both held in Week 13. The final examination was worth 50 percent and concentrated on material taught in Weeks 7 through 12. It consisted of both multiple-choice questions and problems. The remaining ten percent of the final score was contributed by unannounced short quizzes held at the end of 12 randomly chosen lectures, six in each half of the semester. The quizzes provided a mechanism for estimating attendance in the first and last six weeks of lectures.

Two weeks into the semester there were 229 students in the class[5], 31 (13.5 percent) of whom later withdrew[6]. Nine of the remaining 198 students took none of the four assessment tasks. Another 20 students missed at least one of the progressive assessment tasks and had the weight attached to that task transferred to the final examination. Two students completed all progressive assessment but did not take the final examination. Therefore, 167 students received scores for the four assessment tasks. These students contribute data to the balanced panel that is used in the econometric analysis reported in Section IV. Their characteristics appear in Column 1 of Table 1. The characteristics of the 22 students who completed some but not all assessment tasks appear in Column 2 of Table 1. These students, together with the 167 students who completed all assessment, provide data to the unbalanced panel of 179 students used in the econometric analysis below. The characteristics of the nine students who missed all of the assessment tasks but did not withdraw from the course are given in Column 3 Table 1. These nine students are not included in the econometric analysis.

{Table 1 about here.}

Table 1 indicates that students who completed all assessment tasks attended 70.86 percent of lectures in the first half of the semester, 64.27 percent of lectures in the second half of the semester, 78.89 percent of regular tutorials and 82.63 percent of computer labs. These attendance rates are significantly higher than those of students who did not complete all assessment tasks. Lecture attendance fell in the second half of the semester[7] and performance on the final examination was lower than on the mid-semester test.[8]

Only three observable characteristics display significant differences between students who completed all assessment tasks and students who missed some or all assessment. The latter scored significantly lower on other subjects taken in the same semester as this introductory statistics subject. Students who missed some or all assessment were more likely to be part-time.[9] A larger percentage of those who missed all assessment were full-fee paying students.[10] The relative similarity of the three groups of students whose descriptive statistics are reported in Table 1 suggests that the econometric analysis that is based on the panel is unlikely to be biased by the necessary omission of data on students who did not complete all assessment tasks.

IV. The Results

The fixed-effects model (FEM) and the random-effects model (REM) described in Section II were estimated using a panel of data to which each student contributed at least one and at most four observations. The four observations were: (1) score on the mid-semester test and attendance at lectures in Weeks 1 through 6; (2) score on the final examination and attendance at lectures in Weeks 7 through 12; (3) score on the tutorial test and attendance at regular tutorials; and (4) score on the computer lab test and attendance at computer labs. The fixed-effects model was estimated using LIMDEP's least squares dummy variable routine and the random-effects model was estimated using LIMDEP's generalized least squares routine (Greene, 1998, pp.318-325). For comparison purposes, the OLS estimates are also reported. The results of four models estimated with the balanced panel appear in Table 2.

{Table 2 about here.}

The coefficient on attendance is statistically significant at the five percent level in all models reported in Table 2. The FEM indicates that attending an extra one percent of classes increases performance in introductory statistics by approximately 0.05 percentage points. According to the REM the increase is 0.10 percentage points. The coefficient in the OLS model (0.20) indicates a larger effect of attendance on performance than the other two models. This was to be anticipated because the OLS estimate is positively biased, whereas the FEM and REM models control for unobservable characteristics of students that are likely to affect both performance and attendance.[11] The F-test and Breusch and Pagan's Lagrange multiplier test indicate that the OLS model should be rejected in favor of the FEM and REM respectively. Hausman's test indicates that the FEM is preferred to the REM. Based upon the FEM, a student with the average attendance rate, which was approximately 74 percent of all classes, is predicted to score 1.30 (26 times 0.05) points (out of 100) lower than a student who attended all classes. Based upon the REM the loss would be 2.6 (26 times 0.10) points. Although statistically significant, the differential is quite small.[12]

Among the control variables included in the REM, only two are statistically significant at the five percent level. First, the student's average score on other subjects taken in the same semester as introductory statistics has a positive effect on his or her score on introductory statistics. In fact, each additional one-point difference in this average score on other subjects between two otherwise identical students is associated with a difference of 0.99 points in introductory statistics. Second, students who gain "special entry" into the university are predicted to score approximately 15 points lower in introductory statistics than an otherwise identical student who matriculated into university from high school.

The results of the models estimated with the unbalanced panel appear in Table 3. The coefficient on attendance is statistically significant at close to the one percent level in all models. The effect of attendance on performance estimated using the unbalanced panel (Table 3) is slightly larger than in the corresponding model that was estimated using the balanced panel (Table 2). For example, the coefficient on attendance in the FEM is 0.06 in Table 3, rather than 0.05 in Table 2, indicating that a student with average attendance of 74 percent of all classes would score 1.56 (26 times 0.06) percentage points lower than a student who attended all classes.

{Table 3 about here.}

Finally, I investigate the sensitivity of the attendance coefficient to the exclusion from the data set of students with atypically low levels of attendance. The results in Table 4 apply to the majority of students, who are not chronically absent. Columns 1, 2 and 3 report the estimation of the OLS regression, the FEM and the REM using only those students who attended at least one of the eight regular tutorials, at least one of the four computer labs, and at least one of the six randomly chosen lectures in each half of the semester. Columns 4, 5 and 6 report the estimation of the OLS regression, the FEM and the REM using only those students who attended at least one of the eight regular tutorials, at least one of the four computer labs, and at least two of the six randomly chosen lectures in each half of the semester.

All the results in Table 4 are as strong statistically as those obtained with the full panel. Again, the FEM is the preferred model, but its coefficient is larger than in Tables 2 and 3. For example, the coefficient on attendance in the FEM is 0.13 (see Column 2 of Table 4), which indicates that a student with average attendance of 74 percent of all classes would score 3.38 (26 times 0.13) percentage points lower than a student who attended all classes. This is large enough to make the difference of one letter grade for some students.[13]

V. Conclusions

This study has estimated the effect of absenteeism on performance in an introductory statistics class of about 200 business and economics students at a medium size Australian university. Absenteeism from lectures and tutorials was common among these students. On average students attended approximately 68 percent of lectures during the semester, 71 percent in the first half of the semester and 64 percent in the second half of the semester. The average tutorial attendance rate was 80 percent, 87 percent in the first half of the semester and 74 percent in the second half of the semester. Computer laboratories were better attended (83 percent) than regular tutorials (79 percent).

The results reported here are based on a panel of four observations per student, each observation pertaining to performance on a particular test and attendance at the set of classes covering material examined on that test. The methodology takes account of unobserved heterogeneity among students and in so doing constitutes an improvement over cross-section regression results reported previously. Both fixed-effects and random-effects regression models were estimated and the fixed-effects model was judged to be superior. It was able to “explain” more than 70 percent of the variation in performance among students on four different tests. Attendance was found to have a small, but statistically significant, effect on performance. A one percent increase in attendance was found to result in an increase of between 0.05 and 0.13 points out of 100. This means that a student with average attendance of 74 percent of classes would score between 1.3 and 3.4 percentage points lower than an otherwise identical student with perfect attendance. Although modest in size, this forfeited score is large enough to make the difference of one letter grade for some students. One explanation for the small size of the effect of attendance on performance could be the fact that the students in my class had access to printed versions (with “gaps”) of the Power-Point slides that were presented in lectures. This may have both encouraged absenteeism and contributed to the ease with which students could substitute private study for lecture attendance.

Finally, the total effect of attendance on performance may be greater than its impact in one subject suggests. When a subject is a prerequisite for others then the knowledge foregone through absenteeism in the first subject may have negative consequences for performance in subjects that build upon that knowledge.

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Table 1

Descriptive Statistics

	Completed all assessment (1)	Completed some assessment (2)	Completed no assessment (3)
Mean mid-semester test score (100)	62.69	52.34**	n.a.
Mean tutorial test score (100)	64.49	44.63***	n.a.
Mean lab test score (100)	64.15	51.13*	n.a.
Mean final exam score (100)	53.65	25.88***	n.a.
Total weighted score (100)	57.67	n.a.	n.a.
Mean % lectures attended in weeks 1-6	70.86	49.62***	14.82***
Mean % lectures attended in weeks 7-12	64.27	31.95***	1.85***
Mean % regular tuts attended	78.89	53.98***	27.78***
Mean % labs attended	82.63	57.95***	16.67***
Average mark on other subjects (100)	61.85	48.63***	29.77***
Percentage in 1st-year	44.91	36.36	44.44
Percentage part-time students	34.13	50.00	66.67*
Percentage paying full fees	12.57	9.09	44.44**
Percentage male	60.48	72.73	66.67
Percentage B. Commerce	83.83	86.36	66.67
Percentage other single degree	6.59	9.09	11.11
Percentage double degree	9.58	4.55	22.22
Percentage entry via final year of secondary school	27.54	27.27	11.11
Percent entry via higher educ instit (Au)	16.77	13.64	22.22
Percent entry via higher educ instit (o/s)	1.80	4.55	00.00
Percentage entry via TAFE	16.17	9.09	11.11
Percentage entry via special entry	1.80	4.55	00.00
Percentage entry via prof. or instit exam	12.57	27.27	11.11
Percentage entry via other method	23.35	13.64	44.44
Number of students	167	22	9

*** significantly different at the 1% level from the students who completed all assessment tasks
** significantly different at the 5% level from the students who completed all assessment tasks
* significantly different at the 10% level from the students who completed all assessment tasks

Table 2: Effect of Attendance on Performance

Balanced Panel of 167 Students

	OLS Coeff (P-value) (1)		FEM Coeff (P-value) (2)		REM Coeff (P-value) (3)		REM + Controls Coeff (P-value) (4)	
Model								
constant:	40.92	(0.0000)			47.50	(0.0000)	-9.77	(0.1993)
attendance	0.20	(0.0000)	0.05	(0.0474)	0.10	(0.0000)	0.06	(0.0033)
TEST1	7.74	(0.0002)	8.71	(0.0000)	8.41	(0.0000)	8.61	(0.0000)
TEST2	7.94	(0.0002)	10.10	(0.0000)	9.44	(0.0000)	9.89	(0.0000)
TEST3	6.86	(0.0013)	9.57	(0.0000)	8.74	(0.0000)	9.31	(0.0000)
Av score on other subjects							0.99	(0.0000)
1st year student							-0.29	(0.9112)
Part-time student							3.67	(0.1470)
Full-fee paying							5.78	(0.1092)
Male student							-2.12	(0.3066)
Course: Other single degree							-3.51	(0.3918)
Course: Double degree							1.58	(0.6526)
Entry: higher educ (Australia)							-0.27	(0.9317)
Entry: higher educ (overseas)							0.71	(0.9286)
Entry: TAFE							-4.93	(0.1484)
Entry: special entry							-15.41	(0.0431)
Entry: instit or prof exam							-4.34	(0.2352)
Entry: other							-3.03	(0.3324)
R-sq	0.1286		0.7251		0.1286		0.3950	
R-sq (adj)	0.1234		0.6310					
F	24.47	(0.0000)	7.71	(0.0000)				

No. of observations = 668;
F test of FEM (column 2) versus OLS (column 1): 6.495 (P-value=0.0000);
Lagrange Multiplier test of REM (column 3) versus OLS (column 1): 303.81 (P-value=0.0000);
Hausman test of FEM (column 2) versus REM (column 3): 17.73 (P-value=0.0014)

Table 3: Effect of Attendance on Performance
Unbalanced Panel of 189 Students

	OLS Coeff (P-value) (1)		FEM Coeff (P-value) (2)		REM Coeff (P-value) (3)		REM + Controls Coeff (P-value) (4)	
Model								
constant:	38.44	(0.0000)			43.90	(0.0000)	1.28	(0.8454)
attendance	0.22	(0.0000)	0.06	(0.0121)	0.12	(0.0000)	0.07	(0.0007)
TEST1	8.37	(0.0000)	9.89	(0.0000)	9.27	(0.0000)	9.82	(0.0000)
TEST2	8.13	(0.0001)	10.33	(0.0000)	9.55	(0.0000)	10.21	(0.0000)
TEST3	7.33	(0.0005)	10.06	(0.0000)	9.07	(0.0000)	9.93	(0.0000)
Av score on other subjects							0.81	(0.0000)
1st year student							-0.50	(0.8431)
Part-time student							2.88	(0.2344)
Full-fee paying							4.42	(0.2192)
Male student							-2.69	(0.1879)
Course: Other single degree							-5.05	(0.2005)
Course: Double degree							2.35	(0.5022)
Entry: higher educ (Australia)							-0.29	(0.9260)
Entry: higher educ (overseas)							-6.90	(0.3505)
Entry: TAFE							-6.64	(0.0460)
Entry: special entry							-11.34	(0.1060)
Entry: instit or prof exam							-5.94	(0.0869)
Entry: other							-3.88	(0.2082)
R-sq	0.1494		0.7276		0.1494		0.3829	
R-sq (adj)	0.1446		0.6270					
F	31.09	(0.0000)	7.23	(0.0000)				

No. of observations = 713;
F test of FEM (column 2) versus OLS (column 1): 5.87 (P-value=0.0000);
Lagrange Multiplier test of REM (column 3) versus OLS (column 1): 300.3 (P-value=0.0000);
Hausman test of FEM (column 2) versus REM (column 3): 23.49 (P-value=0.0001)

Table 4: Sensitivity of the Effect of Attendance on Performance
To Students Included in the Panel

	OLS Coeff (P-value) (1)		FEM Coeff (P-value) (2)		REM Coeff (P-value) (3)	
Estimated using 136 students with more than 0% attendance in each component						
Model						
constant:	31.33	(0.0000)			41.08	(0.0000)
attendance	0.31	(0.0000)	0.13	(0.0004)	0.18	(0.0000)
TEST1	7.47	(0.0011)	8.19	(0.0000)	7.99	(0.0000)
TEST2	9.58	(0.0000)	10.32	(0.0000)	10.11	(0.0000)
TEST3	8.04	(0.0005)	9.88	(0.0000)	9.35	(0.0000)
R-sq	0.1560		0.7390		0.1560	
R-sq (adj)	0.1498		0.6492			
F	24.91	(0.0000)	8.23	(0.0000)		

No. of observations = 544;
F test of FEM (column 2) versus OLS (column 1): 6.684 (P-value=0.0000);
Lagrange Multiplier test of REM (column 3) versus OLS (column 1):
258.45 (P-value=0.0000));
Hausman test of FEM (column 2) versus REM (column 3): 12.38 (P-value=0.0147)

	OLS Coeff (P-value) (4)		FEM Coeff (P-value) (5)		REM Coeff (P-value) (6)	
Estimated using 121 students with more than 25% attendance in each component						
Model						
constant:	26.61	(0.0000)			42.01	(0.0000)
attendance	0.36	(0.0000)	0.11	(0.0098)	0.17	(0.0000)
TEST1	7.09	(0.0037)	7.43	(0.0000)	7.34	(0.0000)
TEST2	9.90	(0.0001)	9.85	(0.0000)	9.86	(0.0000)
TEST3	8.74	(0.0004)	10.16	(0.0000)	9.80	(0.0000)
R-sq	0.1385		0.7335		0.1385	
R-sq (adj)	0.1313		0.6414			
F	19.25	(0.0000)	7.97	(0.0000)		

No. of observations = 484 ;
F test of FEM (column 2) versus OLS (column 1): 6.678 (P-value=0.0000);
Lagrange Multiplier test of REM (column 3) versus OLS (column 1):
220.33 (P-value=0.0000);
Hausman test of FEM (column 2) versus REM (column 3): 17.02 (P-value=0.0019)

FOOTNOTES

[1] To my knowledge, only one other study has utilized Australian panel data. It is reported in an unpublished working paper by Rodgers and Rodgers (2000).

[2] While my study is of just one class in one faculty at one university during one semester, when considered in conjunction with results from other studies it contributes to an informed judgment as to the seriousness of absenteeism in universities.

[3] Interactions between attendance and the assessment tasks were also included in the models to allow the effect of attendance on performance to be different for the various assessment tasks.

[4] This point is made by Romer (1993, p.172) and by Park and Kerr (1990, pp.105-108).

[5] In the first two weeks of each semester a considerable amount of “subject sampling” takes place as students finalize decisions about which subjects to take. Students can drop subjects and avoid fees until the middle of the fifth week of the semester; they can drop without having an F recorded on their academic transcript prior to the end of Week 8.

[6] Only four of these students completed any of the progressive assessment tasks before withdrawing.

[7] Attendance at tutorials (regular plus labs) was also lower in the second half of the semester (73.55 percent) compared with the first half (86.53 percent).

[8] Correlation coefficients between attendance rates in the various components of the course based on the 167 students in the balanced panel are:

Attendance Correlations

	Lect wk1-6	Tuts	Labs	Lect (wk7-13)
Lect (wk1-6)	1.00			
tuts	0.37	1.00		
labs	0.29	0.46	1.00	
Lect (wk7-13)	0.76	0.42	0.41	1.00

Correlation between performance in the various components of the course based on the 167 students in the balanced panel are:

Performance Correlations

	Mid-S test	Tut test	Lab test	Final exam
Mis-S test	1.00			
Tut test	0.54	1.00		
Lab test	0.49	0.61	1.00	
Final exam	0.67	0.67	0.68	1.00

9 In this paper a part-time student is defined as a student taking less than the normal load of 24 credit points per semester.

10 In the Australian context at this time most full-fee-paying students were international students.

11 Multicollinearity does not appear to be a problem. The correlations among the independent variables in Columns 1, 2 and 3 of Table 2 are::

	ATTEND	TEST1	TEST2	TEST3
ATTEND	1.00			
TEST1	-0.07	1.00		
TEST2	0.10	-0.33	1.00	
TEST3	0.17	-0.33	-0.33	1.00

The largest correlations among the control variables in Column 4 are:
r(attendance, average score on other subjects) = 0.53
r(1st year student, part-time student) = -0.43
r(full-fee paying, entry by higher education overseas) = 0.38
r(1st year student, entry by institute or professional exam) = -0.35
r(full-fee paying, entry by “other” method) = 0.32
r(part-time, entry via TAFE) = 0.30
All but six of the remaining correlations are less in absolute value than 0.20.

12 The models were also estimated with interactions between attendance and the three dummy variables for the assessment tasks. None of the coefficients on the interactions was significant at the five percent level.

13 The models in this paper assume that performance in a later component (such as the final exam) depends only on attendance in classes when the subject matter of the later component was covered (Weeks 7-12), not on attendance in earlier classes (Weeks 1-6). To the extent that this assumption is untrue the total effect of attendance on performance may be greater than results in this section suggest.