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# INFLUENCES ON THE PERFORMANCE OF BUSINESS STUDENTS AND THE EFFECTIVENESS OF INTERVENTION MEASURES AT AN URBAN FOUR-YEAR UNIVERSITY

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## ABSTRACT

This study uses the Ordered Logit model with student performance in an introductory accounting course to measure the influence of various factors in business students' performance as measured by academic grades. Data collected from a large urban university is used to identify factors that contribute to academic success. The empirical results reveal that several factors correlate to students' academic success: the individual instructor, total credit hours earned at the current university, cumulative GPA, transfer GPA, ethnicity, and whether they are in their first semester after transferring to the current university. The empirical findings suggest several potential policy recommendations: (i) assign instructors selectively, (ii) provide or more broadly advertise tutoring services, (iii) institute minimum GPA and minimum hour requirements, (iv) offer courses to orient students in their first semester at the university, and (v) use scholarships and other incentives to attract higher GPA transfer students to improve retention and graduation.

***Key Words**:* Ordered Logit model, maximum likelihood, non-normal distribution, urban university, performance, administrative intervention.

**JEL classification codes:** C14; I21; I23

# INTRODUCTION

Empirical evidence indicates that higher education pays financial dividends. Nationally, accounting majors command one of the highest starting salaries in the US. Tinto (2012) reports that, on average, people who go to college and complete a bachelor's degree can earn over one million dollars more during their lifetime than do those who do not go to college. The author stresses that what makes the difference is not merely attending college but completing a degree, especially a four-year degree. In the age of globalization, where the labor market has been internationalized, what also matters in the labor market is academic success as measured by grade point average (GPA). Unacceptably low GPAs may lead to suspensions and possibly dismissals from college, and hence being unable to complete degrees. Low GPAs that nevertheless allow students to complete degrees may result in undesirable employment opportunities and a reduction in lifetime earning potential. These students may also become frustrated and demotivated and subsequently drop out.

Noble and Sawyer (1987), Ting (2001), and Pike and Saupe (2002) show that the academic success and retention of students, particularly during their first year, are major concerns for colleges and universities, as well as for their stakeholders. Academic success and retention of students are also increasingly attached to the academic success of students as a measure of the effectiveness of higher education. Moreover, as articulated by Pascarella and Terenzini (2005) and McLaughlin (2006), this, in addition to the inclusion of underprepared students in the pool of incoming freshmen by many colleges and universities, has intensified the retention concerns of college and university administrators and researchers. Many of these students are granted conditional and special admissions, which often exacerbate retention problems. These concerns continue to challenge researchers exploring student characteristics that contribute to academic success.

Some urban universities specialize in offering undergraduate and selected graduate programs with an open admission or low standard policy. These universities often rely heavily on transfer students from regional junior colleges or other universities to fill their classes, and, as a result, face unique challenges not familiar to traditional research institutions. First of all, they are often located near downtowns of large U.S. metropolitan areas and serve a largely nontraditional student body. Most students work full-time jobs and a significant number of them are married or are heads of families. The average student age is in the mid-twenties or older. A large percentage of the student body is transferred from the surrounding junior colleges, though a few come from other four-year institutions that the students could not afford to attend or could not stay in good academic standing with. These nontraditional urban universities most likely have a more diversified student body within which many different languages are spoken. Most of their colleges are accredited by regional accreditation agencies such as SACS or MSA.

These universities with open (or low standard) admission policies serve many first-generation college students and "second chance" students. Not surprisingly, these students pose some challenges in retention and graduation. These issues have been addressed from many angles, such as evaluating student transcripts to identify their strengths and weaknesses, requiring strong advising services to identify proper courses and course loads, and requiring at risk students to take remedial courses before allowing them to enter programs of their choice. A recent strategy to increase the graduation rate is to offer automatic scholarships to transfer students with high GPAs. The higher the student's GPA, the more scholarship money that student could be awarded. This strategy benefits the university's retention and graduation rates, but does little to address the lower-GPA students the university is dedicated to serve.

Statistically, measures of students' performance, such as grades and intervention activities, are truncated both from below and above. For example, typical grades are A, B, C, D, F, or W (withdraw), while interventions are measure by student participation and participation frequency. The numerical values of these measures are usually discrete and truncated, which renders the conventional econometric procedures inappropriate for identifying the covariates contributing to the students' performances and the effects of administrative interventions. To use any regression model with doubly-truncated and discrete data, the probability density of the dependent variable must be relocated from plus and minus infinity to the range between the upper and the lower limit values.

From another perspective, and in a much narrower focus, are the challenges of the accounting discipline, specifically, to colleges of business. While the research reflected in literature has led to designing and implementing measures that improve the performance of students and that lead to an overall improvement in retention and graduation, the positive effects are not uniform across colleges and majors at a given university. The accounting discipline poses additional challenges for faculty and administrators because of the following characteristics: (i) the quantitative nature of the subject matter, (ii) the strict sequencing of the courses in the program, (iii) in addition to the retaining and graduating of students, the success of an accounting program is also judged by the passing rate of its graduates on the CPA examination. It should be noted that the CPA exams have become more and more challenging, precipitated by the wave of corporate failures in the early 2000s, with WorldCom, Enron, and particularly Arthur Anderson being the most infamous.

In light of the aforementioned, this study utilizes the Ordered Logit model, which can handle qualitative responses to identify factors contributing to student performance and the effectiveness of administrative interventions. The motivation for this investigation is that if social-economic factors, delivery modes, academic status of faculty teaching accounting courses, and/or administrative intervention measures are identified as having positive effects on students' performances, they would be invaluable for informing policy decisions that address these pressing issues. This paper is organized as follows: a brief review of the literature is followed by a description of the methodology used in the investigation, and then the data is presented, along with the empirical results of the study. The final section offers concluding remarks and limitations of the investigation.

## REVIEW OF LITERATURE

There is extensive research on student academic success and persistence, especially among freshmen (Tinto, 1975, 1993; Pike & Saupe, 2002; McLaughlin, 2006; Tracey & Sedlacek, 1989). Tinto (1993) conceptually argues that academic performance and persistence are impacted by student characteristics that are measured by levels of academic preparation in high school and college admissions test scores. This underlying assumption may explain why the College Admission Index is based, for the most part, on cognitive measures. McLaughlin (2006) White and Sedlacek (1986), Tracey and Sedlacek (1989), and Boyer and Sedlacek (1988) have confirmed that cognitive variables, such as high school GPA, high school percentile rank and college admission test scores, predict the academic success of college students.

The search for factors associated with university students' academic success by Trockel, Barnes, and Egget (2000) has stimulated keen interest and spawned a large number of empirical studies in recent decades. Cumulative GPA is a frequently used measure of academic success. George, Dixon, Stansal, Gelb, and Pheri (2008) argued that the purpose of education also extends to personal and professional achievement. Therefore, researchers conducting studies of this nature must also include subjective measures of personal success. Consequently, George et al., (2008) duplicate certain aspects of research by Trockel, et al., (2000) who used GPA as their standard of success and a variety of physical and mental health criteria as predictors. Also, these authors argued that Trockel et al. (2000) involved a mail-in survey that included self-reports of exercise, eating patterns, sleep habits, mood states, perceived stress, time-management skills, social support, and others, they asked participants to maintain a time diary of daily activities and answer a questionnaire with additional exploratory variables. Furthermore, George et al. (2008) used an expanded measure of success that includes both objective (GPA) and subjective (personal success) measures. To minimize social desirability biases and increase objectivity, they also analyzed assessments of certain questionnaire items by a friend of each participant.

Empirically, George et al., (2008) found the following seven significant predictors of GPA: (i) time-management skills, (ii) intelligence, (iii) time spent studying, (iv) early wake-up times, (v) computer ownership; (vi) less time spent in passive leisure; and (vii) a healthy diet. Adebayo (2008) empirically found one cognitive variable—high school GPA, and two non-cognitive measures—realistic self-appraisal and understanding and coping with racism; to be the best predictors of academic success for conditionally admitted students during their first semester. Adebayo (2008) indicates that high school GPA, which accounted for 14 percent of the variance in the first semester GPA of the cohort, is a stronger predictor of first semester GPA of conditionally admitted students. Realistic Self-Appraisal is defined as the ability of students to reflect from a realist self-appraisal system to modify their behavior. Understanding and coping with racism is defined as the ability of students to understand their positions in a multicultural society and cope effectively with racism.

## METHODOLOGY

Among the members of the class of the logistic regression models, the Ordered Logit model is more appropriate for handling the aforementioned truncation and non-normal distribution. The general objective of the analysis is to construct a probability model that links the changes in a set or a 1xn vector of independent variables or covariates to the probability of an outcome. Following Greene (2012), this study specifies equation (1) as the basis condition to construct the Ordered Logit model, where $y^*$ is an unobservable dependent variable relating to the vector of covariates *x's* as follows:

$$y^* = x'\beta + \varepsilon \tag{1}$$

What we do observe is

$$\begin{aligned}
y_i &= 0 \text{ if } \quad y_i^* \le 0 \\
y_i &= 1 \text{ if } \quad 0 < y_i^* \le \mu_1 \\
y_i &= 1 \text{ if } \quad \mu_1 < y_i^* \le \mu_2 \\
&\dots \\
y_i &= J \text{ if } \quad \mu_{J-1} \le y^*
\end{aligned}$$

which is a form of censoring. $\mu$'s are the *J-1* unknown parameters to be estimated with $\beta$

$$\begin{aligned}
&\Pr(y_i = 0 \mid x, \beta, \mu) = \varphi(-x'\beta) \\
&\Pr(y_i = 1 \mid x, \beta, \mu) = \varphi(\mu_1 - x'\beta) - \varphi(-x'\beta) \\
&\Pr(y_i = 2 \mid x, \beta, \mu) = \varphi(\mu_2 - x'\beta) - \varphi(\mu_1 - x'\beta) \\
&\ldots \\
&\Pr(y_i = J \mid x, \beta, \mu) = 1 - \varphi(\mu_{J-1} - x'\beta)
\end{aligned} \tag{3}$$

Finally, for all the probabilities to be positive, the $\mu's$ must satisfy the following condition:

$$0 < \mu_1 < \mu_2 < \ldots < \mu_{J-1}$$

Econometrically, equation (1) specifies how a vector of factors, *x*, influences the students' performances. The log-likelihood function, denoted by $Ln(\beta, \mu)$, of this model can be expressed as:

$$Ln(\beta, \mu) = \sum_{i=1}^{I} \sum_{j=0}^{J} \log[\Pr(y_i = j \mid x_i, \beta, \mu)].\zeta(y_i = j) \tag{4}$$

where $\zeta(y_i = j)$ is an indication function which takes the value of 1 if the argument is true, and 0 if the argument is false. This model can be used to estimate the coefficient vector $\beta$ of the covariates or independent variables *x* and the threshold values of $\mu$'s. The Ordered Logit model is the standard approach to modeling a dependent variable that displays a large cluster of limit values and under a variety of assumptions about the latent error distribution; therefore, it is an appropriate model to describe the influences of the demographic and other characteristics of students on their qualitative earning grades which range from A, B, C, D, F and W that are quantitatively indexed, as well as to assess interventions to address the aforementioned challenges posed by the accounting discipline to the colleges of business.

Additionally, partially differentiating the system of equations (4), with respect to the covariate vector *x*, yields the system of partial derivatives (5). The system of equations (5) describes the marginal impacts of the covariates or the regressors *x* on the probabilities *y* and *y**.

$$\begin{aligned}
&\frac{\partial \Pr(y_i = 0 \mid x, \beta, \mu)}{\partial x} = -\varphi(x'\beta)\beta \\
&\frac{\partial \Pr(y_i = 1 \mid x, \beta, \mu)}{\partial x} = [\varphi(-x'\beta) - \varphi(\mu_1 - x'\beta)]\beta \\
&\frac{\partial \Pr(y_i = 2 \mid x, \beta, \mu)}{\partial x} = [\varphi(\mu_1 - x'\beta) - \varphi(\mu_2 - x'\beta)]\beta \\
&\frac{\partial \Pr(y_i = 3 \mid x, \beta, \mu)}{\partial x} = [\varphi(\mu_2 - x'\beta) - \varphi(\mu_3 - x'\beta)]\beta \\
&\frac{\partial \Pr(y_i = J \mid x, \beta, \mu)}{\partial x} = \varphi(\mu_{J-1} - x'\beta)\beta
\end{aligned} \tag{5}$$

Mathematically, the system of equations (5) indicates that the partial or the marginal effects of the regressors *x*, i.e., the effect of changing an arbitrary element $x_k$ of the vector *x*, ceteris paribus, on the probabilities are not equal to the coefficients. As diagrammatically illustrated by Green (2012), an increase in any arbitrary element $x_k$ of covariate vector *x*, ceteris paribus, is equivalent to shifting the distribution slightly to the right within the range of the probability density function (pdf). The effect of the shift is unambiguously to shift some density mass out of the leftmost cell of under the graph of the pdf.

Additionally, if the estimated corresponding coefficient of $x_k$, $\beta_k$ — an element of the vector $\beta$ — is positive, the $\Pr(y_i = 0 \mid x, \beta, \mu)$ must decline. To this end, Green (2012) pointed out that the first expression in the system of equations (5) indicates that the derivatives of $\Pr(y_i = 0 \mid x, \beta, \mu)$ have the opposite sign of $\beta_k$. By a similar logic, the last expression of the system of equations (5) shows that $\Pr(y_i = J \mid x, \beta, \mu)$ must have the same sign as $\beta$. More specifically, if $\beta_k$ is positive, the marginal effect of the element $x_k$ must shift some density mass into the rightmost cell under the graph of the pdf. However, analyses of the remainder of the equations of the system of equations (5) reveal that the marginal effect of the arbitrary element $x_k$ of the covariate vector $x$ on any other cell in the middle is ambiguous, i.e., only the signs of the changes in $\Pr(y_i = 0 \mid x, \beta, \mu)$ and $\Pr(y_i = J \mid x, \beta, \mu)$ are unambiguous. The marginal effect on any other cell in the middle depends on the two densities.

The upshot of the aforementioned, in general, is that it is unclear how the coefficients in the Ordered Logit model should be interpreted. However, if the objective of the empirical investigation is to determine the impacts of certain covariates on the probabilities $y$ and $y^*$, then their corresponding estimated coefficients (the elements of $\beta$), their signs and the characteristics of the covariates would provide sufficient information to satisfy the objective. As an example, if the objective is to investigate the possible differences in students' performances between face-to-face and hybrid courses, the hybrid and face-to-face courses are numerically indexed as 0's and 1's respectively, and the estimated coefficient of this covariate is positive and significant; then, it is logical to suggest that there are differences in students' performances between the two delivery modes and students in face-to-face courses seem to perform better, ceteris paribus.

## DATA AND EMPIRICAL RESULTS

This study uses the 2014 cohort of Accounting 2302 students' data collected by a large urban university serving the minority and Hispanic student body with the students' identifications encrypted. The database structure with many data fields of this data set is designed and maintained by the information system that this particular university uses for students' records and information management. This data set recorded some demographic characteristics and some performing measures of students in fall of 2013 and spring of 2014, supplemented by tracking data on whether and how many times a particular student in the cohort came to the accounting tutoring lab, as recorded by the Finance, Accounting, and Computer Information Systems Department. The data set consists of complete information on 178 students.

One of the most challenging obstacles for this type of study is the availability of the data. The unavailability of such data may be due to its protected nature or to not being collected at all. The data set used in this analysis is challenging in different aspects since it not only it has many missing values for each student, but also the missing values are different for different students. For the sample of 178 students used in this analysis, only the following common characteristics are available: the course grade earned by the student (A, B, C, D, F, and W), the academic status of the instructor (adjunct, lecturer, tenured/tenure track), the age, gender and ethnicity of the student, whether the student has declared a major in a business discipline, the number of the current university's credit hours earned by the student, the total hours attempted by the student at the current university, the student's GPA at the current university prior to enrolling in Accounting 2302, the total hours attempted by the student at the institution(s) the student transferred from, the number of credit hours that a student earned (and are accepted by the current university) from other institution(s) before attending the current university, the student's GPA upon transferring, whether he or she is a transfer student in his or her first semester at the current university, the number of credit hours a student enrolls in, the student's class standing, whether the student is in college for the first time, is fulltime/part time, is a junior or senior (upper level student), is a Pell Grant recipient, and the frequency with which the student came to the accounting tutoring lab.

To index the ordered qualitative covariates, student grades that are quantitatively indexed, such as A, B, C and all other grades, are indexed 3, 2, 1 and 0, respectively. These quantitative values are used as the dependent variable of the Ordered Logit model. Student ethnicities were indexed to numerical values from 1 to 5: White =1, Black = 2, Hispanic=3, Asian = 4, other = 5. A student with a declared business major is assigned a value of 1, and otherwise the value of 0. Seven instructors taught these accounting courses over the sample period, and their academic statuses ranged from adjunct to tenured professors. Each instructor in each category was randomly assigned a numerical value to the dummy variable according to the orders of their last names, starting with the adjunct instructor, lecturers, and then tenured professors. Thus, the adjunct instructor whose last name appears first among those with last names beginning with the alphabet "A" would be assigned the numerical value of 1; the next adjunct instructor would be assigned the value of 2. Consequently, the dummy variable in this sample has the numerical values ranging from 1 to 7. The scores on Math 1301 assume the value of 4, 3, 2, 1, and 0; corresponding to the alphabetical grades of A, B, C, D, and F. The estimation results of the Ordered Logit model using the aforementioned data set are summarized in Table 1. Over all, the empirical results reveal the goodness of fit as evidenced by the log likelihood ratio statistic, Akaike information criterion, and Schwarz information criterion.

**Table 1**
***Relevant Statistics of Covariates***

| Covariate | | Est. coef. | *Std. Error* | *z-statistic* | Pr. > \|*z*\| |
|---|---|---|---|---|---|
| **Enrollment** | | -0.025473 | 0.017676 | -1.441104 | 0.1496 |
| **Academic status of instructor** | | -0.497796 | 0.299554 | -1.661789 | **0.0966** |
| **Visiting the accounting lab** | | 0.419596 | 0.576760 | 0.727505 | 0.4669 |
| **Times visiting the accounting lab** | | -0.041481 | 0.222903 | -0.186096 | 0.8524 |
| **Age** | | -0.031244 | 0.030083 | -1.038591 | 0.2990 |
| **Declared business major** | | -0.076977 | 0.361007 | -0.213229 | 0.8311 |
| **Total attempted hours at current univ.** | | -0.039609 | 0.025186 | -1.572683 | 0.1158 |
| **Total attempted transfer hours** | | 0.007979 | 0.007853 | 1.016067 | 0.3096 |
| **Total credit hours earned at current univ.** | | 0.065192 | 0.031336 | 2.080437 | **0.0375** |
| **GPA at current university** | | 1.344557 | 0.345862 | 3.887555 | **0.0001** |
| **Transferred GPA** | | 0.487933 | 0.197738 | 2.467572 | **0.0136** |
| **First time in college** | | -0.261076 | 0.631013 | -0.413741 | 0.6791 |
| **Pell Grant recipient** | | -0.121726 | 0.334158 | -0.364278 | 0.7157 |
| **Gender** | | -0.003383 | 0.310689 | -0.010889 | 0.9913 |
| **Class standing** | | -0.144282 | 0.470962 | -0.306355 | 0.7593 |
| **Ethnicity** | | -0.214120 | 0.129975 | -1.647396 | **0.0995** |
| **Credit hours enrolled in Fall 2012** | | -0.077549 | 0.098528 | -0.787079 | 0.4312 |
| **Full time/part time** | | -0.170420 | 0.599394 | -0.284320 | 0.7762 |
| **First semester at current univ. as transfer** | | 3.761020 | 1.073427 | 3.503749 | **0.0005** |
| **Upper level students** | | 0.009900 | 0.643965 | 0.015374 | 0.9877 |
| ***Estimates of*** $\mu's$ | $\mu_1$ | 0.118781 | 2.144769 | 0.055382 | 0.9558 |
| | $\mu_2$ | 1.214754 | 2.144777 | 0.566378 | 0.5711 |
| | $\mu_3$ | 2.704745 | 2.159223 | 1.252648 | 0.2103 |
| ***Statistics*** | Akaike information criterion | | | 2.5737 | |
| | Schwarz information criterion | | | 2.9880 | |
| | Log likelihood | | | -203.4858 | |
| | Log likelihood ratio statistic | | | 49.2549 | |
| | Prob. (Log likelihood ratio statistic) | | | 0.0002 | |

***Note:*** z-statistic tests for the significance of the corresponding estimated coefficient. *Pr.>|z| is the p-value.*

A closer examination of the empirical results shows that, based on the z-statistics and their p-values, the estimated coefficients for the academic status of the instructors, total credit hours earned at the current university, students' GPA at the current university, students' transferred GPA, students' ethnicity, whether he/she is in the first semester at the current university as transfer student, all have significant impact on performance.

# CONCLUDING REMARKS AND LIMITATIONS

There is no question that higher education pays. The underlying assumption of this articulation is that one must successfully complete a degree. Tinto (2012) revealed that, on average, people who go to college and complete a bachelor's degree earn over one million dollars more during their lifetime than those who do not go to college. Clearly, to succeed academically, students must pass every course they attempt. To this end, the empirical results of this investigation indicated that the status of the instructors, the course delivery modes, the declaration of a business major, and the GPA at the time they take the Accounting 2302, all correlate to students' grades in this course.

By and large, accounting majors command the highest average starting salary among the business majors. Accounting 2302 is the second course of the two introductory accounting courses in the degree sequence. Successful completion these two courses is a necessary condition for an accounting degree. Additionally, retention and graduation are two of the most important criteria to evaluate the effectiveness of large urban four-year universities with selected graduate programs pursuing an open admission or low standard policy and accepting transferred students from other universities and junior colleges by their stake holders. The empirical results suggest the following measures to retain and graduate accounting majors:

1) Selectively assign instructors

Instructor quality significantly contributes to student success in this class, and student success in this course would likely help enrollment numbers in the program in the near future. Thus, the department may want to be selective in the assignment of instructors to Accounting 2302 classes.

2) Minimum GPA requirements/high-GPA students

Student transfer GPA is predictive of the grade in this course. This empirical finding lends credence to the idea that GPA is a very accurate predictor of student performance. Therefore, colleges and universities with a large proportion of transfer students could use their available incentives to attract high-GPA students. Additionally, the fact that student GPAs significantly affect their grades in this course suggests that the department might impose a minimum GPA requirement before students can take Accounting 2302 to improve their retention and graduation. At the very least, students below a certain GPA could be monitored and targeted for remediation efforts before the rigors of the course cause them to fall behind.

3) Minimum credit hour requirements

The empirical evidence suggests that the number of credit hours earned at the current university has the largest impact on student outcomes in this course. Therefore, universities could require a certain number of credit hours be earned post-transfer before allowing a student to enroll in the course. If that measure is impractical, then universities could identify students having few earned credit hours and monitor them for remediation.

4) Offer introductory courses

Students of different ethnicities have different cultures; therefore their behaviors and expectations during a college education may differ. Along the same lines, it is interesting that whether a student is in the first semester at the current university as a transfer student affects their grade in Accounting 2302. Both of these truths lend weight to the idea of introductory university seminar courses as an interventional instrument to retain and graduate students.

5) Tutoring lab improvements

The empirical results indicate that a tutoring lab as the interventional instrument does not yield the desired results, in that it is not a significant factor in student performance. However, this finding might be attributed to a lack of awareness among non-traditional students about tutoring lab services or the ability of students who are employed full time to take advantage of the program due to the limited service hours of the lab. Broader advertisement, more service hours and online tutoring sessions may help improve the effectiveness of this interventional instrument by ensuring that the students who would benefit from it the most actually use it.

As always, there are limitations to any empirical investigation due to the unavailability of pertinent data, and this study is no exception. For nontraditional student populations, social-economic statuses (income, working hours, marital status, family size, etc.) could affect their performances at school. Unfortunately, due to the unavailability of pertinent data, some of these factors could not be incorporated into this investigation. This study was performed entirely on a population from a single urban university's accounting program, which limited the dataset and confined the observations to the needs and behaviors of that population.

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