

HAS THE STUDENT PERFORMANCE IN MANAGERIAL ECONOMICS BEEN AFFECTED BY THE CLASS SIZE OF PRINCIPLES OF MICROECONOMICS?

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ABSTRACT

This research focuses on the influence of the principles of microeconomics class size on students' achievement in the managerial economics course. The logistic regression results suggest that the class size effect is negative and highly significant. Caution should be used in interpreting the negative introductory class size effect found in this study which might be underestimated due to the potential grade inflation problem resulting from the traditional letter grading system. For future studies, a better measure of student performance in the managerial economics course is necessary.

INTRODUCTION

The impact of class size at the college level on students' performance has long been of interest. It is generally believed that the student-instructor interaction in a small class is more effective than in a large class. Yet, state-owned universities and colleges are generally under substantial financial pressure and increasing class size naturally becomes one of the instruments that administrators use to deal with the pressure.

This research examines the effect of class size in the introductory microeconomics course on students' performance in the managerial economics course. The setting for the research is the Belk College of Business, University of North Carolina-Charlotte, an AACSB International accredited, public university. All business majors, except accounting majors are required to take Managerial Economics (ECON 3125). This course builds on the principles of microeconomics course and emphasizes their applications to business decision problems. The prerequisites of this course are Principles of Microeconomics, Calculus, Elements of Statistics, and Introduction to Business Computing. Thus, to take this course, students must have acquired the basics of economic theory and be equipped with elementary mathematical, statistical and computing tools. However, in response to increased enrollment but limited resources, the Department of Economics has in recent years begun to offer primarily large-section classes for the principles of microeconomics course. To accommodate students' diverse schedule demands, the department also offered small lecture sections for the same course. Regardless of the section size, all

instructors were required to use the same text book and cover the same core-course outline. This raises the question of “has the student performance in Managerial Economics been affected by the class size of the Principles of Microeconomics course?” The research poses the hypothesis that the large-sized introductory class has a negative impact on students’ performance, in large part, because the student-instructor interaction in a large section tends to be less effective than in a small section. With less effective interaction, a large section may hinder students from understanding the course materials, developing problem-solving skills and cultivating independent thinking. These are essential achievement elements for a managerial economics course.

LITERATURE REVIEW

Does a large class size adversely influence student achievement in higher education? Many studies have looked at this issue but the empirical results have been mixed. Toth and Montagna (2002) summarize eight studies published between 1990 to 2000 – two studies show no relationship between class size and achievement, two indicate a negative relationship, one shows a positive relationship, while three report mixed findings.¹ The most recent research by Kokkelenber et al. (2008) finds a negative relationship between class size and average grade point for various specifications and subsets of the data.

In a class size study specific to the economics discipline, Bellante (1972) found students in a “mass lecture” introductory economics class scored 2 points less than students in the small classes. Using a national economic education data base (TUCE III), Kennedy and Siegfried (1997) found class size does not affect student achievement in introductory economics. This insignificant or no class-size effect research result seems counterintuitive. Most of us implicitly believe that students in large classes learn less than students in smaller classes, partly because of the less effective student-instructor interaction. Becker and Powers (2001) argued that the missing data problems might cast a doubt on the no class-size effect result in earlier studies. In contrast, Arias and Walker (2004) find significant evidence that small class size in principles of economics has a positive impact on student performance in the course. The literature on the relationship between student performance and class size has often focused on the introductory economics courses. Little research has been done on intermediate level economics. Raimondo et al. (1990) examined the relationship between class size in introductory economics courses and student performance in subsequent intermediate economics courses. The results showed large-sized introductory microeconomics course did not significantly influence students’ performance in the intermediate microeconomics course, but large-sized introductory macroeconomics course did have a negative and statistically significant effect on students’ performance in the intermediate macroeconomics. Hou (1994) conducted a class-size effect study on managerial economics. As expected, students in a small-sized managerial economics class performed significantly better than students in a large-sized class.

THE DATA AND THE METHOD OF RESEARCH

This paper seeks to identify factors that influence student performance in managerial economics at the Belk College of Business, University of North Carolina at Charlotte. Full-time students who had completed both microeconomic principles and managerial economics during the ten-semester interval from fall 2004 to spring 2009 were selected for this study. The sample consists of observations on 1156 students. Transfer students are excluded from this study because they had taken one or two of the prerequisite courses for ECON 3125 from other institutions. Part-time students are excluded mainly because their work schedule generally does not allow them to devote more time to their studies comparing with full-time students. Table 1 reports some selected characteristics of the student profile. Logistic regression analysis is applied for this research due to the categorical nature of the dependent variable. The dependent variable is managerial economics course grade (3125GRADE). While class size (SIZE) is the independent variable of most interest to this study, other independent variables - the student's grade point average (GPA), microeconomic principles course grade (2102GRADE), average grade for other prerequisite courses for managerial economics (MATHGRADE), the number of semesters pause between the completion of microeconomic principles and the beginning of managerial economics (PAUSE), gender (GENDER) and age (AGE) are also considered. Table 2 lists the variables in the model with their mean, standard deviation, minimum, and maximum values reported. The explanation of each variable follows.

Dependent Variable

3125GRADE: The grading issues have hotly debated in higher education. One concern is the problem of grade inflation associated with the traditional letter grade system. Grade inflation refers to the phenomenon that shows a continued rise in the number of A's and B's assigned to students, which do not necessarily reflect increased levels of students' academic performance. Quann (1987) and Bressette (2002) have documented a reduction in grade inflation using a plus/minus system. Wilamowsky et al. (2008) found that the effect of the plus/minus system on curbing the problem of grade inflation is uncertain. The University of North Carolina at Charlotte uses a traditional letter grade system, i.e. A, B, C, D and F. Although there has been some discussion at the UNC-Charlotte on changing the grading system to plus/minus system, it has not been pushed further. Grades are measured as A = 4.0, B = 3.0, C = 2.0, etc. For this study, student performance in managerial economics is measured solely by the letter course grade. In the sample data, 24% of the students made an A, 35% made a B, 33% made a C, 6% made a D and only 2% made an F. The mean and standard deviation for 3125GRADE are 2.73 and 0.97, respectively.

Independent Variables

SIZE: What is a “large class”? Gibbs et al. (1996) and Toth & Montagna (2002) define a “small” class as “30 or fewer students” while a “large” class as “70 or more students”. Maxwell & Lopus (1995) defines a “small” class as having a ceiling of 55 students and a “large” class as having a ceiling of 120 students. This study defines a small class as 46 or fewer students and a large class as 60 or more students. There is a gap between 46 and 60 seen in the actual class size distribution. Over the ten semesters from fall 2004 to spring 2009, 733 students enrolled in small-sized principles of microeconomics classes and 423 students enrolled in large-sized classes. SIZE has a value equal to 1 if the class size is large and a value of 0 if the class size is small. The Principles of Microeconomics class size is expected to have a negative impact on student performance in the Managerial Economics class (3125GRADE) mainly because of the lack of teacher/student interaction in a large class which tends to hinder student understanding of the introductory economics material. The mean and standard deviation for SIZE are 0.64 and 0.48, respectively.

GPA: Student’s grade point average prior to the managerial economics course is used as predictor of student success since GPA indicates how much effort the student has put into his or her studies as well as student ability. Higher GPA is expected to lead to higher 3125GRADE. The mean and standard deviation for GPA are 3.01 and 0.46, respectively.

PREGRADE: The managerial economics course extends the principles of microeconomics course and emphasizes application to business decisions by employing marginal analysis and regression analysis. A higher average grade for all the prerequisites courses

(PREGRADE) is expected to lead to higher grade in managerial. The mean and standard deviation for PREGRADE are 2.75 and 0.68, respectively.

PAUSE: This independent variable measures the number of semesters pause between students’ completion of the principles of microeconomics course and the beginning of the managerial economics course. Since the introductory microeconomics is the prerequisite for managerial economics, the longer the pause between the two courses, the lower 3125GRADE is expected to be. The mean and standard deviation for PAUSE are 1.62 and 1.21, respectively.

GENDER: In the literature on student performance in economics, gender has been highlighted as a factor influencing learning. For example, Anderson, Benjamin, and Fuss (1994) found that male students perform better than female students in the introductory economics course. Ballard and Johnson (2005) found that women tend to have low expectations about their ability to succeed in introductory economics mainly because of their relatively low level of competency in math. Marcal et al. (2007) found that females earn slightly lower grades in intermediate macroeconomics course. However, males and females students earn similar grades in intermediate microeconomics. In order to investigate whether or not there is a difference between the odds of success in the managerial economics course for female and male students, this study includes GENDER in the regression. The sample includes 667 male students and 489

female students. Following Ballard and Johnson (2005), this study hypothesizes that female students earn lower grades than male students in the managerial economics course because of the required math skills in the course. The GENDER variable takes a value equal to 1 if the student is a female and a value of 0 if the student is a male. GENDER is expected to have a negative effect on 3125GRADE. The mean and standard deviation for GENDER are 0.42 and 0.49, respectively.

Table 1		
Characteristics of Student Profile: Fall 2004 – Spring 2009		
Total Number of Students	1156	
Managerial Economics Grade		
A	277	(24%)
B	406	(35%)
C	381	(33%)
D	64	(6%)
F	28	(2%)
Gender		
Male	667	(58%)
Female	489	(42%)
Age (in years at the time when 3125 was taken)		
22 and under	988	(85.5%)
23 – 30	144	(12.5%)
31 and above	24	(2%)
Ethnicity		
American Indian/Alaskan Native	2	(<1%)
Asian/Pacific Islander	84	(7%)
Black/Non-Hispanic	125	(11%)
Caucasian/Non-Hispanic	808	(70%)
Hispanic	28	(2%)
Others	109	(10%)
Class Size		
Small class (≤ 46)	584	(51%)
Large class (≥ 60)	572	(49%)
Source: Office of Institutional Research, Academic Affairs, UNC-Charlotte		

Table 2				
Mean, Standard Deviation, Minimum and Maximum Values				
Variable	Mean	Standard Deviation	Min	Max
Dependent				
3125GRADE	2.726644	0.9668171	0	4
Independent				
SIZE	0.641869	0.479659	0	1
GPA	3.010493	0.455163	1.95	4
PREGRADE	2.754542	0.6848949	0	4
2102GRADE	2.955882	0.7844539	0	4
MATHGRADE	2.68743	0.84530	0	4
PAUSE	1.616782	1.210071	0	8
GENDER	0.42301	0.49425	0	1
AGE	21.48270	2.874376	18	48

AGE: This demographic variable measures the student's age at the time of the managerial economics course. AGE is included in the regression because some studies have found that age of the student is a significant predictor of student success in economics. For example, Siegfried and Walstad (1990), Tay (1994) and Marcal et al. (2007) found age of student has positive effect on student performance in economics courses. Therefore, this study hypothesized that AGE has a positive effect on 3125GRADE. The mean and standard deviation for AGE are 21.28 and 2.87 respectively.

REGRESSION RESULTS

Due to the categorical nature in the traditional letter grade system, this research uses ordered logistic estimation to examine the class size effect of the introductory microeconomics course on student performance in managerial economics.² The first regression results are reported in Table 3. With the exception of AGE, all the variables have the expected signs and are statistically significant at either the 5% significance level (SIZE, PREGRADE and PAUSE) or the 1% significance level (GPA). The coefficient of SIZE is negative and significant. This indicates that students in a large-sized introductory microeconomics class have a greater probability of scoring a lower managerial grade than students in a small-sized class. A logistic calculation can transform the SIZE coefficient (-.3409024) into the probability of making a certain letter grade in managerial economics.

Table 3
Regression Results
3125GRADE = f(GPA, SIZE, PREGRADE, PAUSE, GENDER, AGE)

	Coefficient.	t ratio
Size	-.3409024	-3.03***
GPA	2.204805	14.29***
Pregrade	.1909007	2.06**
Pause	-.1178678	-2.46***
Gender	-.3630465	-3.18***
Age	-.0032063	-0.16
Number of Observations	1156	
Log Likelihood	-1367.9307	
Chi squared	329.81***	
*** indicates significant at 1% significance level, ** at 5% significance level		

Table 4 reports the results by setting all other independent variables at their mean values. There is a 22% chance for students from small-sized principles of microeconomics classes to make an A and a 17 percent chance for students from large-sized classes. Students from large-sized introductory classes are 5% less likely to make an A compared with students from small-sized classes and approximately 3% less likely to make a B. The chance of making a C increases by about 6% when moving from a small class to a large class. There is a very minor increase in the probability of making a D or F when moving from a small introductory class to a large class.

Table 4
Probability of Principles of Economics Class Size Effect on 3125GRADE

	P(A)	P(B)	P(C)	P(D)	P(F)
Small class	0.2207	0.4334	0.2995	0.0334	0.0130
Large class	0.1676	0.4058	0.3625	0.0459	0.0182

To further investigate the class size effect, a second regression is done by using actual class size instead of a class dummy among the independent variables. The mean and standard deviation for the actual introductory class size are 68.41 and 31.14, respectively and the minimum and maximum are 17 and 123, respectively. The regression results are reported in Table 5. Other than the coefficient values, all variables have the same signs and significances as

in Table 3. In particular, an increase in micro principles class size is likely to lower students' managerial grade.

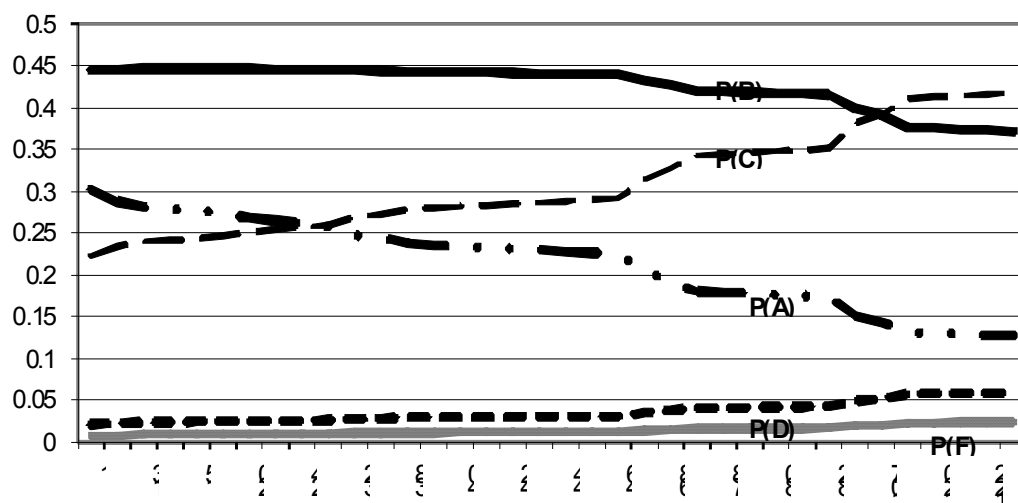
Table 5
Regression Results
3125GRADE = f(GPA, SIZE, PREGRADE, PAUSE, GENDER, AGE)

	Coefficient.	t ratio
Size(ACTUAL)	-.0089423	-4.97***
GPA	2.223482	14.36***
Pregrade	.1916868	2.07**
Pause	-.1436423	-2.97***
Gender	-.37090933630465	-3.24***
Age	-.0030177	-0.15
Number of Observations	1156	
Log Likelihood	-1360.0853	
Chi squared	345.50***	
*** indicates significant at 1% significance level, ** at 5% significance level		

By setting all other independent variables at their mean values, a logistic calculation can transform the SIZE coefficient (-.0089423) into the probability of making a certain managerial grade associated with a certain introductory class size. Figure 1 illustrates the results. The probability of earning an A or a B in managerial economics gradually decreases and the probability of making a C gradually increases as the introductory class size increases up to 46. We then see a larger change in the probabilities when the introductory class size goes beyond 46 students and an even larger change in the probabilities when the class size reaches 82 students. The increase in the introductory class size has minor impact on D and F students.

The coefficient of GPA is positive, large and highly significant. Thus, students with a higher GPA are more likely to receive higher grades in the managerial economics course. A higher average grade for all the prerequisites for managerial economics (PREGRADE) also helps students to get a higher grade in the course. The results also indicate the longer the pause between the completion of the introductory course and the beginning of the managerial course, the less likely a student will score a higher grade in the managerial course. Finally, the results show female students are likely to earn lower grades in the managerial class than male students. Among all the independent variables, PAUSE has the weakest impact on 3125GRADE.

Figure 1
Probability of Principles of Microeconomics Class Size Effect on 3125Grade



One of the significant challenges facing instructors of managerial economics is the weak mathematical and statistical skills among the students. The managerial course covers the use of marginal analysis and regression analysis in business decision makings. Students are expected to have equipped with basic algebra, calculus and statistics when they walk into the managerial classes. To investigate the impact of students' mathematical skill on their performance in the managerial class, PREGRADE is broken into the micro principles grade (2102GRADE) and the math prerequisite average grade (MATHGRADE) in the third regression. The math prerequisite average grade is the average grade students earn from calculus, statistics and business computing. Both prerequisites are expected to have positive effects on 3125GRADE. The mean and standard deviation for 2102GRADE are 2.96 and 0.78, respectively, and for MATHGRADE are 2.69 and 0.85, respectively.

The regression results are reported in Table 6. Similar to the results in Table 3, AGE has neither the expected sign nor is significant. The variables - SIZE, GPA, 2102GRADE, PAUSE and GENDER have expected signs and are significant. Students' 2102GRADE has a significant impact on their managerial grades. However, MATHGRADE has the expected positive sign but is not statistically significant. One possible explanation is the differences in teaching methodologies across managerial economics instructors. Some managerial instructors might choose not to use a mathematically oriented approach and some might choose to skip the chapter on regression. If MATHGRADE does not have a significant effect, then what causes the female students to earn lower grades in the managerial class than the male students? Is it because of male students' inherently superior grasp of managerial economic concepts or because of other reasons? Ballard and Johnson (2004) pointed out that female students would learn better from a female professor. For future research, this study could investigate this possibility by professor's

gender among the independent variables. It will allow us to analyze the influence of matching gender for student and professor.

Table 6 Regression Results 3125GRADE = f(GPA, SIZE, 2102GRADE, MATHGRADE, PAUSE, GENDER, AGE)		
	Coefficient	t ratio
Size	-.2692308	-2.37**
GPA	1.96199	12.05***
2102 grade	.3967985	4.56***
Mathgrade	.081388	0.85
Pause	-.0930099	-1.92*
Gender	-.2884344	-2.50**
Age	-.0189688	-0.94
Number of Observations	1156	
Log Likelihood	-1357.4973	
Chi squared	350.68***	
*** indicates significance at 1% significance level, ** at 5% significance level, * at 10% significance level		

CONCLUSION

This paper examines whether the Principles of Microeconomics class size has affected students' performance in Managerial Economics at the Belk College of Business, University of North Carolina at Charlotte. While class size is the independent variable of most interest to this study, other independent variables - the student's grade point average, Principles of Microeconomics course grade, average grade of other prerequisite courses for the managerial course, the number of semesters pause between the completion of the introductory course and the beginning of the managerial course, gender and age are also considered. The sample consists of observations of 1156 students who have completed both the introductory microeconomics course and the managerial course between Fall 2004 and Spring 2009. The logistic regression results suggest that for UNC-Charlotte, at least, the class size effect is negative and highly significant. Students in large-sized introductory economics classes are likely to earn lower grades in the managerial economics course than students in small-sized classes. This finding suggests that in order to improve students' performance in the large managerial classes, mandatory discussion sections for the large lectures might be useful. Students' GPA prior to enrolling in the managerial class has a significant and positive effect on the students' managerial grade. Students' average

grade for all prerequisites also has a positive effect on the managerial grade. However, although the effect of the average grade on all the mathematical requirements is positive, surprisingly it is not significant. The longer the period between students' completion of the introductory course and the beginning of the managerial course, the lower is the managerial grade. Further, female students are likely to earn lower grades in the managerial economics course than male students and students' age at the beginning of the managerial class has a negative effect, but the effect is not significant.

Finally, caution should be used in interpreting the negative introductory class size effect found in this study which might be underestimated due to the potential grade inflation problem resulting from the traditional letter grading system. For future studies, a better measure of student performance in the managerial economics course is necessary.

NOTES

- 1 The eight studies are – Raimondo et al. (1990), Kopeika (1992), Hofmann et al. (1994), Hou (1994), Gibbs et al. (1996), Hancock (1996), Kennedy and Siegfried (1997), Borden and Burton (1999), and Noble (2000).
- 2 Refer to J. Scott Long (1997) for this estimation method.

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