Pretest in an Introductory Finance Course: Value Added?

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Abstract

In this study, it is hypothesized that student performance on a quantitative pretest given at the beginning of the introductory finance course should be a good predictor of performance in the course. Based on the research results, we conclude that scores for the math and accounting questions on the pretest are a predictor of student performance in the introductory finance course. However, we find that scores on economics questions have little or no predictive value regarding course performance. Additionally, while we find that GPA has predictive value whereas gender and year of study do not, all of the study results are tempered by the apparent existence of multi-collinearity among the variables.

Introduction

Educators have long known that students learn more and perform better in many courses when they have completed specific prerequisite courses. For the introductory finance course, earlier research tells us that students perform better when they have completed course work in math, financial accounting, and economics (Marcal and Roberts, 2001; Borde, et al., 1998; and Ely and Hittle, 1990). In fact, virtually every undergraduate business curriculum requires students to complete foundation courses in these three areas prior to taking the introductory finance course.

Undoubtedly, part of the benefit of requiring a number of prerequisites for the introductory finance course comes from the strengthening of the student's analytical skills and study habits through exposure to challenging quantitative courses. It has been our observation that the more prerequisites completed, the better equipped students are to handle the rigors of the principles of finance course. In this paper, however, we are interested in quantifying just how much of the knowledge obtained in the prerequisite courses in math, financial accounting, and economics is actually remembered by students when they start the introductory finance course and whether the retention of that knowledge affects performance in the course.

In this study, students are tested at the beginning of the introductory finance course to assess the level of knowledge retained from the prerequisite courses. These pretest scores are then analyzed against the students' performance in the finance course as measured by their course grade. In the following section, we review the literature on predictors of student performance in quantitative business courses. We then report on the research design and methodology, results, conclusions, limitations of this research, and ideas for future research in this area.

Review of Literature

Over the years, numerous studies have examined the relationship between student performance in accounting, economics or finance courses and various aptitude variables. The

variables studied include cumulative GPA, SAT/ACT scores, performance in prerequisites, completion of similar courses in high school, number of hours of employment, involvement in other activities on campus, age, gender, number of credits completed, etc. In one of the earlier studies, Bellico (1972) finds that performance in advanced economics courses is strongly related to cumulative GPA. Interestingly, he also finds that variables measuring students' verbal ability have a stronger relationship with performance in economics courses than those measuring the quantitative ability of students.

Schaffer and Calkins (1980) study the importance of seven course prerequisites to the business finance course: Financial accounting, management information systems, business law, business statistics, macroeconomics, microeconomics and mathematical analysis. They find that performance in prerequisites is related to performance in the introductory finance course. Specifically, the letter grade received in financial accounting is the most important discriminating variable and has the highest predictive power for the finance grade, even greater than the student's overall GPA.

Eskew and Faley (1988) develop a regression model to explain student performance in the first college-level financial accounting course. They find that academic aptitude and effort variables, as measured by SAT scores and participation in essentially voluntary quizzes, account for 54 percent of the variance in performance in the first accounting course. However, completion of high school accounting classes and cumulative college GPA have significance as well. In a study examining whether a background in mathematics determines performance in upper level courses by Ely and Hittle (1990), the authors find that mathematical courses are an important determinant of performance in the managerial economics course but not in the fundamentals of finance course, perhaps because of the greater use of calculus in the managerial economics course.

Using a multiple regression analysis to assess the relative importance of various factors in explaining student performance in the first two college accounting courses, Doran, Bouillon and Smith (1991) conclude that the most important determinants of examination performance in both of these courses are academic performance and aptitude, as measured by cumulative GPA and ACT scores. More specifically, they find that students' performance on the first exam of the semester is the single most important predictor of performance on subsequent tests in both courses.

Von Allmen (1996) finds that there is a strong relationship between performance in quantitative prerequisites, specifically calculus courses, and performance in intermediate microeconomics. He finds that better grades in calculus lead to significantly better grades in microeconomics. Von Allmen distinguishes between students who have taken a standard one-semester calculus course and those who came in with a weaker math background and took a two-semester calculus course with an integrated review sequence. No significant relationship between these groups and their performance in microeconomics was found, indicating that students with weak skills can be brought up to the level of students with stronger backgrounds. Von Allmen also finds a positive relationship between students' GPA and grades in the basic principles of economics course and their performance in the more advanced microeconomics course.

Borde, Byrd and Modani (1998) research a number of factors including gender, age, transfer status (from community college), GPA, membership in student organizations, hours of employment, and performance in prerequisite accounting courses and look at their relationship to student performance in introductory corporate finance. They find that high performance in accounting prerequisites and a high prior overall GPA are associated with high performance in finance. Also in 1998, Cohn et al look at the relationship between performance in a principles of macroeconomics course and several student attributes, including students' math background as measured by a

mathematics skill pretest given at the beginning of the semester. They found a strong relationship between performance in the macroeconomics course and students' GPA and SAT scores. However, neither the students' completion of a calculus course nor their scores on the math skills pretest have significant effect on performance in the macroeconomics course. The authors suggest that math background may be more important for a microeconomics course.

Marcal and Roberts (2001) investigate whether completing a statistics prerequisite improves student performance in introductory finance. They find that students who have completed the statistics requirement perform better in finance than otherwise identical students. Additionally, they find that while higher statistics grades lead to better performance in finance, students who delay taking finance after completing statistics do not perform as well. Thus, they conclude that students' understanding of statistics fades with time, affecting their performance in the introductory finance course.

Research Question and Methodology

Given that earlier studies have shown that performance in accounting, economics, and finance courses is a function of various prerequisite courses, it seems reasonable to assume that students gain knowledge in these prerequisite courses that helps them succeed in future courses. This study hypothesizes that student performance in the introductory finance course is a function of the knowledge brought to the course from math, accounting, and economics prerequisites.

To test the hypothesis, a pretest was constructed to determine the level of mathematics, accounting, and economics knowledge students have upon entering the introductory finance course. A 25 question multiple choice pretest was administered to students in the introductory finance course on the second day of class. Although the pretest was given by several different instructors to virtually all students taking principles of finance over two semesters, we analyze the results for just 149 students taught by the same professor. In this way, we control for instructor bias in pretest administration and in grading performance in the course. In addition to students' raw scores on the pretest, their current GPA, gender, and year of study were collected. The gender of the students included 74 males (49.6%) and 75 females (50.4%); in terms of year of study, there were 105 sophmores (70.5%), 43 juniors (28.9%), and one senior (0.6%).

Regression models are estimated using the final course grade as the dependent variable; independent variables included pretest scores (total and broken down into math, accounting, and economics), GPA, gender and year of study. All models estimated include GPA, gender, and year of study plus one or more of the various pretest scores. That is, a separate regression model is estimated using the math portion of the pretest score, one using the accounting portion, one using the economics portion, and one using all scores.

The regression models for math, accounting and economics are reported in Tables 1, 2 and 3, respectively. For the math pretest score, the estimated model yields a coefficient of 1.14 (t = 2.71), which is significant at the .05 level (Table 1); for the accounting pretest score, the estimated model yields a coefficient of 0.78 (t = 2.75), which is significant at the .05 level (Table 2); and for the economics pretest score, the estimated model yields a coefficient of 1.12 (t = 1.28), which is *not* significant at the .05 level (Table 3). These results suggest that for each math question answered correctly, there is an estimated increase in the course grade average of 1.1 points (on a scale of 100), while for each accounting question answered correctly, there is an estimated increase in course grade average of .78 points.

Results from re-estimating the model including all three pretest scores are shown in Table 4. In this model, all three pretest score variables yield coefficients that are not significantly different from zero. The coefficients for gender and year of study are not significant, while the coefficient for cumulative GPA is significant. To help explain the conflicting results between the model results using all pretest scores versus the models using each pretest score individually, a fifth model is estimated using the cumulative score for all three pretest variables. These results, shown in Table 5, yield a coefficient on the cumulative pretest score of .616 ($t = 3.33$), which is significant at the .05 level. This suggests that there is a confounding effect among the pretest variables. To examine this possibility, an analysis of the regression variables for multi-collinearity is undertaken, which yields variance inflation factors between 1.0 and 1.5. These results confirm that there is possible multi-collinearity among the pretest variables.

Summary and Conclusions

The results of the analysis conducted in this research suggest that the math and accounting knowledge students bring to the introductory finance course has an impact on their performance in the course. However, economics knowledge appears to not be a factor in predicting course performance. Cumulative GPA is found to have predictive power, while gender and year of study add no explanatory value. However, the possible existence of multi-collinearity among the pretest scores in math, accounting and economics raises doubts about the research results.

These results beg for further analysis on the pretest scores to control for the possible correlation among the variables. Controlling for this correlation may produce more reliable explanatory coefficients.

References

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Table 1. Regression Results for Course Performance as Function of Math Pretest Score

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.668893494					
R Square	0.447418506					
Adjusted R Square	0.431516881					
Standard Error	6.614604689					
Observations	144					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	4	4924.251168	1231.063	28.13665	4.01E-17	
Residual	139	6081.666332	43.753			
Total	143	11005.9175				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	30.99629093	5.252221044	5.901559	2.62E-08	20.61172	41.38087
Gender	-0.61788875	1.154007126	-0.53543	0.593209	-2.89957	1.663788
Class	-0.45442008	1.109632863	-0.40952	0.682786	-2.64836	1.739521
Cumulative GPA	13.80716684	1.595802053	8.65218	1.12E-14	10.65198	16.96235
Math Score	**1.146897047**	**0.422636687**	**2.713671**	0.007497	0.311269	1.982525

Table 2. Regression Results for Course Performance as Function of Accounting Score

SUMMARY OUTPUT						

	Regression Statistics					
Multiple R	0.669482973					
R Square	0.448207451					
Adjusted R Square	0.432328528					
Standard Error	6.609881026					
Observations	144					
ANOVA						
	df	SS	MS	F	Significance F	
Regression	4	4932.934223	1233.234	28.22657	3.64E-17	
Residual	139	6072.983277	43.69053			
Total	143	11005.9175				
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	34.69552432	5.159361408	6.724771	4.21E-10	24.49455	44.8965
Gender	-0.93770603	1.123812774	-0.8344	0.405489	-3.15968	1.284272
Class	-0.43569872	1.109126628	-0.39283	0.695046	-2.62864	1.757242
Cumulative GPA	13.46212828	1.636339242	8.226979	1.24E-13	10.22679	16.69746
Accounting Score	**0.781607648**	**0.284018591**	**2.751959**	0.006714	0.220052	1.343163

Table 3. Regression Results for Course Performance as Function of Econ Pretest Score

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.651888717					
R Square	0.4249589					
Adjusted R Square	0.408410954					
Standard Error	6.747690736					
Observations	144					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	4	4677.062592	1169.266	25.68046	6.08E-16	
Residual	139	6328.854908	45.53133			
Total	143	11005.9175				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	31.6721853	5.503309241	5.755116	5.3E-08	20.79117	42.55321
Gender	-1.62515765	1.127926999	-1.44084	0.15188	-3.85527	0.604954
Class	-0.71167137	1.135117909	-0.62696	0.531715	-2.956	1.532658
Cumulative GPA	14.70677179	1.587760049	9.262591	3.34E-16	11.56749	17.84606
Econ Score	**1.121856523**	**0.874049022**	**1.283517**	0.201447	-0.60629	2.850007

Table 4. Course Performance as Function of Math, Econ and Accounting Pretest Scores

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.679642298					
R Square	0.461913653					
Adjusted R Square	0.438347827					
Standard Error	6.574743727					
Observations	144					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	6	5083.783554	847.2973	19.601	1.978E-16	
Residual	137	5922.133946	43.22726			
Total	143	11005.9175				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	31.31091664	5.523437938	5.668737	8.17E-08	20.388698	42.233135
Gender	-0.5706736	1.156616508	-0.4934	0.622521	-2.857803	1.716456
Class	-0.46962415	1.108876013	-0.42351	0.672585	-2.66235	1.7231019
Cumulative GPA	12.82619774	1.667116049	7.693644	2.53E-12	9.5295905	16.122805
Math Score	**0.772221398**	**0.465758819**	**1.657986**	0.099608	-0.148785	1.6932274
Econ Score	**0.64885115**	**0.866050763**	**0.749207**	0.455017	-1.063705	2.3614069
Accounting Score	**0.523008069**	**0.315066661**	**1.659992**	0.099203	-0.100015	1.1460307

Table 5. Course Performance as Function of Total Pretest Score

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.67922934					
R Square	0.4613525					
Adjusted R Square	0.44585185					
Standard Error	6.53067468					
Observations	144					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	4	5077.607566	1269.402	29.76343	7E-18	
Residual	139	5928.309934	42.64971			
Total	143	11005.9175				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	31.8579751	5.118667566	6.22388	5.37E-09	21.73746	41.97849
Gender	-0.6208169	1.123310794	-0.55267	0.581379	-2.8418	1.600168
Class	-0.4658428	1.095098802	-0.42539	0.671211	-2.63105	1.699362
Cumulative GPA	12.8202905	1.65308173	7.755388	1.7E-12	9.551854	16.08873
Total Pretest Score	**0.61670176**	**0.184685726**	**3.339196**	0.001079	0.251545	0.981858