Order Number 9035630

A comparison of the performance of developmental and nondevelopmental studies students in principles of economics

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Middle Tennessee State University, 1990

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A COMPARISON OF THE PERFORMANCE OF DEVELOPMENTAL AND NONDEVELOPMENTAL STUDIES STUDENTS IN PRINCIPLES OF ECONOMICS

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A Dissertation presented to the
Graduate Faculty at Middle Tennessee State University
in partial fulfillment of the requirements
for the degree Doctor of Arts

August 1990

A COMPARISON OF THE PERFORMANCE OF DEVELOPMENTAL AND NONDEVELOPMENTAL STUDIES STUDENTS IN PRINCIPLES OF ECONOMICS

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Abstract

A COMPARISON OF THE PERFORMANCE OF DEVELOPMENTAL AND NONDEVELOPMENTAL STUDIES STUDENTS IN PRINCIPLES OF ECONOMICS

By Kenneth Wayne Smith

The primary purpose of this study is to compare the performance of Developmental and Nondevelopmental Studies students in Principles of Economics. The study seeks answers to three major questions:

1. Is there a significant difference in performance between Developmental and Nondevelopmental Studies students as measured by final course grade?

2. Is there a significant difference in performance between Developmental and Nondevelopmental Studies students as measured by the successful completion of Principles of Economics?

3. Do demographic and academic variables influence the probability of successfully completing Principles of Economics?

The study analyzes a population of 2,115 students who took Principles of Economics (1,205 Macroeconomics and 910 Microeconomics) at Middle Tennessee State University during the Spring, Summer, and Fall Semesters of 1989. The Z statistic is used to test for a difference in performance as

measured by final course grade. The Chi-square statistic is used to test for a difference as measured by the successful completion of Principles of Economics. Logistic regression is employed to estimate the probability of successfully completing Principles of Economics.

The study reaches the following conclusions. First, there is a significant difference in performance between Developmental and Nondevelopmental Studies students in Principles of Economics as measured by final course grade. Second, a significant difference in performance exists between Developmental and Nondevelopmental Studies students as measured by the successful completion of Principles of Economics. Third, the results of the logistic model show that age, ACT score, high school GPA, and Developmental Study Skills are the major indicators of the probability of successfully completing Principles of Economics.

ACKNOWLEDGMENTS

The author wishes to express sincere appreciation to Dr. Bichaka Fayissa, Committee Chairman, for his unwavering patience and invaluable assistance during the preparation of this dissertation. Special thanks are also expressed to Dr. Duane Graddy and Dr. Charles Babb, Committee Members, for their support throughout the study.

Best regards are extended to Mrs. Lucinda Lea and Lisa Rogers in the Computer Services Department for their assistance in gathering the data for the study.

Most importantly, the author expresses special appreciation to his wife (Santos) and son (Anthony) for their understanding, patience, and encouragement throughout the course of the doctoral program.

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CHAPTER I

INTRODUCTION

Developmental Studies Programs have grown rapidly at colleges and universities since the sixties when open enrollment and equal access became a social priority. In 1985, the Tennessee Board of Regents mandated that all twenty-six of its institutions of higher education implement a Developmental Studies Program.[1] Nevertheless, some legislators (and educators) claim that Developmental Studies Programs are too expensive relative to the benefits they provide.[2] Empirical studies have attempted to resolve the issue by assessing the contribution of Developmental Studies to the students' overall grade point averages and progress in Mathematics and English.[3] However, research concerning the impact of Developmental Studies in other disciplines is extremely limited.

Problem Statement

This dissertation provides a new perspective on the role of a Developmental Studies Program by analyzing its

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[1]Minutes, State Board of Regents, (June 1985): 5.

[2]S. Chand, "The Impact of Developmental Education at Triton College," Journal of Developmental Education 9, no. 1 (1985): 2-5.

[3]Ibid.

contribution to the student's success in Principles of Economics. Student success is measured by comparing the final grades of Developmental Studies students relative to students not required to take Developmental Studies. This study also investigates the probability of a successful completion of Principles of Economics (receiving a grade of C or better) using a simple contingency table and a logit model.

Hypotheses

Hypothesis 1: No significant difference exists in the performance of Developmental and Nondevelopmental Studies students in Principles of Economics as measured by final course grade.

Hypothesis 2: No significant difference exists in the performance of Developmental and Nondevelopmental Studies students in Principles of Economics as measured by the successful completion of Principles of Economics.

Hypothesis 3: Demographic and academic factors do not influence the probability of a student receiving a grade of C or better in Principles of Economics.

Background and Significance of the Study

The content of Principles of Economics courses has undergone tremendous changes with the advancement of new theories and approaches. The trend has been to move away from teaching primarily economic thought and economic

history toward teaching specific microeconomic and macroeconomic principles and their applications to business decisions and policy. Consequently, Principles of Economics textbooks have incorporated substantial geometry and other quantitative tools.[4]

With the trend toward open enrollment in colleges and universities, there has been a rapid increase in the enrollment of students who are not adequately prepared in basic skills.[5] It is apparent to many instructors of Principles of Economics that a substantial number of students are deficient in basic academic skills. These deficiencies make it difficult for them to follow the logic of economic reasoning, theories, basic equations, and diagrams. The question at hand is whether the Developmental Studies Program improves basic skills enough to enable them to compete on the same level as Nondevelopmental Studies students in Principles of Economics.

Unfortunately, there is very limited research dealing specifically with the relationship between Developmental Studies and achievement in Principles of Economics. Studies by Dawson (1976) and Gery (1972) dealt with Mathematics and

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[4]C. R. McConnell, "Some Reflections of the Introductory College-Level Course in Economics," In Larsen, A. F. and Nappi, A.(eds.), Goals and Objectives of the College-Level Course in Economics, (Minneapolis: Federal Reserve Bank, 1979), 67.

[5]S. G. Buckles and A. L. Welsh, "The Use of Validated Tests in Teaching and Research," Research Papers in Economic Education, 1972, 31.

achievement in Principles of Economics.[6] Their results, however, have been mixed.[7] A need exists for an analysis of other factors determining student success since most studies have dealt exclusively with the relationship between math aptitude and achievement in Principles of Economics. In general, reading comprehension is expected to play an important role in understanding economic thought and theory. Writing skills could also play a role. This study attempts to provide further evidence on the connection between student success in Principles of Economics and the Developmental Studies experience using data from Middle Tennessee State University. The general intent of the study is to examine the effects, if any, of Developmental Studies on successful achievement in Principles of Economics.

Definition of Terms

Economics 241--basic principles to aid the understanding of modern economic society; basic economic concepts; national income and its fluctuations; fiscal and monetary policies; international trade and finance.[8]

Economics 242--basic Principles to aid the understanding of modern economic society; basic economic

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[6]G. G. Dawson, "Special Report: An Overview of the Introductory College-Level Course in Economics," The Journal of Economic Education 7, no. 2 (Spring 1976): 114.

[7]F. W. Gery, "Does Mathematics Matter?" Research Papers in Economic Education, 1972, 143.

[8]MTSU Catalog, 1989-91 edition, 120.

concepts; the pricing of productive factors; contemporary economic problems and policies, consumer and firm behavior, market structure, and alternative systems.[9]

ACT--American College Test, prepared by the American College Testing Service.

RSE 070--Basic Writing. Intensive practice in paragraph and sentence construction and an intensive review of the basics of spelling, grammar, and punctuation.[10]

RSM 070--Basic Mathematics. Intensive study of all arithmetic operations with decimals and fractions, percent and equivalency, units of measure, word problems, geometry, graphs, elementary probability, and statistics.[11]

RSR 070--Basic Reading. Intensive practice in reading comprehension to improve basic reading skills through classroom instruction and self-paced activities.[12]

RSS 070--Basic Study Skills. Intensive study and practice in spelling, vocabulary improvement, note-taking, test-taking, library usage, and study techniques.[13]

DSE 080--Developmental Writing. Intensive practice in writing brief essays which places emphasis on strategies for prewriting, writing, and rewriting.[14]

DSM 080--Elementary Algebra. Intensive study of numbers and sets, algebraic expressions, solutions of linear equations, and rational expressions.[15]

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[9]Ibid. [10]Ibid., 63. [11]Ibid. [12]Ibid.
[13]Ibid. [14]Ibid. [15]Ibid.

DSR 080--Developmental Reading. Intensive practice in methods of understanding and retaining textbook material, in developing an efficient rate of reading, and in learning techniques for improving vocabulary and comprehension.[16]

DSS 080--Developmental Study Skills. Intensive study and practice of effective note and test-taking, study techniques, the use of library resources, and critical thinking.[17]

DSM 080--Intermediate Algebra. Intensive study of algebraic functions, first-degree equations, inequalities, exponents, roots and radicals, second-degree equations, inequalities, functions, relations, and graphs.[18]

AAPP--Academic Assessment Placement Program, which is the assessment examination for students who have a composite score of fifteen or below on the ACT (eighteen on the enhanced ACT), fifteen or below on the English or Math portions of the ACT, or who are twenty-one years of age or older at the time of their admission.[19]

Successful Completion of Principles of Economics--means receiving a grade of C or better.

Limitations of the Study

This study has the following limitations.

1. The study is limited to a particular university (Middle Tennessee State University) during a

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[16]Ibid. [17]Ibid. [18]Ibid. [19]Ibid.

short time period (Spring, Summer, Fall, 1989).

2. Although the text materials covered and emphasized may vary somewhat from instructor to instructor, it is assumed that these differences are not systematically related to the measure of performance.
3. Certain other variables that could affect the learning process, such as class standing and class size, are assumed not to be systematically related to the measure of performance used in this study.

Organization of the Study

Chapter II reviews the relevant literature on Developmental Studies Programs and their effectiveness on student achievement in college level courses. Chapter III describes the data collection process, experimental design, and the measurement instruments used. It also describes the statistical techniques used in evaluating and analyzing the data. Chapter IV interprets the findings of the study. Chapter V presents the summary, conclusions, and policy implications of the study.

CHAPTER II

LITERATURE REVIEW

This chapter reviews literature concerning the relationship between attendance in Developmental Studies Programs and subsequent academic performance. It also reviews the literature pertaining to the philosophical argument over funding Developmental Studies Programs. Currently, there are no studies on the relationship between performance in Principles of Economics and attendance in Developmental Studies. Most analyses of the relationship between academic ability and performance in Principles of Economics do not specifically deal with students who have been involved in Developmental Studies Programs. Instead, the literature relates student characteristics, such as age, race ACT scores, and socioeconomic factors to performance in Economics. There are other studies, however, that assess the overall academic performance of students who have been through a Developmental Studies Program.[1]

In a case study involving students from Villanova University, Rubin (1977) found that verbal aptitude and hours of study were significantly related to students' grade

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[1]S. Chand, "The Impact of Developmental Education at Triton College," Journal of Developmental Education 9, no. 2 (1985): 2-5.

point averages during their first three semesters in college. However, the link between the socioeconomic variables and scholastic success in college was not found to be as clear cut.[2]

Other studies investigated the relationships between personal characteristics and socioeconomic backgrounds of students and their achievement in Economics. Jackstadt and Gootaert (1980) reported that the relevant personal and background variables that affect a student's level of economic understanding include grade level, GPA, intelligence, occupation of the parents, holding a part-time job, and frequent reading of the newspaper.[3] Heath (1989) also showed that gender is a significant variable in determining achievement in Economics. She reported that the differences between male and female students may even be greater than previously thought.[4]

In a study dealing with mathematical aptitude and performance in Principles of Economics, Gery (1972) surveyed students at St. Olaf College. He reported that only a

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[2]L. S. Rubin, "Socioeconomic and Academic Factors Influencing College Achievement of Economics and Business Majors," Journal of Economic Education 8, no. 2 (1977): 124-125.

[3]S. Jackstadt and C. Gootaert, "Gender, Gender Stereotyping, and Socioeconomic Background as Determinants of Economic Knowledge and Learning," Journal of Economic Education 12, no. 80 (Winter 1980): 34-40.

[4]J. Heath, "An Econometric Model of Gender in Economic Education," American Economic Review Proceedings 79, no. 2 (1989): 226-30.

marginal relationship existed between mathematical aptitude and performance in Principles of Economics.[5]

In a 1985 study designed to evaluate the effectiveness of the Developmental Studies Program at Triton College in Illinois, it was shown that a high degree of correlation existed between grades earned in developmental courses and subsequent total grade point averages earned by those students.[6] Mickler and Chapel (1989) supported these findings.[7] Their study showed that at a small state university serving a rural area, remediation resulted in significant increases in the success rates of those students subsequently enrolled in regular collegiate level courses.

Other studies also indicate that retention rates are increased as a result of remediation. Morante (1985) reported that after four semesters, 75 percent of the students completing remediation remained enrolled in state colleges while 39 percent of the students not completing remediation remained enrolled. He also reported that the survival rate of remedial students jumped from 29 percent to 58 percent in state colleges and from 12 percent to 37

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[5]F. W. Gery, "Does Mathematics Matter?" Research Papers in Economic Education, 1972, 143.

[6]S. Chand, "The Impact of Developmental Education at Triton College," Journal Of Developmental Education 9, no. 2 (1985): 2-5.

[7]M. L. Mickler and A. C. Chapel, "Basic Skills in College: Academic Dilution or Solution?" Journal of Developmental Education 8, no. 1 (1989): 2-5.

percent in community colleges.[8]

Michello and Bader (1989) conducted a study at Middle Tennessee State University to assess the success rate of Developmental Studies Math students in the first college level algebra course compared to Nondevelopmental Studies students. Their study showed that students who took developmental math perform just as well or better than students who did not take developmental math.[9]

From a philosophical viewpoint, many people argue that students should be prepared for collegiate level work when they enter college. Legislators seem to hold the same belief as Senator Richard A. Thompson (R) of the Indiana Senate that "remedial programs in colleges should be eliminated because they are more expensive than they would be at high schools, where more students live at home and staff salaries are lower."[10] Representative Jim Scherer (R), Chairman of the Education Committee of the Colorado House of Representatives proposed that, "we should spend our time and money educating those with the ability to learn.[11]

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[8]E. A. Morante, "The Effectiveness of Developmental Programs: A Two-Year Follow-Up Study," Journal of Developmental Education 9, no. 3 (1985): 14-45.

[9]F. Michello and C. Bader, "An Evaluative Study of the Developmental Math Program at Middle Tennessee State University," 1-11.

[10]S. Jaschik, "State Questioning Role of Colleges in Remedial Study," The Chronicle of Higher Education, 11 September 1985, 20.

[11]Ibid.

However, others argue that students should not be penalized for a lifetime simply because they did not acquire the basic skills while they were in high school.[12]

This chapter has considered the role of academic abilities, personal characteristics, and socioeconomic backgrounds of students on their basic skills performance based on the current literature. The following chapter explores both the theoretical and empirical methodologies in order to test for the existence of significant differences in performance between Developmental and Nondevelopmental Studies students. It also tests the determinants (indicators) of the probability of success in Principles of Economics.

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[12]M. L. Mickler and A. C. Chapel, "Basic Skills in College: Academic Dilution or Solution?" Journal of Developmental Education 8, no. 1 (1989): 4.

CHAPTER III

RESEARCH METHODOLOGY

Data Collection Procedures

This study investigates the performance of students who took Principles of Economics (Macroeconomics and Microeconomics) at Middle Tennessee State University during the Spring, Summer, and Fall Semesters of 1989. Students were identified as Developmental or Nondevelopmental Studies students, depending upon whether they were placed in the Developmental Studies Program at the time of their admission.

Students who have a composite score of fifteen or below on the ACT, or on the Math or English portions, are required to take the Academic Assessment Placement Program (AAPP) examination. Students who are twenty-one years of age or older at the time of their admission are also required to take the AAPP examination. Depending upon the results of this examination, students may be placed in the Developmental Studies Program or in regular college level courses. Students placed in Developmental Studies may be required to take either basic or developmental classes. According to the Developmental Studies Department, about 50 percent of the entering freshmen are placed in the Developmental Studies Program at Middle Tennessee State

University.[1]

This study encompasses all students enrolled in Economics 241 and/or Economics 242 during the Spring, Summer, and Fall Semesters of 1989. Data on age, race, sex, ACT score, high school GPA, grade in Economics 241 and 242, and Developmental Studies courses taken and grades were obtained for 2,115 students. The initial data were obtained from the Academic Computing Office at Middle Tennessee State University. Subsequent data were collected using the Student Information Service Query System.

Research Variables

The primary research variables used to measure performance in Principles of Economics were (1) final course grade and (2) successful completion of the course. The letter grade of A, B, C, D, and F were converted to a numerical scale of A = 4, B = 3, C = 2, D = 1, and F = 0. Successful completion of a course (final course grade of C or better) was chosen for this study because it determines whether or not a student is required to repeat the course. Students who withdrew or receive and incomplete are categorized as not having successfully completed Principles of Economics for the purpose of this study.

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[1]Carol Bader, "More Than Half Freshmen Unprepared for College," Daily News Journal, 14 December 1989, 16.

Methods of Tests of Hypotheses

To test the Null Hypothesis (1) that there is no difference in performance in Principles of Economics as measured by final course grade between Developmental and Nondevelopmental Studies students, a test for difference between means was conducted. The Z statistic was computed for this purpose. The formula for the test statistic is:

$$(3.1) \qquad Z = \{[(\bar{X}_1 - \bar{X}_2)] \div [(s_1/n_1 + s_2/n_2)]\}$$

where: $\bar{X}_1$ = mean grade for Nondevelopmental Studies students;

$\bar{X}_2$ = mean grade for Developmental Studies students;

s_1 = standard deviation of Nondevelopmental Studies students;

s_2 = standard deviation of Developmental Studies students.[2]

To test the Null Hypothesis (2) that there is no significant difference in the successful completion of Principles of Economics between Developmental and Nondevelopmental Studies students, the Chi-square test for independence was used. The Chi-square test statistic (X^2) took the following form.

$$(3.2) \qquad X^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} \frac{(f_{o,ij} - f_{t,ij})}{f_{t,ij}}$$

where: f_o = the observed frequencies;

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[2] J. E. Freund and F. J. Williams, Elementary Business Statistics: The Modern Approach (New Jersey: Prentice Hall, Inc., 1982), 333.

f_t = the theoretical frequencies.[3]

To test the Null Hypothesis (3) that demographic and academic variables do not influence the probability of a student receiving a grade of C or better in Principles of Economics, a logistic regression (logit) model was fit to the data. The logit model is specified as follows:

(3.3) $$L_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + u_i$$

where: L_i = a dichotomous dependent variable which takes on a value of 1 for a course grade of C or better, 0 otherwise;

X_{1i} = age;

X_{2i} = a dummy variable; X_{2i} = 1 if male, 0 if not;

X_{3i} = a dummy variable; X_{3i} = 1 if white, 0 if not;

X_{4i} = ACT composite score;

X_{5i} = High School GPA;

X_{6i} = a dummy variable; X_{6i} = 1 if Developmental English taken, 0 if not;

X_{7i} = a dummy variable; X_{7i} = 1 if Developmental Study Skills taken, 0 if not;

X_{8i} = a dummy variable; X_{8i} = 1 if Developmental Math taken, 0 if not;

β_i = parameters to be estimated, reflect the impact of X on L, holding all other variables

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[3]R. Mills, Statistics for Applied Economics and Business (New York: McGraw-Hill Book Company, 1977), 304.

constant;

u_i = an error resulting from the omission of variables, or some other random perturbation inherent in the study--u_i is assumed to be normally distributed, with a mean or zero, constant variance, and is uncorrelated with the explanatory variables.[4]

This chapter has set forth the theoretical models to be employed to test the research hypotheses. Empirical validation of the theoretical models and their interpretations will be presented in the next chapter.

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[4]D. N. Gujarti, Basic Econometrics (New York: McGraw-Hill Book Company, 1988), 483.

CHAPTER IV

STATISTICAL FINDINGS AND INTERPRETATIONS

Initially, descriptive statistics were computed to describe the indicators of performance using the Principles of Economics database. The Shazam statistical software package was utilized to analyze the data.

The test for difference between means grades (Hypothesis 1) was conducted using the Z statistic. The first test for difference between mean grades dealt with Economics 241 in the three semester sequence. Table 1 reports the critical Z values and the computed Z value necessary for making a decision whether to accept or reject the Null Hypothesis. The Null Hypothesis was rejected at the .01 level of significance. The evidence suggests that there is a significant difference in performance between Developmental and Nondevelopmental Studies students in Principles of Economics as measured by final course grade. That is, the evidence suggests that Nondevelopmental Studies students perform better in Principles of Economics than do Developmental Studies students.

TABLE 1

DIFFERENCE IN MEAN COURSE GRADES Principles of Macroeconomics (241)

	Nondevelopmental	Developmental
N	729	369
$\bar{X}$	2.246914	1.761518
S^2	1.321750	1.113859
S	1.496674	1.055395
Critical Z value: $\alpha_{.01}$ = 2.575		
Computed Z value = 6.983110		
Significant at $\alpha_{.01}$		

Repeated tests for each semester under study individually, yielded similar results as reported in Tables 2, 3, and 4.

TABLE 2

DIFFERENCE IN MEAN COURSE GRADES
Principles of Macroeconomics (241)
Spring Semester, 1989

	Nondevelopmental	Developmental
N	289	172
$\bar{X}$	2.103806	1.616279
S^2	1.477115	1.236479
S	1.215366	1.111971
Critical Z value: $\alpha_{.01}$ = 2.575		
Computed Z value = 4.3958934		
Significant at $\alpha_{.01}$		

TABLE 3

DIFFERENCE IN MEAN COURSE GRADES
Principles of Macroeconomics (241)
Summer Semester, 1989

	Nondevelopmental	Developmental
N	46	15
$\bar{X}$	2.586957	1.533333
S^2	0.9948466	0.915556
S	0.990742	0.956847
Critical Z value: $\alpha_{.01}$ = 2.575		
Computed Z value = 3.6646045		
Significant at $\alpha_{.01}$		

TABLE 4

DIFFERENCE IN MEAN COURSE GRADES
Principles of Macroeconomics (241)
Fall Semester, 1989

	Nondevelopmental	Developmental
N	394	182
$\bar{X}$	2.312183	1.917582
S^2	1.2147236	0.965735
S	1.102145	0.982718
Critical Z value: $\alpha_{.01}$ = 2.575		
Computed Z value = 4.3082004		
Significant at $\alpha_{.01}$		

Similar tests were also conducted for Economics 242. The Null Hypotheses were again rejected at the .01 level of

significance. Tables 5, 6, 7, and 8 contain the pertinent Z statistic information for Economics 242.

TABLE 5

DIFFERENCE IN MEAN COURSE GRADES
Principles of Microeconomics (242)

	Nondevelopmental	Developmental
N	554	281
$\bar{X}$	2.214802	1.617857
S^2	1.352778	1.071823
S	1.16309	1.305289
Critical Z value: $\alpha_{.01}$ = 2.575		
Computed Z value = 7.546999		
Significant at $\alpha_{.01}$		

TABLE 6

DIFFERENCE IN MEAN COURSE GRADES
Principles of Microeconomics (242)
Spring Semester, 1989

	Nondevelopmental	Developmental
N	287	135
$\bar{X}$	2.121951	1.525926
S^2	1.535651	1.108588
S	1.239214	1.052895
Critical Z value: $\alpha_{.01}$ = 2.575		
Computed Z value = 5.1179439		
Significant at $\alpha_{.01}$		

TABLE 7

DIFFERENCE IN MEAN COURSE GRADES
Principles of Microeconomics (242)
Summer Semester, 198[illegible]

	Nondevelopmental	Developmental
N	22	12
$\bar{X}$	2.727273	1.909091
S^2	0.834711	0.446281
S	0.913625	0.668043
Critical Z value: $\alpha_{.01}$ = 2.575		
Computed Z value = 2.9849643		
Critical at $\alpha_{.01}$		

TABLE 8

DIFFERENCE IN MEAN COURSE GRADES
Principles of Microeconomics (242)
Fall Semester, 1989

	Nondevelopmental	Developmental
N	245	134
$\bar{X}$	2.277551	1.686567
S^2	1.147454	1.065939
S	1.071193	1.032443
Critical Z value: $\alpha_{.01}$ = 2.575		
Computed Z value = 5.256934		
Significant at $\alpha_{.01}$		

The tests conducted thus far clearly indicate that a significant difference in performance exists between

Developmental and Nondevelopmental Studies students in Principles of Economics as measured by final course grade.

The test for the difference in performance as measured by the successful completion of Principles of Economics (Hypothesis 2) was conducted using the Chi-square statistic. The first test for the difference in the successful completion of Principles of Economics dealt with Economics 241 for the three semester sequence starting from Spring, 1989. Table 9 reports the computed Chi-square grid. The Null Hypothesis was rejected at the .01 level of significance. The evidence suggests that Nondevelopmental Studies students perform better than Developmental Studies students as measured by their successful completion rates in Principles of Economics. Repeated tests for each semester under study resulted in the rejection of the Null Hypotheses at the .01 level of significance. As in the previous case, a significant t difference in performance exists between Developmental and Nondevelopmental Studies students as measured by the successful completion of Economics 241.

However, in the Summer Semester, the Chi-square approximation is not significant. In the no grade cut-off case, one cell contains a value of less than one. With a grade cut-off of C, the Chi-square statistic is not significant at the conventional level of significance ($\alpha_{.05}$). The small sample size for the Summer Semester data may have resulted in the insignificance of the difference

between the Developmental and Nondevelopmental Studies students with respect to the successful completion of Principles of Economics. Tables 10, 11, and 12 contain the Chi-square grids for each semester.

TABLE 9

CHI-SQUARE TABLE FOR ECONOMICS 241
Principles of Macroeconomics

No Grade Cut-Off						
Grade	A	B	C	D	F	NG
N.D.S.	109	192	275	80	75	67
Expected	82.12	170.86	291.39	94.04	90.06	69.54
D.S.	15	66	165	62	61	38
Expected	41.88	87.14	148.61	47.96	45.94	35.46
Total	124	258	440	142	136	105

Critical Chi-square value: $\alpha_{.01} = 4.032$

Computed Chi-square value = 50.467 df = 5

Significant at $\alpha_{.01}$

Grade Cut-Off of C			
Grade	A	B	C
N.D.S.	109	192	275
Expected	81.63	104.02	288.35
D.S.	15	66	165
Expected	42.37	53.98	149.65
Total	124	258	440

Critical Chi-square value: $\alpha_{.01} = 9.925$

Computed Chi-square value = 33.307 df = 2

Significant at $\alpha_{.01}$

TABLE 10

CHI-SQUARE TABLE FOR ECONOMICS 241
Principles of Macroeconomics
Spring Semester, 1989

No Grade Cut-Off

Grade	A	B	C	D	F	NG
N.D.S.	35	80	93	38	42	35
Expected	26.59	65.54	102.02	40.81	50.08	38.95
D.S.	7	26	72	28	39	28
Expected	16.41	40.46	62.98	25.19	30.92	24.05
Total	43	106	165	66	81	63

Critical Chi-square value: $\alpha_{.01} = 4.032$

Computed Chi-square value = 24.153 df = 5

Significant at $\alpha_{.01}$

Grade Cut-Off of C

Grade	A	B	C
N.D.S.	36	80	93
Expected	28.62	70.55	109.82
D.S.	7	26	72
Expected	14.38	35.45	55.18
Total	43	106	165

Critical Chi-square value: $\alpha_{.01} = 9.925$

Computed Chi-square value = 17.179 df = 2

Significant at $\alpha_{.01}$

TABLE 11

CHI-SQUARE TABLE FOR ECONOMICS 241
Principles of Macroeconomics
Summer Semester, 1989

No Grade Cut-Off

Grade	A	B	C	D	F	NG
N.D.S.	10	12	21	1	2	1
Expected	7.46	10.44	20.89	2.98	3.73	1.49
D.S.	0	2	7	3	3	1
Expected	2.54	3.56	4.11	1.02	1.27	0.51

Critical Chi-square value: $\alpha_{.01} = 4.032$

Computed Chi-square value = 13.312

Chi-square approximation is probably invalid. One cell contains an expected count of less than one.

Significant at $\alpha_{.01}$

Grade Cut-Off of C

Grade	A	B	C
N.D.S.	10	12	21
Expected	8.27	11.58	23.15
D.S.	0	2	7
Expected	1.73	2.42	4.85
Total	10	14	28

Critical Chi-square value: $\alpha_{.05} = 4.303$; $\alpha_{.01} = 9.925$

Computed Chi-square value = 3.340 df = 2

Not significant at either level

TABLE 12

CHI-SQUARE TABLE FOR ECONOMICS 241
Principles of Economics
Fall Semester, 1989

No Grade Cut-Off						
Grade	A	B	C	D	F	NG
N.D.S.	63	100	159	41	31	31
Expected	48.99	95.21	169.03	49.68	34.50	27.60
D.S.	8	38	86	31	19	9
Expected	22.01	42.79	75.97	22.32	15.50	12.40
Total	71	138	245	72	50	40

Critical Chi-square value: $\alpha_{.01} = 4.032$

Computed Chi-square value = 23.012 df = 5

Significant at $\alpha_{.01}$

Grade Cut-Off of C			
Grade	A	B	C
N.D.S.	63	100	159
Expected	50.36	97.88	173.77
D.S.	8	38	86
Expected	20.64	40.12	71.23
Total	71	138	245

Critical Chi-square value: $\alpha_{.01} = 9.925$

Computed Chi-square value = 15.392 df = 2

Significant at $\alpha_{.01}$

Similarly, the tests were conducted for Economics 242. As was the case for Economics 241, the Null Hypothesis was rejected at the .01 level of significance, except for the Summer Semester. Once again, the Chi-square

approximation is probably invalid in the case of no grade cut-off because four cells contain a value of less than one. Tables 13, 14, 15, and 16 contain the Chi-square values for Economics 242.

TABLE 13

CHI-SQUARE TABLE FOR ECONOMICS 242
Principles of Microeconomics

No Grade Cut-Off						
Grade	A	B	C	D	F	NG
N.D.S.	80	148	196	71	59	46
Expected	56.70	129.23	201.76	89.67	72.53	50.11
D.S.	6	48	110	65	51	30
Expected	29.30	66.77	104.24	46.33	37.47	25.89
Total	86	196	306	136	110	76

Critical Chi-square value: $\alpha_{.01} = 4.032$

Computed Chi-square value = 56.389 df = 5

Significant at $\alpha_{.01}$

Grade Cut-Off of C			
Grade	A	B	C
N.D.S.	80	148	196
Expected	62.01	141.33	220.65
D.S.	6	48	110
Expected	23.99	54.67	85.35
Total	86	196	306

Critical Chi-square value: $\alpha_{.01} = 9.925$

Computed Chi-square value = 29.707 df = 2

Significant at $\alpha_{.01}$

TABLE 14

CHI-SQUARE TABLE FOR ECONOMICS 242
Principles of Microeconomics
Spring Semester, 1989

No Grade Cut-Off

Grade	A	B	C	D	F	NG
N.D.S.	42	73	91	40	41	24
Expected	30.56	62.47	98.46	46.85	48.21	24.45
D.S.	3	19	54	29	30	12
Expected	14.44	29.53	46.54	22.15	22.79	11.55
Total	45	92	145	69	71	36

Critical Chi-square value: $\alpha_{.01} = 4.032$

Computed Chi-square value = 27.151 df = 5

Significant at $\alpha_{.01}$

Grade Cut-Off of C

Grade	A	B	C
N.D.S.	42	73	91
Expected	32.87	67.21	105.92
D.S.	3	19	54
Expected	12.13	24.79	39.08
Total	45	92	145

Critical Chi-square value: $\alpha_{.01} = 9.925$

Computed Chi-square value = 19.058 df = 2

Significant at $\alpha_{.01}$

TABLE 15

CHI-SQUARE TABLE FOR ECONOMICS 242
Principles of Microeconomics
Summer Semester, 1989

No Grade Cut-Off

Grade	A	B	C	D	F	NG
N.D.S.	4	10	7	0	1	2
Expected	2.74	8.23	8.91	2.06	0.69	1.37
D.S.	0	2	6	3	1	2
Expected	1.26	3.77	4.09	0.94	0.31	0.63
Total	4	12	13	3	1	2

Critical Chi-square value: $\alpha_{.01} = 4.032$

Computed Chi-square value = 12.275 df = 5

Chi-square approximation is probably invalid. Four cells contain a value of less than one.

Significant at $\alpha_{.01}$

Grade Cut-Off of C

Grade	A	B	C
N.D.S.	4	10	7
Expected	2.90	8.69	9.41
D.S.	0	2	6
Expected	1.10	3.31	3.59
Total	4	12	13

Critical Chi-square value: $\alpha_{.05} = 4.303$

Computed Chi-square value = 4.484 df = 2

Significant at $\alpha_{.05}$

TABLE 16

CHI-SQUARE TABLE FOR ECONOMICS 242
Principles of Microeconomics
Fall Semester, 1989

No Grade Cut-Off

Grade	A	B	C	D	F	NG
N.D.S.	34	65	98	31	17	22
Expected	23.58	58.63	94.31	40.78	24.21	25.49
D.S.	3	27	50	33	21	18
Expected	13.42	33.37	53.69	23.22	13.79	14.51
Total	37	92	148	64	38	40

Critical Chi-square value: $\alpha_{.01} = 4.032$

Computed Chi-square value = 28.720 df = 5

Significant at $\alpha_{.01}$

Grade Cut-Off of C

Grade	A	B	C
N.D.S.	34	65	98
Expected	26.31	65.43	105.26
D.S.	3	27	50
Expected	10.69	26.57	42.74
Total	37	92	148

Critical Chi-square value: $\alpha_{.05} = 4.303$

Computed Chi-square value = 9.515 df = 2

Significant at $\alpha_{.05}$

Thus far, the study has shown that Nondevelopmental Studies students perform better than their Developmental counterparts as measured by the difference in mean scores and success rates as measured by a grade of C or better. Up

to this point, however, no attempt has been made to determine what student attributes result in the probability of successfully completing Principles of Economics. The next section attempts to measure the determinants (indicators) of the probability of successfully completing Principles of Economics. A logistic regression (logit) model is used to test Null Hypothesis 3 (that the probability of successfully completing Principles of Economics is determined by age, sex, race, ACT, HSGPA, DSE, DSS, and DSM). A simple contingency table was also formulated to describe the probability of successfully completing Principles of Economics given that a student has taken Developmental Studies courses.

For Economics 241, the contingency table reveals that approximately 72 percent of the Nondevelopmental Studies students successfully completed the course while only approximately 60 percent of the Developmental Studies students successfully completed the course. Similar results were obtained for Economics 242. Approximately 71 percent of the Nondevelopmental Studies students successfully completed Economics 242 while only about 53 percent of the Developmental Studies students successfully completed the course. Tables 17 and 18 provide the conditional probabilities of successfully completing Principles of Economics given that a randomly selected students is a Developmental or Nondevelopmental Studies student.

TABLE 17

PROBABILITY/CONTINGENCY TABLE
Principles of Macroeconomics (241)

	D.S. Students	N.D.S. Students	Total
Successful	246 (60.4%)	576 (72.2%)	822 (68.2%)
Unsuccessful	161 (39.6%)	222 (27.8%)	383 (31.8%)
Total	407 (33.8%)	798 (66.2%)	1205 (100 %)

TABLE 18

PROBABILITY/CONTINGENCY TABLE
Principles of Microeconomics (242)

	D.S. Students	N.D.S. Students	Total
Successful	164 (52.9%)	424 70.7%)	588 (64.6%)
Unsuccessful	146 (47.1%)	176 (29.3%)	322 (35.4%)
Total	310 (34.0%)	600 (60.0%)	910 (100 %)

The following independent variables have been identified for the formulation of the empirical logit model: (1) age, (2) sex, (3) race, (4) ACT score, (5) High School GPA, (6) whether or not Developmental English taken, (7) whether or not Developmental Study Skills taken, and (8) whether or not Developmental Math taken. The dependent variable in this case was whether Principles of Economics was successfully completed. If the course was successfully completed, a value of one was assigned. If the course was not successfully completed, a value of zero was assigned.

The first logistic regression model combined both

Economics 241 and Economics 242 for the three semester sequence beginning with Spring, 1989. The result of the first version of the model, which includes all the independent variables identified, is reported in equation I of Table 19. Equation II represents the logit model consisting of only the statistically significant variables in the first version.

TABLE 19

LOGISTIC REGRESSION
Principles of Economics (241 and 242)

Equation	I	II
Variable	Coefficient(t)	Coefficient(t)
Age	.11(2.1719)*	0.12(2.3322)*
Sex	-0.17(-1.0879)	
Race	0.07(0.32346)	
ACT	0.15(5.1827)**	0.15(6.1215)**
HSGPA	1.15(7.1101)**	1.12(7.4493)**
DSE	-0.29(-0.86068)	
DSS	0.66(2.7618)*	0.71(3.0865)*
DSM	0.29(0.8596)	
Constant	-7.63(-5.5718)**	-7.89(-6.0009)**
Number obs.	1053	1053
Likelihood Ratio Test	146.398	144.524

t values are in parentheses
* Significant at $\alpha_{.05}$
** Significant at $\alpha_{.01}$

Age, ACT, HSGPA, and DSS emerged as significant determinants of the probability of successfully completing Principles of Economics. While the significant relation between the overall academic achievement and a student's

successful performance is easy to see, it is interesting to note that older students seem to grasp Principles of Economics better than their younger counterparts. Perhaps, the reason is that older students are more exposed to the workings of the economy and may also be more patient with economic reasoning than their younger counterparts. This finding is in accordance with a study by Baumol and Highsmith (1988).[1] Developmental Study Skills were also found to have a positive impact on the successful completion of Principles of Economics. Based on the data for this study however, gender, race, DSE, and DSM did not exhibit any measurable influence on the probability the of successful completion of the Principles of Economics courses. Surprisingly, DSM did not emerge as a significant variable in predicting the probability of successfully completing Principles of Economics. The literature review revealed that math aptitude was shown to be positively related to achievement, but only marginally.[2] However, the difference in this instance may be explained by the fact that attendance in DSM exhibits a deficiency in math aptitude on a student's part.

The logistic regression equation for Principles of

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[1]W. Baumol and R. Highsmith, "Variables Affecting Success in Economic Education: Preliminary Findings From a New Data Base," American Economic Review Proceedings 78, no. 2 (1988): 257-62.

[2]F. W. Gery, "Does Mathematics Matter?" Research Papers in Economic Education, 1972, 143.

Macroeconomics (241) are reported in Table 20. Equation I again includes all variables identified, while equation II identifies the model after the statistically insignificant variables were deleted. Unlike the model for the combined Principles of Economics (241 and 242), age did not emerge as a significant determinant of the probability of successfully completing Economics 241. ACT, HSGPA, and DSS were again found to be statistically significant for predicting the probability of successfully completing Economics 241.

TABLE 20

LOGISTIC REGRESSION
Principles of Macroeconomics (241)

Equation	I	II
Variable	Coefficient(t)	Coefficient(t)
Age	0.08(1.1335)	
Sex	0.11(-0.5388)	
Race	0.09(0.31881)	
ACT	0.16(4.2065)**	0.15(4.5025)**
HSGPA	1.21(5.5379)**	1.10(5.6069)**
DSE	0.09(0.20670)	
DSS	0.77(2.3979)*	0.81(2.6709)*
DSM	0.07(0.15239)	
Constant	-7.46(-4.1033)**	-5.35(-6.7925)**
Number obs.	591	591
Likelihood Ratio Test	83.466	81.113

t values are in parentheses

* Significant at $\alpha_{.05}$
** Significant at $\alpha_{.01}$

Similarly, the model was fit to the data for Economics 242. In this instance, age was found to be significant at the .05 level, while ACT and HSGPA were significant at the .01 level. Gender, race, Developmental English, Developmental Study Skills, and Developmental Math were not found to be significant predictors of the probability of a successful completion of Principles of Economics. Table 21 contains the logistic regression equations for Principles of Microeconomics (242). It is again interesting to note that age was found to be a significant. Many students hold jobs in addition to

TABLE 21

LOGISTIC REGRESSION
Principles of Microeconomics (242)

Equation	I	II
Variable	Coefficient(t)	Coefficient(t)
Age	0.17(2.0995)*	0.18(2.2611)*
Sex	-0.25(-1.0656)	
Race	0.08(0.27150)	
ACT	0.13(3.0823)**	0.15(4.0709)**
HSGPA	1.12(4.5528)**	1.09(4.7855)**
DSE	-0.76(-1.4556)	
DSS	0.49(1.3573)	0.56(1.5939)
DSM	0.60(1.1640)	
Constant	-8.34(-3.8701)**	-9.11(-4.4330)**
Number obs.	462	462
Likelihood Ratio Test	67.0284	63.9928

t values are in parentheses

* Significant at $\alpha_{.05}$
** significant at $\alpha_{.01}$

attending school. It may be that for these students, an understanding of and interest in Principles of Microeconomics are enhanced by the practical application of economic theory to the business environment.

In summary, the logit model appears to be a satisfactory predictor of the probability of successfully completing Principles of Economics. The model is a better predictor for the combined Principles of Economics courses (241 and 242) than for Economics 241 or Economics 242 separately due to a larger sample size in the former than in the latter case. The value of the likelihood ratio test is 146.398 for the combined model, but is only 67.0284 in the case of Economics 242. This further indicates that the combined model is superior to the models for the individual courses in predicting the probability of successfully completing Principles of Economics.

For the average student, the logit model predicts that the probability of successfully completing Principles of Economics is 71 percent. The value (L_i) is obtained by computing the mean values for each of the independent variables specified in the logit model and entering these values into the logistic regression equation. This is consistent with the results of Tables 17 and 18 in which the relative frequency of a student successfully completing Principles of Economics is determined to be 68 percent for Economics 241 and 65 percent for Economics 242.

Alternatively, combining the results of Tables 17 and 18, the simple probability of successfully completing Principles of Economics is 67 percent.

In Table 22, a random sample of twenty students was chosen to illustrate how the logit model predicts the probability of a student successfully completing Principles of Economics. Student 8, for example, has a 76 percent chance of successfully completing Principles of Economics. This is based upon the student's age, sex, ACT score, and High School GPA. The coefficients of the logistic regression model reported in Table 19 indicate that age, ACT, and HSGPA contribute .11 percent, .15 percent, and 1.15 percent, respectively to the probability of successfully completing Principles of Economics. Likewise, Student 15 has a 27 percent chance of successfully completing Principles of Economics. The coefficients of the logistic regression model indicate that age, race, ACT, HSGPA, and DSM contribute .11 percent, .07 percent, .15 percent, 1.15 percent, and .29 percent respectively to the probability of successfully completing Principles of Economics.

TABLE 22

LOGISTIC REGRESSION MODEL
Random Sample of Twenty Students

Stud.	L_i	Age	Sex	Race	ACT	HSGPA	DSE	DSS	DSM
1	.79	19	0	0	23	3.16	0	0	0
2	.82	22	0	0	21	2.50	0	0	1
3	.87	20	0	0	19	3.00	0	0	0
4	.05	20	0	0	16	2.10	1	1	1
5	.98	19	0	0	17	3.45	0	0	1
6	.07	19	1	0	14	2.63	1	1	1
7	.74	21	0	0	13	3.00	1	1	1
8	.76	20	1	0	19	3.05	0	0	0
9	.92	18	0	0	19	3.24	0	0	0
10	.28	20	1	0	15	2.58	1	1	1
11	.87	19	0	0	17	3.36	0	0	0
12	.91	21	1	0	15	3.04	1	1	1
13	.31	19	1	0	16	3.15	0	0	0
14	.48	20	1	0	16	3.20	0	0	0
15	.27	21	0	1	17	2.33	0	0	1
16	.87	21	1	1	13	3.20	1	1	1
17	.07	19	0	0	16	2.22	1	1	1
18	.95	19	0	0	20	3.03	0	0	0
19	.67	24	0	0	19	2.47	0	0	0
20	.12	19	0	0	17	2.70	0	0	0

Aside from investigating whether any significant differences in performance exist between Developmental and Nondevelopmental Studies students, this study was designed to determined whether the probability of successfully completing Principles of Economics could be estimated. The logit model incorporated eight independent variables, namely, age, sex, race, ACT score, High School GPA, whether Developmental English taken, whether Developmental Study Skills taken, and whether Developmental Math taken. The next chapter summarizes and draws specific conclusions and implications from the study.

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

This study had two primary purposes. The first was to investigate the differences between Developmental and Nondevelopmental Studies students as measured by final course grade and successful completion rates. Secondly, the study attempted to isolate those factors that appeared important in determining the probability of successfully completing Principles of Economics.

Specifically, this study addressed three major questions:

1. Is there a significant difference in performance in Principles of Economics between Developmental and Nondevelopmental Studies students as measured by final course grade?
2. Is there a significant difference in performance in Principles of Economics between Developmental and Nondevelopmental Studies students as measured by the successful completion of the course?
3. Is the probability of successfully completing Principles of Economics explained by demographic and academic variables?

Data on students who took Principles of Economics at Middle Tennessee State University during the Spring, Summer,

and Fall Semesters of 1989 were used to examine the above mentioned issues. The sample included 1,205 students who took Economics 241 and 910 students who took Economics 242. The RBase and Shazam software packages were utilized to analyze the data.

The findings showed a significant difference in performance exists between Developmental and Nondevelopmental Studies students as measured by final course grade. The results indicated that differences also exist between Developmental and Nondevelopmental Studies students as measured by the successful completion of Principles of Economics. On the average, the logit model predicts that the probability of successfully completing Principles of Economics given that a student has the Developmental Studies experience is 71 percent. The logistic regression model revealed that age, ACT score, high school GPA, and DSS were the four statistically significant variables for predicting the probability of successfully completing Principles of Economics.

Based on the findings, the following conclusions can be drawn: (1) students placed in the Developmental Studies Program may be required to emphasize Developmental Study Skills, (2) further research may be conducted to examine specific study skills which promote improved (successful) achievement in Principles of Economics, (3) the study may be replicated in other college and university settings and

disciplines, since the conclusion of this study may only be applicable to Middle Tennessee State University, and (4) additional variables be considered and incorporated in future studies which attempt to estimate the probability of successfully completing Principles of Economics.

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