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Do Prerequisites Matter?

An Analysis of Agribusiness Financial Management and Agribusiness Marketing Management Courses

David Barber, Richard Weldon, Allen Wysocki
Food and Resource Economics Department
College of Agricultural and Life Sciences
University of Florida
1193 McCarty Hall
Gainesville, FL 32611

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Synopsis

Success in Agribusiness Financial Management (AEB 4141) and Agribusiness Marketing Management (AEB 4342) classes at the University of Florida in respect to course prerequisites was evaluated. In the case where multiple courses satisfy a prerequisite, the individual course impact on success was evaluated. The primary finding was that one introductory finance course (AEB3144) and one introductory marketing course (AEB3300) was statistically important for Agribusiness Financial Management (AEB 4141) and one introductory marketing (MAR3023) and one introductory finance course (AEB3144) was statistically important for Agribusiness Marketing Management (AEB 4342). Results also indicate that students with higher upper division GPAs received higher course grades.

Introduction

Prerequisites are standard in college curricula and establish the preconditions for course enrollment. Prerequisites may include specific courses, academic status, and tests of preparedness. Such prerequisites perform two distinct yet related functions. First, they can be used as a filter that prevents program continuation. Second, they serve as a measure of course preparedness. As a filter, prerequisites may improve course performance by eliminating weak students. As a measure of preparedness, valid prerequisites should increase the likelihood for success. As preparation, prerequisites signal the set of entering skills that are required for successful course completion. With the movement toward increased program assessment, the effect of prerequisites on student outcomes becomes increasingly important.

Numerous studies have analyzed the effects of quantitative prerequisites on course performance. A number of papers have explored the characteristics of successful students to introductory economics courses. For example, Anderson, Benjamin, and Fuss (1994) found that a high school calculus course was significant in predicting performance in basic economics. Cohn, Cohn, Hult, Balch, and Bradley (1998) also found math skills important but questioned math as a prerequisite, arguing that evidence from other courses or SAT performance would suffice. Ely and Hittle (1990) found that performance in business finance was improved by completion of accounting courses and was not influenced by mathematical background.

Some of these papers (Siegfried and Strand; B. Greene; Watts and Lynch) have measured success by student performance on standardized exams, while others have used students' final grades in an introductory course (e.g., Borg and Shapiro; Anderson, Benjamin, and Fuss). Most of the remaining studies investigated how a course or individual characteristics affect student success. For example, Henebry (1997) considered the importance of class schedule and found students were more likely to pass a financial management course if it met more than once a week. Hovath, Beaudin, and Wright (1992) investigated gender differences in course persistence and found that female students were less likely to persist in the introductory economics course sequence.

Building upon these works, Buschena and Watts (2001) evaluated success in intermediate economics classes with respect to course prerequisites. Their primary finding was that prerequisites matter two ways: an individual student lacking the prerequisite receives a

lower grade, *ceteris paribus*, and a student will receive a lower grade in a class in which a high proportion of his or her contemporaries have the prerequisite.

Determining the characteristics of successful agribusiness and agricultural economics students at the senior or “cap-stone” level has received less attention. These senior courses allow evaluation of the benefits to the students of having a prior, often prerequisite, university-level intermediate course. The effect of this prior intermediate course on student performance in senior level courses is important since many agribusiness and agricultural economics departments serve students who have diverse levels of preparedness and have satisfied prerequisites through a mixed variety of courses. This work measured the effect of prerequisites on performance in subsequent senior courses as measured by final grades.

This work models the direct effects of the completion of prerequisite intermediate courses on a student’s performance in a senior level course, and then compares the effect between the courses that satisfy a given prerequisite requirement. This second part is particularly important if students are given a choice between courses to satisfy a prerequisite. The concern arises as to similarity of course material, especially those courses provided by different departments.

Institutional Setting

The University of Florida is a major, public, comprehensive, land grant, research university. The state's oldest, largest and most comprehensive university, Florida is among the nation's most academically diverse public universities. Florida has a long history of established programs in international education, research and service. It is one

of only 17 public, land-grant universities that belong to the Association of American Universities. Enrollment for fall semester 2001 totaled 46,515 students, including 40,499 in-state students representing all Florida counties, with approximately 2,700 international students representing over 100 countries, with the remainder representing all 49 of the other states, the District of Columbia, Puerto Rico, and the Virgin Islands. The ratio of women to men is currently 52:48. Seventy-two percent of enrolled students are undergraduates, 21 percent are graduate students and 7 percent are in professional degree programs (including dentistry, law, medicine, pharmacy and veterinary medicine). Approximately 23 percent of the members of the UF student body are minorities with 7.2 percent of the student population consisting of African-American students, 9.6 percent Hispanic students, and 6.8 percent Asian American or Pacific Islander students.

The Food and Resource Economics Department (FRED) is in the College of Agricultural and Life Sciences (CALS) at the University of Florida. It is home to approximately 42 faculty, 35 support staff, about 200 undergraduate majors and 95 graduate students. FRED deals with the business and economics of agriculture, natural resources and rural communities.

We evaluated the effect of prerequisites on two senior level “cap-stone” courses. The first, Agribusiness Financial Management (AEB 4141) is an integration of finance and management to solve problems faced by agricultural firms and agribusiness. It is offered once a year during the fall semester and is facilitated through a lecture and case study based format. The second, Agribusiness and Marketing Management (AEB 4342) is

based on the application of management and marketing principles to solve agribusiness and food marketing problems faced by managers. It is offered in the spring semester and is facilitated through the use of lectures, case studies, group projects and student presentations.

Both courses, AEB 4141 and AEB 4342, list as a prerequisite an introductory management course. This requirement could be satisfied by Introduction to Agribusiness Management (AEB 3133) or Introduction to Management (MAN 3025). In addition, AEB 4141 required an introductory finance course satisfied by Introduction to Agricultural Finance (AEB 3144) or Introduction to Business Finance (FIN 3408). Likewise, AEB 4342 also required an introductory marketing course satisfied by Introduction to Agricultural Marketing (AEB 3300) or Introduction to Marketing (MAR 3023). In each prerequisite situation the students had the choice of meeting the requirement with a course offered within the FRE department or through the business department.

This situation gave rise to an additional question, “Did the prerequisite choice at the intermediate level affect the grade achieved at the senior level?” A review of the courses revealed some distinct differences between the two departments. Courses within the FRE department were limited in size (fewer than 90 students) and presented “live” during specific course meeting times. Business department courses averaged 1000-2000 students with flexible delivery times through various media outlets including television, tape, and internet.

Descriptive Statistics

Academic records and demographic information were acquired through the University of Florida Registrar. Student information was collected from graduated students (earned a minimum of 60 upper-division semester hours) between Fall 1999 and Spring 2001.

Grades were collected for the two senior courses as well as all prerequisite courses. In addition, age at time of graduation and upper division GPA (average of grades earned beyond the first 60 hours of college coursework) was determined. Table 1 provides descriptive statistics.

Table 1

	<i>N</i>	<i>Mean</i>	<i>StdDev</i>	<i>Min</i>	<i>Max</i>
AEB 3133	124	3.22	0.82	1.00	4.00
MAN 3025	142	2.28	0.86	0.00	4.00
AEB 3300	128	3.12	0.77	0.00	4.00
MAR 3023	146	2.47	0.96	0.00	4.00
AEB 3144	92	3.02	1.01	1.00	4.00
FIN 3408	119	2.11	0.72	0.00	4.00
AGE	231	23.4	3.09	20.0	49.0
UD GPA	231	2.69	0.66	1.52	4.00
AEB 4141	167	2.78	0.85	0.00	4.00
AEB 4342	208	3.32	0.70	0.00	4.00

Model Determination

With the use of course grades as an indicator of performance, multinomial logit or probit models would fail to account for the ordinal nature of the dependent variable. Ordinary regression analysis would err in the opposite direction, however. Linear regression would treat the difference between a 4 and a 3 (an A and a B) the same as that between a 3 and a 2 (a B and a C) whereas in fact they are only rankings. The ordered probit and logit models have come into fairly wide use as a framework for analyzing such responses

(Zavoina and EcElvey, 1975). The model is built around a latent regression in the same manner as the binomial probit model.

We begin with:

$$y^* = \beta' x + \varepsilon$$

As usual, y^* is unobserved. What we do observe is:

$$\begin{aligned} y = 0 & & \text{if } y^* \leq 0 \\ & = 1 & \text{if } 0 < y^* \leq \mu_1, \\ & = 1.5 & \text{if } \mu_1 < y^* \leq \mu_2, \\ & \cdot & \\ & \cdot & \\ & = 4.0 & \text{if } \mu_7 \leq y^* \end{aligned}$$

The μ 's are unknown parameters to be estimated with β . We assume that ε is normally distributed across observations. For the same reasons as in the binomial probit model (which is a special case of $J=1$), we normalize the mean and variance of ε to 0 and 1.

With the normal distribution, we have the following probabilities:

$$\text{Prob}(y = 0 | x) = \Phi(-\beta' x),$$

$$\text{Prob}(y = 1 | x) = \Phi(\mu_1 - \beta' x) - \Phi(-\beta' x),$$

$$\text{Prob}(y = 2 | x) = \Phi(\mu_2 - \beta' x) - \Phi(\mu_1 - \beta' x),$$

⋮

$$\text{Prob}(y = J | x) = 1 - \Phi(\mu_{J-1} - \beta' x).$$

The marginal effects of the regressors x on the probabilities are not equal to the coefficients. The marginal effects are:

$$\frac{\partial \text{Prob}[y = 0]}{\partial X} = -\phi(\beta'X)\beta,$$

$$\frac{\partial \text{Prob}[y = 1...7]}{\partial X} = [\phi(-\beta'X) - \phi(\mu - \beta'X)]\beta,$$

$$\frac{\partial \text{Prob}[y = 8]}{\partial X} = \phi(\mu - \beta'X)\beta$$

Estimation Results

An ordered probit model was estimated for the two courses. Table 2 defines variables used where “Course”D represents a dummy variable, 0=not taken, 1=taken and “Course”CP represents an interaction variable (“Course”D*Grade in course).

The results are presented in tables 3 and 4.

Table 2

<i>Variable</i>	<i>Param</i>	<i>Definition</i>
Constant	B ₀	
AEB3300D	B ₁	Agricultural Marketing, 0=not taken, 1=taken
AEB3300CP	B ₂	Agricultural Marketing, AEB3300D*Grade in course
MAR3023D	B ₃	Business Marketing, 0=not taken, 1=taken
MAR3023CP	B ₄	Business Marketing, MAR3023D*Grade in Course
AEB3133D	B ₅	Agribusiness Management, 0=not taken, 1=taken
AEB3133CP	B ₆	Agribusiness Management, AEB3133D* Grade in Course
MAN3025D	B ₇	Business Management, 0=not taken, 1=taken
MAN3025CP	B ₈	Business Management, MAN 3025D* Grade in Course
AEB3144D	B ₉	Agricultural Finance, 0=not taken, 1=taken
AEB3144CP	B ₁₀	Agricultural Finance, AEB3114D*Grade in Course
FIN3408D	B ₁₁	Business Finance, 0=not taken, 1=taken
FIN3408CP	B ₁₂	Business Finance, FIN3408D*Grade in course
GPA	B ₁₃	Final Grade Point Average

Table 3, AEB4141

<i>Variable</i>	<i>Parameter</i>	<i>Estimate</i>	<i>Std Error</i>	<i>t-stat</i>	<i>P-value</i>
Constant	B ₀	.340327	1.43421	.237292	.812
AEB3300D	B ₁	-1.1753	.520669	-2.25729	.024
AEB3300CP	B ₂	.271873	.149405	1.81970	.069
MAR3023D	B ₃	-.588589	.435777	-1.35066	.177
MAR3023CP	B ₄	.178205	.162287	1.09809	.272
AEB3133D	B ₅	-1.17723	.602877	-1.95269	.051
AEB3133CP	B ₆	.289859	.191314	1.51510	.130
MAN3025D	B ₇	-.348926	.382027	-.913354	.361
MAN3025CP	B ₈	.137921	.147241	.936698	.349
AEB3144D	B ₉	-.253437	.680254	-.372563	.709
AEB3144CP	B ₁₀	.248831	.152646	1.63012	.103
FIN3408D	B ₁₁	-.117828	.574766	-.205002	.838
FIN3408CP	B ₁₂	.154448	.179693	.859514	.390
GPA	B ₁₃	.936213	.430622	2.17410	.030

Marginal Effects, AEB4141

B₂ (AEB330CP)

	PROB2*	PR1B2	PR15B2	PR2B2	PR25B2
Value	-0.0023068	-0.0054436	-0.0042442	-0.056807	-0.029168
	PR3B2	PR35B2	PR4B2		
	-0.0032232	0.043063	0.058130		

*The probability decrease (or increase) of receiving a “0” or failing AEB4141 if

AEB3300 is taken.

B₁₀ (AEB3144CP)

	PROB10	PR1B10	PR15B10	PR2B10	PR25B10
Value	-0.002111	-0.004982	-0.0038845	-0.051992	-0.026696
	PR3B10	PR35B10	PR4B10		
	-0.00295	0.039413	0.053203		

B₁₃ (GPA)

	PROB13	PR1B13	PR15B13	PR2B13	PR25B13
Value	-0.0079437	-0.018746	-0.014615	-0.19562	-0.10044
	PR3B13	PR35B13	PR4B13		
	-0.011099	0.14829	0.20017		

Table 4, AEB4342

<i>Variable</i>	<i>Parameter</i>	<i>Estimate</i>	<i>Std Error</i>	<i>t-stat</i>	<i>P-value</i>
Constant	B ₀	-1.75282	1.37039	-1.27907	.201
AEB3300D	B ₁	-6.88616	.579914	-1.18744	.235
AEB3300CP	B ₂	.204043	.166495	1.22552	.220
MAR3023D	B ₃	-.182460	.451249	-.404346	.686
MAR3023CP	B ₄	.250314	.168481	2.15965	.031
AEB3133D	B ₅	-.647540	.527568	-1.22741	.220
AEB3133CP	B ₆	.214652	.152064	1.41160	.158
MAN3025D	B ₇	.137568	.370443	.371360	.710
MAN3025CP	B ₈	-.058686	.133282	-.440310	.660
AEB3144D	B ₉	-1.07908	.588090	-1.83488	.067
AEB3144CP	B ₁₀	.467544	.174421	2.68055	.007
FIN3408D	B ₁₁	.599259	.478901	1.25132	.211
FIN3408CP	B ₁₂	-.212454	.183954	-1.15493	.248
GPA	B ₁₃	1.45414	.475841	3.05593	.002

Marginal Effects, AEB4342

B₄ (MAR3023CP)

	PROB4	PR1B4	PR15B4	PR2B4	PR25B4
Value	-0.00307	-0.0007	-0.0016	-0.0111	-0.016
	PR3B4	PR35B4	PR4B4		
	-0.062849	0.00073	0.09464		

B₁₀ (AEB3144CP)

	PROB10	PR1B10	PR15B10	PR2B10	PR25B10
Value	-0.00573	-0.001347	-0.002999	-0.020778	-0.029889
	PR3B10	PR35B10	PR4B10		
	-0.11739	0.0013662	0.17678		

B₁₃ (GPA)

	PROB13	PR1B13	PR15B13	PR2B13	PR25B13
Value	-0.017845	-0.0041916	-0.009329	-0.064623	-0.092959
	PR3B13	PR35B13	PR4B13		
	-0.36511	0.004249	0.54981		

Conditional Probabilities

For each of the probabilities, there are two effects for taking a particular course. The first is the effect of simply having taken the course, regardless of the grade earned. Since it is a dummy variable, this effect is calculated by evaluating the probability of each grade conditionally upon having taken the course. Then a probability is also calculated for the case where the course was not taken. The difference in the two probabilities is then the effect of having taken the course.

As an example, the probability of receiving an “A” in AEB4141 conditional upon completing AEB3144 versus not taking the course was evaluated using TSP in the following manner:

1) Probability $[y=4|AEB3114D=1] = 1 - \text{CNORM}(A6 - \text{MXB} + B_9 * (\text{Mean of AEB3144D}) + B_{10} * (\text{Mean of AEB3144CP}) - B_9 - B_{10} * (\text{Mean grade of students who took the course}))$

2) Probability $[y=4|AEB3114D=0] = 1 - \text{CNORM}(A6 - \text{MXB} + B_9 * (\text{Mean of AEB3144D}) + B_{10} * (\text{Mean of AEB3144CP}))$

Results are reported in tables 4 and 5 along with the differences in probabilities for grade attainment.

Table 5, AEB4141

	<i>Value</i>	<i>Y=4 "A"</i>	<i>Y=3 "B"</i>	<i>Y=2 "C"</i>
AEB3144D	1 (taken)	0.2516	.77175	0.99162
	0 (not taken)	0.093188	0.59739	0.97089
Difference		0.11197	0.17436	0.020733

Table 6, AEB4342

	<i>Value</i>	<i>Y=4 "A"</i>	<i>Y=3 "B"</i>	<i>Y=2 "C"</i>
MAR3023D	1 (taken)	0.43991	0.95296	0.99523
	0 (not taken)	0.27860	0.89222	0.98446
Difference		0.16131	0.060737	0.010764

Discussion

In the case of AEB4141, Agribusiness Financial Management, introductory finance and management courses are required prerequisites. Analysis showed that the completion of AEB3144, the FRE department's finance course, had a significant impact on the grade achieved in the senior level course, while the Business course did not. Looking at the marginal effects, a one-unit increase in the AEB3144 grade achieved would decrease the probability of receiving a F, D, D+, C, C+, or B, while increasing the probability of receiving a B+ or A in AEB4141. The conditional probabilities, directly comparing the probability of grade attainment based upon completion of the course versus not, revealed a clear increase in the probability differences as you move from a projected grade of "C" to an "A" in favor of completing the course. These results provide a strong justification for choosing AEB3144 over FIN3408 and validating its requirement as a prerequisite. The introductory marketing course AEB3300 was also significant although not a prerequisite, while neither management course was significant. In light of this, there would appear to be justification in reviewing the management requirement and its importance to later material as well as the marketing course to determine existing synergies.

With AEB4342, Agribusiness Marketing Management, introductory marketing and management courses are required prerequisites. Analysis showed that the completion of MAR3023, the Business department's course, had a significant impact on the grade achieved in the senior level course, while the FRE department course did not. Looking at the marginal effects, a one-unit increase in the MAR3023 grade achieved would decrease

the probability of receiving a F, D, D+, C, C+, or B, while increasing the probability of receiving a B+ or A in AEB4342. The conditional probabilities revealed a clear increase in the probability differences as you move from a projected grade of “C” to an “A” in favor of completing the course. This information provides rationale for the FRE department to review AEB3300 and the role it must play in order to justify it as a valid prerequisite. The introductory finance course AEB3144 was also significant although not a prerequisite, while neither management course was significant once again.

In both cases, the upper-division GPA was significant with a positive effect on grade achievement. The marginal effects showed that a one-unit increase in GPA would decrease the probability of receiving a F, D, D+, C, C+, or B, while increasing the probability of receiving a B+ or A in AEB4141 and AEB4342. In this case, upper-division GPA was used as an explanatory variable as a proxy of overall individual student effort.

Conclusion

Today, there is an increasing public demand for institutions to provide effective and efficient levels of education. Institutions are challenged to increase the quality of education and the quantity of graduates in light of unprecedented budget restrictions. One area of potential efficiency gains is the evaluation of prerequisite courses. Today’s administrators are focusing on ways to reduce course material duplication (i.e. multiple courses providing the same material) and standardized levels of preparedness for students entering programs or courses (i.e. structure and strength of prerequisite work).

This analysis illustrated the importance of prerequisite intermediate courses in the determination of grades in both a senior-level marketing and finance course. It provided the information necessary to answer two questions. First, does the completion of a specific prerequisite course significantly impact future grade attainment and second, if so, what is the measure of that impact?

Additional research would focus on the continual update of the student database and evaluation of prerequisite course significance in grade determination. Also this work could evolve into a cost-benefit evaluation viewed from the academic as well as student perception.

References

Akpom, U., & Hullur, I. "Class Attendance and Student Performance in a Principles of Economics Course. *Midsouth Academy of Economics and Finance Papers and Proceedings*, 18, 1994:319-328.

Anderson, G.D. Benjamin, and M.A. Fuss. "The Determinants of Success in University Introductory Economics Courses." *Journal of Economic Education*. 25, 1994:99-119

Borg, M.O., and S.L. Shaprio. "Personality Type and Student Performance in Principles of Economics." *Journal of Economic Education*. 27, 1996:3-25

Brasfield, D., McCoy, J., & Milkman, M. "The Effect of University Math on Student Performance in Principles of Economics. *Journal of Research and Development in Education*, 25(4), 1992:240-247.

Brasfield, D., Harrison, D., & McCoy, J. "The Impact of High School Economics on the College Principles of Economics Course." *Journal of Economic Education*, 24(2), 1993:99-111.

Buschena D., and M. Watts. "Do Prerequisites Matter? Analysis of Intermediate Microeconomics and Agricultural Economics Grades. *Review of Agricultural Economics*. 23,2001:203-213

Cohn, E., Cohn, S., Hult, Jr., R., Balch, D., and Bradley Jr., J. "The Effects of Mathematics Background on Student Learning in Principles of Economics." *Journal of Education for Business*, 74(1), 1998:18-22.

Ely, D., & Hittle, L. "The Impact of Math Background on Performance in Managerial Economics and Basic Finance Courses." *Journal of Financial Education*, 19(2), 1990:59-61.

Greene, B. "Verbal Abilities, Gender, and the Introductory Economics Course: A New Look at an Old Assumption." *Journal of Economic Education*. 28, 1997:13-30

Greene, W. (1993). *Econometric Analysis*. New York: Macmillan.

Henebry, K. "The Impact of Class Schedule on Student Performance in a Financial Management Course. *Journal of Education for Business*, 73(2), 1997:114-120.

Horvath, J., Beaudin, B., & Wright, S. "Persisting in the Introductory Economics Course: An Exploration of Gender Differences. *Journal of Economic Education*, 1992:101-108.

Marcal, L., and W.W. Roberts. "Computer Literacy Requirements and Student Performance in Business Communications." *Journal of Education for Business*. 75, 2000:253-257

Siegfried, J.J., and R. Fels. "Research on Teaching College Economics: A Survey." *Journal of Economic Literature*. 17, 1979:923-969

Siegfried, J.J., and S.H. Strand. "Sex and the Economics Student." *Review of Economic Statistics*. 59, 1997:247-249

Von Allmen, P. "The Effect of Quantitative Prerequisites on Performance in Intermediate Microeconomics. *Journal of Education for Business*, 72(1), 1996:18-22.

Watts, M., and G.L. Lynch. "The Principles Course Revisited." AEA Papers and Proceedings. American Economic Review. 79, 1989:236-241

Zavoina, R., and W. McElvey. "A Statistical Model for the Analysis of Ordinal Level Dependent Variables." Journal of Mathematical Sociology, Summer, 1975:103-120.