STUDENT CHARACTERISTICS, PEER EFFECTS AND SUCCESS IN INTRODUCTORY ECONOMICS

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ABSTRACT

This research presents two important pedagogical findings. First, the regression model developed in this study demonstrates that high school grade point average, math entrance score on the Scholastic Aptitude Test, and enrollment in the Honors College at Western Carolina University were all statistically significant predictors of student achievement in principles of economics classes at this university. Conversely, gender, one of the explanatory variables in the model, proved not to be statistically significant. Second, a t-test of means revealed that there were positive and statistically significant peer effects for Honors College students who were enrolled in Honors College classes. Specifically, honors students in honors classes had significantly higher test scores than honors students in non-honors classes.

INTRODUCTION

This purpose of this study is twofold. First, it examines the student characteristics that are most likely to lead to student success in introductory courses in economics, as measured by exam scores. Special attention was given to student aptitudes as measured by high school grade point average (GPA) and college entrance scores—measured by verbal and math scores in the Scholastic Aptitude Test (SAT)—and gender. Second, the study examined whether or not peer effects exist at the individual class level between honors students who are enrolled in strictly honors sections versus honors students who are enrolled in non-honors sections of principles of economics.

This research approaches peer effects uniquely in that they are examined at the individual section level. The study first employs regression analysis to identify the important determinants of student success in principles of economics classes. Secondly, two tests of means are employed to ascertain whether or not there are peer effects for Honors College students based on whether they were enrolled in an honors only section of principles of economics or in a section open to all undergraduate students.

PREVIOUS RESEARCH

In previous pedagogical studies of student traits that contribute to success in introductory principles of economics courses, researchers have focused on various student characteristics,

such as math aptitude, verbal aptitude, and gender as possible predictors of student achievement in these classes. With respect to student aptitude, Durden and Ellis (1995) found that the math entrance score of the SAT was significantly related to student success in economics. Williams, Waldauer, and Duggal (1992) found that Math SAT scores were positively related and statistically significant to success in non-essay economics tests. In a comprehensive study of college in the United Kingdom, Lumbsden and Scott (1987) reported that achieving an "A" understanding of mathematics contributed significantly to student success to multiple-choice exams in economics. Using their own test for math skills, as well as American College Testing (ACT) math entrance scores, researchers Ballard and Johnson (2004) found that math skills were a statistically significant predictor of student success on economics exams. In the same study, they also found that ACT verbal entrance scores to be significantly positive indicators of success in economics tests.

Several studies have explored whether or not there is a statistically significant difference between the performance of male and female students on economics exams. Some research has concluded that females do not perform as well as their male counterparts in economics classes, at least those that employ multiple-choice questions to assess student performance. Studies that support this conclusion include Anderson, Benjamin, and Fuss (1994), Lumbsden and Scott (1987), and Siegfried (1992). A contrary conclusion was reached by Williams, Waldauer, and Duggal (1992).

Several studies have examined the peer effects of roommates in higher education. In an extensive study at Dartmouth, Sacerdote (2001) concluded that peer effects based on room assignment had a significant impact on GPA. In a later study, Zimmerman (2003) came to a similar result. However, in a study at the University of Maryland, Foster did not find peer effects on the basis of either roommates or friends. Brunello, De Paola, and Scoppa (2010) examined peer effects by subject and found that roommate peer effects were positive and significant for students enrolled in math, engineering and the natural sciences, but close to zero in the humanities and social sciences.

DATA

The study presented here encompasses three semesters at Western Carolina University, spring 2006, fall 2006, and spring 2007. During that period, primary data was collected from two principles of microeconomics classes and five principles of macroeconomics classes. All seven classes were taught by the same professor. The two micro classes and two of the macro classes were honors sections, while three of the macro sections were non-honors. Class size varied from thirteen students in the smallest section of principles to thirty-five students in the largest section. Honors sections were smaller on average than non-honors sections. Honors classes averaged approximately sixteen students per section, while non-honors classes averaged thirty students per section.

The original sample consisted of 153 students who completed the courses they were enrolled in by taking the four tests required in each of these seven classes. There were thirty-three multiple-choice questions in each exam. The tests administered to honors sections and non-honors sections were identical. The individual test was the observational unit. Thus, there were potentially 612 observations. However, nine students had missing data from their records—specifically, high school grade point average and/or verbal and math entrance scores (SAT)—because they were transfer students. Hence, thirty-six observations were lost, leaving a sample of 144 students and 576 observations. The descriptive statistics for the sample are given in Table 1, below.

Table 1: Descriptive Statistics

	Total	Honors	Non-Honors
Number of Students	144	72	72
Female	58	33	25
Male	86	39	47
High School GPA Mean	3.268	3.586	2.950
High School GPA St Dev.	.585	.547	.427
High School GPA Range	1.87 – 4.92	2.31 – 4.92	1.87 – 3.71
Verbal SAT Score Mean	513.125	548.056	478.194
Verbal SAT Score St. Dev.	79.095	78.552	62.566
Verbal SAT Score Range	350 – 670	350 – 670	350 – 620
Math SAT Score Mean	539.375	573.333	505.417
Math SAT Score St. Dev.	79.004	75.445	67.073
Math SAT Score Range	260 – 770	410 – 770	260 – 640

REGRESSION MODEL

The dependent variable in the regression model was percentage of correct answers on each exam. The independent variables were: overall high school GPA; verbal SAT score; math SAT score; a dummy variable for whether or not a student was in the Honors College (one was assigned to Honors College students); a dummy variable for gender (one was assigned for males); a dummy variable to separate the first three tests from the fourth exam because a preliminary examination of the data revealed a seemingly lower test score for the fourth exam when compared to the average score of the first three tests (one was assigned to the fourth exam); class size. Based on the above dependent and independent variables, the following regression model was then estimated:

$$Y = \text{intercept} + \beta 1 \text{ high school GPA} + \beta_2 \text{ verbal SAT score} + \beta_3 \text{ math SAT score}$$

$$+ \beta_4 \text{ honors college student} + \beta_5 \text{ male} + \beta_6 \text{ test 4} + \beta_7 \text{ class size} + e_i$$

The predictive model generated by the regression was:

$$Y_i = 21.616 + 2.969 \text{ high school GPA} + .002 \text{ verbal SAT score} + .057 \text{ math SAT score}$$

$$+ 9.456 \text{ honors college student} - .308 \text{ male} - 3.248 \text{ exam 4} + .091 \text{ class size}$$

The empirical statistics generated by the regression model are given in Table 2, below.

A review of the data indicates that students' high school GPAs were a statistically significant predictor of test scores at the 95% level of confidence. Math SAT scores were a statistically significant predictor at the 99% level of confidence, while verbal SAT scores proved to be an insignificant predictor of test scores. The most plausible explanation for the insignificance of verbal scores is that there are several international students in the sample for whom English is a second language. Their relatively low SAT scores likely reflect their English proficiency rather than their overall language skills. For instance, it is not uncommon for some international students to score 350 in the verbal portion of the SAT and 650 in the mathematical section of the SAT. Enrollment in the Honors College was a significant predictor of student success in principles of economics classes at Western Carolina University. It was statistically significant at the 99% level of confidence. Although females scored slightly higher than their male counterparts on exams, gender was not a statistically significant explanatory variable. Class size positively influenced test scores, but was statistically insignificant—a Pearson correlation coefficient of .91766 revealed the probability of multicollinearity between the independent variables of class size and Honors College student .

Table 2: Regression Results

Statistics for Overall Model					
Multiple R			0.557616		
R-square			0.310936		
Adjusted R-square			0.302444		
Standard Error			12.97999		
Number of Observations			576		
ANOVA	df	SS	MS	f-stat	p-value
Regression	7	43182.52	6168.931	36.61517	2.6564E-42
Residual	568	95696.75	168.4018		
Total	575	138879.3			

Table 2: Regression Results				
Variable	Coefficients	Standard Error	t-stat	p-value
Intercept	21.61615	6.301485	3.430327**	0.000647
High School GPA	2.968906	1.20959	2.454473*	0.014408
Verbal SAT Score	0.001916	0.008993	0.213075	.831345
Math SAT Score	0.056991	0.009171	6.214342**	98E-10
Honors College Student	9.456155	1.821381	5.19175**	.91E-07
Male	-0.30783	1.176023	-0.26176	0.793604
Test4	-3.24785	1.249	0.009555**	0.009555
Class Size	0.091179	0.106325	0.391503	0.391503
*significant at .05 **significant at .01				

As noted above, students scored significantly lower on the fourth exam than the previous three exams. The explanation for this is not level of difficulty because the test is not comprehensive, and to the extent possible, is calibrated at the same level of difficulty as the prior three tests. There are two plausible explanations for this outcome. First, some students may feel that their grade is "locked in" and, therefore, there is no payoff for extra effort—indicative perhaps of their understanding of the fundamental economic concept of opportunity cost. Second, some students may be fatigued at the end of the semester, and are consequently not willing or able to muster that last push.

The adjusted R^2 statistic indicates that about thirty per cent of the variation in exam scores is explained by the regression model. The robust F-statistic is significant, indicating that the overall model is a good predictor of student performance in principles of economics courses.

MEANS TESTS FOR PEER EFFECTS

Because of the statistically significant difference between student performance on the first three exams and student performance on the final exam, two separate t-tests of means were performed to analyze whether or not peer effects based on section type—honors versus non-honors—affected Honors College students' performance. The first test of means was on exams one through three, and the second test was on the fourth exam only. Both tests of means assumed equal variances in the samples because they were drawn from the same population of students. A one-tailed test was performed because peer effects, if any existed, were hypothesized to be positive.

In the first test, sample one consisted of Honors College students who were enrolled in strictly honors sections of principles—there were sixty-one students, each taking three tests, for a total of 183 observations. Sample two consisted of Honors College students enrolled in regular

sections of principles—that sample consisted of eleven students each taking three exams, for a total of thirty-three observations. The empirical results are given in Table 3, below.

The means test employed for the first three exams revealed statistically significant positive peer effects at the ninety-five percent level of confidence. This test of means strongly indicated that Honors College student performance was positively enhanced by being enrolled in strictly honors sections of principles courses in economics. This empirical finding is evidence that positive peer effects exist at the individual class level for Honors College students at Western Carolina University.

Table 3: Two-Sample t-test for Exams 1-3		
	Honors Students in Honors Classes	Honors Students in Non-honors Classes
Mean	78.028514	73.7397
Variance	128.259144	135.8204
Observations	183	33
Pooled Variance	129.389797	
df	214	
t-stat	1.99350141	
p-value	0.02373821	
t-critical	1.65200516	

The second means test was then performed on the same two samples of students, but this time on only their last exam only. Sample one consisted of sixty-one observations, while sample two consisted of eleven observations. The results are given below in Table 4, below.

Table 4: Two-Sample t-test for Exam 4		
	Honors Students in Honors Classes	Honors Students in Non-honors Classes
Mean	181.7452459	75.48363636
Variance	45486.54002	261.6261855
Observations	61	11
Pooled Variance	29025.83805	
Df	70	
t-stat	1.642083672	
p-value	0.052529038	
t-critical	1.66691448	

In the means test on the last exam only, Honors College student achievement in principles of economics courses was positively affected by being enrolled in strictly honors sections. However, though not statistically significant at the ninety-five percent level of

confidence, the p-value of 0.0525 closely approaches significance. The empirical results from the two tests of means indicate that honors students are more likely to achieve an optimum outcome if they are enrolled in an honors section.

CONCLUSION

In this study, a statistically significant regression model was developed to predict student success in principles of economics courses. The independent variables chosen for the model that were found to be statistically significant indicators of student outcomes were: 1) high school GPA, 2) math SAT score, 3) enrollment in the Honors College. The model did not find the independent variable of gender to be a statistically significant predictor of student success.

In addition, the study utilized two tests of means to analyze whether there were any positive peer effects for Honors College students enrolled in honors college courses. The first t-test revealed statistically significant positive peer effects for those Honors College students enrolled in honors only sections. The second t-test showed positive peer effects associated with enrollment in honors only courses, but the results were statistically insignificant. One of the ways in which the Honors College at Western Carolina University attempts to create the most conducive environment for student achievement is through offering honors only sections. The two tests of means undertaken in this study reveal that there are positive peer effects in these sections, and thus, the honors only sections do indeed enhance student performance.

Approximately sixty percent of currently enrolled Honors College students at Western Carolina University are housed in the honors dorms (Balsam and Blue Ridge). An interesting future study would be to analyze whether there are positive peer effects associated with being housed in an Honors College dorm, rather than other student housing. Another potential contribution to the study of peer effects in higher education would be to explore whether peer effects exist on the roommate level among both honors college students and non-honors college students.

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