Is There a Link Between Performance in International Economics Courses and Academic Success?

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Abstract

This paper uses a sample of 6,470 students and Maximum Likelihood Estimation to determine the relationship between grades received in international economics courses and academic success of business majors. The results indicate that the grades earned in international economics courses as well as the number of international economics courses are significant and positive determinants of students' final GPA.
Key Words: International Economics, GPA, Maximum Likelihood Estimator, Truncated Sample

Introduction

In selecting courses to complete their undergraduate curriculum, students choose courses to boost their GPA, courses that complement other courses, and courses that they believe will improve their jobs prospects after graduation. In the business administration curriculum of some schools, in majors like International Business, Accounting, Management, Marketing, and Finance students are also expected to complete courses that fulfill the international component of the curriculum. Some students take International Economics courses (International Trade, International Monetary Economics, or International Economics of Development) while others take courses such as International Finance, International Health Care Systems, or Cross-Cultural Human Relations and Negotiations to fulfill this requirement.

International Economics courses are generally more mathematical and statistical in nature, and students tend to agree that they are more difficult than some of the other courses that can be used to fulfill the international component requirement. In some universities like Florida Atlantic University where the sample is chosen, the difficulty of International Economics courses is amplified by the fact that the introductory Principles of Economics courses are the only pre-requisite economics courses needed to register for International while in others universities the more advanced Intermediate Economics courses are additional prerequisites economics courses and these tend make students better prepared to handle International Economics courses.

International Economics courses teach students about the relationship between sectors of the economy, and the economic interdependence between nations. Students who complete these courses and begin to think like economists may be cognitively superior, and this could facilitate their learning in courses thereafter. We believe that completing International Economics courses

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help students integrate relevant points into a coherent structure, and improve their explanation of causation between factors as well as their ability to analyze, relate and apply theories. Of course, the extent to which such "externalities" exist in teaching and learning between International Economics and other courses in the business curriculum depends on how closely the topics are related, what fundamental concepts, methods of analysis, and ways of understanding are common to topics in the business curriculum. We believe that there could be spillovers between the topics International Economics courses and the topics in other courses in the business curriculum in areas such as International Business, Finance, and Accounting.

The issue that this research seeks to clarify is whether or not there is a relationship between international economics courses and students' achievement in the business administration program as indicated by their overall GPA. Do the more difficult international economics courses complement other courses in the business school curriculum and thus cause students to perform better resulting in higher GPA? What are the determinants of success for under-graduate business majors and does the performance in international economics courses have any effect? An even broader question is whether or not statistical analysis of generally available information in most universities' official records systems about students engaged in undergraduate business programs can identify *ex post* factors that predict students' levels of academic success.

The questions are in fact relevant because of the widely held belief that the mathematical and statistical relationships that are common in applied economics courses including international economics courses make them more difficult than other business courses, and that students who perform well in these courses will undoubtedly perform better in the more difficult courses in the business curriculum. Furthermore, with increasing globalization and the inclusion of content related to international economics in finance, management, accounting, and marketing courses, students that perform above average in international economics courses could do better in the business curriculum.

Research of this nature is not new as a paper by Nieswiadomy (1998) tested what may at first appear to be an "artificial" relationship between Law School Admission Test (LSAT) scores and the "majors" of college graduates taking this test. Using 1994-1995 LSAT data, Nieswiadomy (1998) found that when compared to engineering, history, English, finance, political science, psychology, accounting, communications, sociology, and business administration majors, economics majors performed at or near the top of all majors taking LSAT. In fact, the test was repeated by Nieswiadomy (2006) with students from 29 majors and the conclusions were similar. What was also indicated but not stressed in this research was the above average performance of finance and accounting majors.

Determining the relationship between international economics courses and academic success could prove useful for educators who are developing curriculum for core knowledge courses in business schools. If these core knowledge courses are taken in the student's junior year, they could serve as important predictors of overall academic success or early warning signals of students' future performances. Such knowledge by administrators could better facilitate guidance and career planning decisions aimed at improving the student's overall chances of academic success.

The next section of this paper provides an overview of several published studies that examine intellectual and non-intellectual factors that have been used to predict academic success as well as a review of studies that specifically address a variety of potential determinants of student performance. Section III describes a data sample containing academic and demographic

information on 6,470 students who recently graduated from an AACSB-accredited business school with undergraduate degrees in 9 different majors. Section IV proposes a method for analyzing the data to detect relationships between the available variables for the sample. The final section describes the results of applying this analysis method to the data and summarizes the findings of this analysis.

Literature Review

Numerous published studies have considered a variety of potential predictors of academic success for college students. Some of these studies focus on variables that attempt to measure students' intellect while others focus more on non-intellectual variables some of which include students' personality traits, behavioral tendencies, and demographic characteristics. Using these intellectual and non-intellectual variables, numerous studies focus on the determinants of student success in basic business courses while others have looked at overall academic success. Although business programs have an international cognate, no test has been conducted to determine whether or not this stipulation is meaningful in the business school curriculum, that is, whether or not academic success for undergraduate business majors is tied to courses like international economics.

Research by Willingham (1985), Young and Barrett (1992), Cabrera, Nora and Castaneda (1993), Mouw and Kkanna (1993), Eimers and Pike (1997), Noble *et al.* (1999), Brookshire and Palocsay (2005), and Smith and Schumacher (2006) provide evidence that intellectual variables can be useful predictors of overall academic outcomes for college students (not necessarily business majors). The intellectual variables considered in these studies include ACT and SAT scores, high school grades, and various measures of writing, quantitative, and technology skills. The more recent studies from the group above, Brookshire and Palocsay (2005) and Smith and Schumacher (2006) found that generally intellectual variables such as those listed above are statistically significant predictors of academic success (with the expected signs) for college students in general and business school students in particular.

The inclusion of non-intellectual variables such as demographic, behavioral, and personality descriptors, has also been shown to increase success predictability. Studies of this nature include those by Cantor *et al.* (1986), Wolfe and Johnson (1995), Harackiewicz *et al.* (2002), and Nonis *et al.* (2005). Among the list of demographic variables considered in these studies are gender, race/ethnicity, age, and marital status; the list of behavioral variables include time spent on class/exam preparation, assignments, and outside work activities; and personality variables include self-assessed measures proposed to measure the level of students' academic motivation (achievement striving) and their confidence in their own abilities (self-efficacy). In general, the results from these studies suggest that there are some gains in predictability when non-intellectual variables are included in the analysis, but there is considerable variation in the significance of these variables across the studies identified here.

Several articles focus on student performance in the introductory courses. For example, in what has been termed an "educational production function" approach, Didia and Hasnat (1998) considered the determinants of grades received in the principles of finance course for 224 students enrolled in seven sections offered in fall semester 1994 and spring semester 1995 at the State University of New York at Brockport. The grade received is the "output" in their production model and the "inputs" are variables collected through a student survey (except course grades and semester course loads) that are meant to measure such factors as aptitude,

background, maturity, and effort. Also in the study by Didia and Hasnat (1998) cumulative GPA was used to measure aptitude while the other variables included grades earned in prerequisite courses (accounting, economics, and mathematics), transfer student status, total number of credits taken during the semester, gender, age, class standing (freshmen, sophomore, junior, and senior), and hours spent studying per week (to show effort). Their study also controlled for variation in faculty contribution using binary variables for the four instructors who taught the courses.

Among the findings of Didia and Hasnat (1998) are cumulative GPA, prerequisite course grades in accounting, economics and mathematics, and student age have significant and positive coefficients in both ordinary least square (OLS) and ordered-probit specifications of their model. Didia and Hasnat (1998) also reported that students with heavier course loads perform significantly better in Principles of Finance than those with lesser course loads. In addition, their results suggest a negative relationship between study effort (time) and performance in the course.

Chan, Shum, and Wright (1997) also consider potential determinants of Principles of Finance grades using the performances of 56 students in two sections of the course taught by the same instructor during one semester at an unspecified mid-western regional state university. Potential determinants considered in their study include class attendance, GPA, number of weekly work hours, number of credit hours enrolled, age, gender, major, and self-reported quantitative skill level.

Chan, Shum, and Wright (1997) used the TOBIT model (Tobin (1959) and Heckman's two-stage procedure (Heckman, 1976) to address potential sample selection bias caused by the fact that 12 students withdrew from the courses before the semester ended and were not accounted for in the sample. It is possible that the students who withdrew were performing poorly and choose to withdraw rather than fail. Ignoring their existence in the population simply because no final course grade is available for them and proceeding to analyze the remaining sample with ordinary least squares could have led to biased results. Chan, Shum, and Wright (1997) data sample is therefore described as 'censored' because some observations of the dependent variable of their model corresponding to known values of the independent variables were not observable.

The TOBIT model is a maximum likelihood estimator that recognizes there is a "selection equation" that determines whether an observation makes it into the sample. The TOBIT model assumes that the selection equation is identical to the equation being estimated: the variables in the equation of interest are the same variables that determine selection into the sample. Maximum likelihood is used to jointly estimate both the equation of interest and the selection equation. Using the TOBIT model, Chan, Shum, and Wright (1997) found that class attendance and status as a finance major have positive and significant effects on course grades, but that GPA, course load, number of credit hours currently enrolled, weekly work houses, and age are not significant determinants of course grades.

Other studies that looked at performance in Principles of Finance courses included Johnson, Joyce, and Sen (2002), Van Ness, Van Ness, and Kamery (1999), Sen, Joyce, Farrell, and Toutant (1997), and Ely and Hittle (1990). These articles commonly employ both ordinary least squares (OLS) and ordered-probit regression techniques (but not TOBIT or Heckman's two-step procedure) and focus on such issues as student effort, full and part-time status and rank of instructors, declared majors, and mathematical background as determinants of student success in basic finance courses.

With regards to Economics courses, Ballard and Johnson (2004) concluded that mathematics skills as measured by (1) the student's score on the mathematics portion of the ACT Assessment Test, (2) whether the student has taken calculus, (3) whether the student has been required to take remedial mathematics, and (4) the student's score on a test of very basic mathematical concepts are significant factors explaining performance in an introductory Microeconomics course. In fact, the findings were similar regardless of whether they use self-reported information from students or official administrative records from the university. These results indicate that improvements in student performance in microeconomics may depend on improved mastery of basic algebra.

A somewhat similar study was conducted by Johnson and Kuennen (May 2006) that concluded that on-line remedial mathematics reviews improve student performance in introductory Microeconomics courses. Using graded pre and post-tests to assess student understanding of graphing, systems of linear equations, area, slope, ratios and percentages, they found that pre and post-test scores are positively and significantly related to course grade, more so than variables designating which mathematics courses have been taken by students.

Arias and Walker (2004) study focused on the importance of class size in introductory Economics courses. Using total exam points as the dependent variable and controlling for variation in instruction, lecture material, and topic coverage by using the same instructor for all sections, Arias and Walker (2004) concluded that small class size has a positive impact on student performance.

Studies on overall performance include Nonis, Philhours, Syamil, and Hudson (2005) whose research focused on the impact of non-intellectual variables on the academic success of business students. Wolfe and Johnson (1995) studied personality as a predictor of college performance, while Young and Barrett's (1992) paper analyzed high school transcripts to determine their relationship with college performance. Also, a paper by Naylor and Smith (2004) used individual-level data for United Kingdom university graduates who were enrolled for economics degrees between 1984 and 1998 to determine the factors that influenced overall performance. Their research concluded that performance depends not only on prior qualifications as measured by 'A-level' scores, but also on the individual student's ranking within their cohort at their university.

Business majors, like all other students for that matter, possess many different intelligence levels, behaviors, lifestyles, study skills and habits, preferred learning methods, experiences, backgrounds, and demographics. It is therefore difficult to predict *a priori* how successful any given student will be in an undergraduate business program. The present study attempts to contribute to the understanding of factors affecting overall academic success by examining gender, age, ethnicity, and performance in international economics courses as predictors of academic success for a sample of undergraduate students at an AACSB-accredited business school.

Data Sample

To investigate factors affecting the academic success of undergraduate business students, a sample of 6,470 grade point averages was obtained from the official university records system at Florida Atlantic University (FAU) for graduates with undergraduate degrees in 9 majors (Accounting, Economics, Finance, Health Administration, International Business, Management, Management and Computer Information, Marketing, and Real Estate), along with their age,

gender, ethnicity, major, minor (if any), total credit hours earned, and grades received in international economics courses.

The students included in this sample are graduates from the Barry Kaye College of Business at FAU, a Southern Association of Colleges and Schools (SACS) accredited, public university located in southeast Florida. As of 2006, FAU had enrollment of 26,000+ students, including 6,300+ full and part-time business students at the graduate and undergraduate levels. The business school is fully accredited through the doctoral level by AACSB International, the Association to Advance Collegiate Schools of Business. The school can be characterized as a regional commuter school serving a diverse population at multiple campuses over a geographic area along the I-95 corridor of southeast Florida from Port St. Lucie in the north to Fort Lauderdale in the south.

Students can be admitted to the FAU business school only after they reach junior status (60 complete credit hours) and have a minimum grade point average of 2.0 on a 4.0 scale. Students may not graduate from the FAU business school with a grade point average below 2.0. Business students at FAU can choose to major in one or more of the fields listed above and can attach minors (usually 9 to12 credit hours in a specific area) to their degree.

Between 2000 and 2007, the Barry Kaye College of Business conferred undergraduate business degrees on 6,470 students in the majors mentioned above. Of these, 1,344 completed international economics courses (International Monetary Economics – ECO 4713, International Trade – ECO 4704, or International Economic Development – ECS 3013) either as a requirement for their degree program or by choice (as electives). Whereas the International Monetary Economics course focuses on the balance of payments, exchange rate markets and exchange rates, and open-economy macroeconomics, the International Trade course provides students with extensive analysis of theories of international trade. The International Economic Development course looks at economic development in third-world countries, applying the traditional economic theories to development issues in developing countries. The three courses are taught with a common syllabus, grading scheme, and test bank to maintain a minimum measure of consistency across instructors.

Based on the sample for this study, the average grade point average (GPA) for these graduates over the study period was 2.940 on a 4.0 scale. The average grades received by students taking ECO 4704, ECO 4713, and ECS 3013 were 2.816, 2.841, and 2.775 respectively, again on a 4.0 scale. The average age of students in the sample at the time of graduation was 27.8 years. Of the sample, 45.1 percent of the graduates were male and 54.9 percent were female; 57.9 percent were White, 16.0 percent were African-American, 18.1 percent were Hispanic, 7.0 percent were Asian, and 1.0 percent was others. Additional descriptive statistics for the variables available for this study are provided in Table 1.

Statistical Analysis Method

The determinants of overall academic success for undergraduate business students are tested using the following conceptual model:

$$\textit{Adjusted GPA} = f(\textit{composite grade on international economics courses, gender, age, ethnicity, year, major, minor, credits earned}) \quad (1)$$

In this model, overall grade point average at graduation (adjusted to remove the grades in ECO4704, ECO4713, and ECS 3013) is a function of the composite grade earned in the international economics courses, the student's gender, age at graduation, ethnicity, graduation year, and whether or not the student also earned a minor to supplement the major. The grade earned in international economics courses is the sum of the letter grades that are converted to the 0 to 4 scale. Including year of graduation in the model addresses the potential for grade inflation/deflation over the study period. The number of credits earned by student is also included in the model as in many cases students graduate with more than the required 120 credit hours. Students graduating with more than the 120 credit hours could be an indication that they may have transferred from another college in the university or changed their major within the university.

Previous studies of academic success factors have used several different statistical analysis methods to explore the relationships between academic success (typically measured by GPA) and intellectual and non-intellectual predictor variables. In studies investigating the determinants of overall academic success, the analysis methods include simple correlation analysis, ANOVA, OLS regression, hierarchical regression, and logistical regression. In studies that consider the determinants of success in economics principles and basic finance courses, the analysis methods include OLS, Probit, ordered-Probit, TOBIT, and Heckman's two stage procedure.

As in the Chan, Shum, and Wright (1997) study described earlier, the data available for the current study presents potential sample selection bias. However, unlike the 'censored' data sample used in Chan, Shum, and Wright (1997), the data sample available for the current study is not only missing the "output" of the education production function (grades), but it is also missing the "inputs" for these students who withdrew (voluntarily or involuntarily) from the Barry Kaye College of Business before graduation. Therefore, the data available for the current study is a "truncated" rather than a "censored" sample and neither the TOBIT or Heckman procedure are appropriate for this situation.

A truncated regression approach is appropriate for investigating this sample because some observations in the population of business students who attended the FAU during this time period are excluded from the analysis because they were dismissed from the program due to poor performance (cumulative GPA of less than 2.0 on a 4.0 scale) prior to graduation from the program. Thus, the sample is drawn from a restricted part of the population: the sample is "truncated from below" with a minimum GPA of 2.0 for all observations. The sample also omits students who transferred to other schools during their degree programs at FAU or otherwise voluntarily withdrew from FAU, whether or not they successfully completed international economics courses. We assume those transfers and withdrawals are randomly distributed and do not bias the remaining sample.

A more formal exposition of the truncated sample problem following Long (1997) is summarized below. Assume that the truncated variable x has a normal distribution with mean μ and standard deviation σ. The density function of the truncated normal distribution is

$$f(x \mid a < x < b) = \frac{f(x)}{\Phi\left(\frac{b-\mu}{\sigma}\right) - \Phi\left(\frac{a-\mu}{\sigma}\right)} = \frac{\frac{1}{\sigma}\phi\left(\frac{x-\mu}{\sigma}\right)}{\Phi\left(\frac{b-\mu}{\sigma}\right) - \Phi\left(\frac{a-\mu}{\sigma}\right)} \qquad (2)$$

where φ and Φ are the density and distribution functions of the standard normal distribution. When the truncation is "from below" (with *a* in this situation equal to 2.0), the mean of the truncated variable is greater than the true mean of the distributed and the variance is less than the true variance.

In the presence of truncation, Ordinary Least Squares is not an appropriate regression estimator when the goal is to draw inferences about the full population. OLS is, however, adequate if the goal is to draw inferences only from the restricted population. Similarly, neither TOBIT or Heckman's procedure are appropriate with truncated data samples because both of those methods make use of known independent variable values for observations with unknown dependent variable values.

Fitting a regression function with a truncated dependent variable can be accomplished with Maximum Likelihood Estimation (MLE). The log likelihood function when *a* is the lower limit and *b* is the upper limit is:

$$L = -\frac{n}{2}\log(2\pi\sigma^2) - \frac{1}{2\sigma^2}\sum_{i=1}^{n}(y_i - x_i\beta)^2 - \sum_{i=1}^{n}\log\left[\Phi\left(\frac{b - x_i\beta}{\sigma}\right) - \Phi\left(\frac{a - x_{i\beta}}{\sigma}\right)\right]. \qquad (3)$$

Fitting the conceptual model provided above to the data sample using MLE provides the results discussed in the next section.

Results

Table 2 shows the truncated regression results for the full sample of 6,470 business school graduates who completed 1, 2, or 3 international economics courses at Florida Atlantic University. The Wald χ^2 statistics for the model (758.51) suggests rejection of the null hypothesis that all coefficients in the model are equal to zero. The coefficients are significant at beyond the one percent level. The aggregate grade earned in International Economics courses is significantly and positively related to students' adjusted GPA. Based on the sample, a one-unit increase in a student's aggregate score for International Economics courses causes an increase in overall adjusted GPA at graduation of 0.0363. A student completing three International Economics courses and earning the maximum 4.0 (a grade of "A") on each course is expected to increase his GPA by 0.4356 or just below one half of a letter grade holding all other factors constant. The results also indicate that gender, age, and ethnicity/race impact the overall academic success of business majors. With regards to age, the implication from the results is that the older students that bring a wealth of knowledge acquired through employment and or life experience to the program perform better in the business program than younger students. The coefficients for African American, Hispanic, and Asian students indicate that they do not perform as well as White students in the business program. Furthermore, the coefficients indicate that the performance of African American students is the worst compared to all other ethnic groups.

From Table 2, the coefficient for the gender variable indicates that females are 13.2 percent more likely to graduate with a higher GPA than males. This of course is quite disconcerting because of the emphasis place on equal opportunity for males and females at FAU. The coefficient on the *year* variable is not significantly different from zero, dispelling the perception that grades are inflating or deflating over the study period. The coefficient on the

minor variable is significantly different from zero. In fact it suggests that students who include a minor in their plan of study earn a higher GPA than those students who do not include a minor.

For the "major" variable, the results indicate that the students' choice of a major can impact their overall performance. From Table 2, the coefficients for Economic Majors, Real Estate Majors, Marketing Majors, and International Business Majors were not significant hence students completing these majors were judged to perform similar to Management Majors (the omitted dummy variable). However, the coefficients for Finance Majors, Accounting Majors, Health Administration Majors, and Management and Computer Information Systems Majors are significant at the 1% level and students completing these courses of study are expected to perform better than Management Majors.

Conclusions

The analysis presented provides useful insight into the factors that could affect the overall academic success of undergraduate business majors. Previous research on academic success factors suggests that both intellectual and non-intellectual variables may serve as useful predictors of a student's academic success. This study contributes to that line of research and shows that grades earned in a certain area (international economics courses) that complements the core knowledge in other courses are good predictors of overall academic success.

The analysis does indicate that certain demographic variables (age, gender, and ethnicity) are useful indicators of students' overall academic success. The analysis controls for students' decisions to include a minor in their plans of study and for potential grade inflation/deflation over the study period. The data sample does not include behavioral or personality variables that other researchers have considered as important predictors of academic success, but future research may permit these issues to be examined more carefully.

The data sample does not include a measure of general ability of students which could impact overall ability. This information was not available in a uniform manner due to the diversity of the population. Students attending FAU come from over 50 countries, some using SAT for entry while others transfer from universities. Furthermore, GPA's and letter grades are often not based on the same scales.

Overall, the results of this study further provide some evidence that information which is readily available from most universities' official records systems can be useful in predicting students' future academic success.

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APPENDIX A

Table 1: Descriptive Statistics for Variables in the Sample

$N = 6{,}470$

CONTINUOUS VARIABLES	***MEAN***	***STD DEVIATION***
GPA	2.940	0.45
ECO4704 GRADE	2.816	0.81
ECO4713 GRADE	2.841	0.79
ECS3013 GRADE	2.775	0.77
Age at Graduation	27.80	6.84
Number of Credits at Graduation	133.39	24.63
BINARY VARIABLES	***COUNT***	***PERCENT***
DEMOGRAPHICS		
Females	3,552	54.9
Male	2,918	45.1
White	3,746	57.9
African-American	1,035	16.0
Hispanic	1,171	18.1
Asian	453	7.0
Others	65	1.0
MINOR	1,857	28.7

Appendix B

Table 2: Truncated Regression Results Obtained from MLE for all Graduates Completing 1, 2, or 3 International Economics Courses

dependent variable = Adjusted GPA $N = 6{,}470$			
Variable	*Coefficient*	*Standard Error*	*Wald z-statistic*
Composite Grade in International Courses	0.0363	0.0043	8.45*
Age	0.0123	0.0009	13.35*
Female	0.1321	0.0125	10.54*
African American	-0.2826	0.0180	-15.68*
Hispanic	-0.1204	0.0166	-7.26*
Asian	-0.0783	0.0242	-3.23*
Minor	0.1343	0.0140	9.59*
Credits Earned	-0.0012	0.0003	-4.62*
Year	0.0042	0.0027	1.57
Finance Major	0.0957	0.0193	4.96*
Accounting Major	0.1431	0.0214	6.69*
Health Administration Major	0.1901	0.0268	7.09*
Economics Major	0.0081	0.0571	0.14
Real Estate Major	0.0041	0.0515	0.08
Marketing Major	-0.0033	0.0202	-0.16
International Business Major	-0.0209	0.0290	-0.72
Management/Computer Info. System Major	0.1134	0.0225	5.05*
Constant	2.5835	0.0408	63.31*
Wald χ^2 *(18 df)*	758.51*		

Asterisks indicate significance of the coefficients at the 1 percent level.