Early Core Curriculum Outcomes in the Lindquist Business School and their Subsequent Effects on Graduation

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Professor William Harbaugh

Abstract

The University of Oregon has 16% of students enrolled in either Pre Business Administration or Business Administration. Students within this major have a graduation rate of 34.4% within 6 years compared to 66% for the rest of the student population. This study was aimed to find what courses within the Lindquist School of Business cause students to drop out or switch majors. We identify the roadblock-courses as BA101, WR 121-123, MATH241-243, EC 201-202, ACTG211, ACTG213, and . The biggest impact on graduation rates came from student's scores in their introductory courses. BA 101, MATH 243, WR121. Further analysis showed that HS GPA, SAT V and SAT M have a significant impact on course grades. After controlling for these variables, we still find roadblock courses have a negative effect on a student's graduation. Our analysis shows that HS GPA is a slightly better indicator. We also show that a student's introductory teacher had a significant impact on a student's graduation. We recommend the University implement a stronger advising program that can identify low-success first and second year students and guide them back on track to graduation.

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Introduction

The University of Oregon has 16% of all students majoring in Pre-Business Administration or Business Administration. Students seeking entry into this program require a 3.0 GPA, completion of 6 core courses, and 90 college credits. These requirements are put in place to pre-select successful students.

Business majors take a variety of courses within their upper-division work. These courses include BA 352 Leadership & Communication, MKTG 311 Marketing Management, FIN 311 Economic Foundations of Competitive Analysis, FIN 316 Financial Management, MGMT 321 Managing Organizations, BE 325 Global, Legal, and Social Environment of Business, OBA 330 Business Statistics, OBA 335 Operations Management, OBA 340 Business Information Systems, and BA 453 Business Strategy and Planning. These courses all have prereqs in basic skills such as reading, writing and math. Without mastery of these basic skills, students struggle to succeed. An example is class MATH 243 which has a prerequisite of MATH 111. Although a C in MATH 111 is enough for a student to continue on into MATH 243, this may not set a student up for success in the given major. Instead if students can be identified through previous SAT scores, HS GPA and transcript data, counselors can push a student to go into a different major that they are better suited for.

Our research also examines the effects different teachers have on a student. Teachers have a great amount of influence over a student's ability to succeed. Students who fail early on in courses may have had a teacher who was not suited for them. Research shows that females who take a course with a female teacher often have improved scores. (Dee 2007) Likewise males who take courses with a male teacher often have improved scores as well. We note a small effect

within our data that supports this idea. This research is secondary, but may be a gateway to future projects on teacher effects in College.

This paper aims to analyze the effects of core course outcomes have graduation rates. The University of Oregon has provided us with data on the past 10 years of students in the Lindquist School of Business. We will begin by discussing past literature on core curriculum outcomes in other colleges and their subsequent effects on the student. Next we will analyze the data based on individual classes and their subsequent effects on graduation are. With our analysis, we plan to run a regression to test all classes and identify which class is the most important for Business majors to excel in. We further plan to separate first year and second year courses. This will help develop a timeline so students understand which courses to focus on. Next we will identify student background effects on course grades. These variables will include SATs, HS GPA, international students, transfer students, gender, and resident students. Including these will help explain the effects of our roadblock courses. We will include in our regressions the graduation time to see course grade effects on graduation. Lastly we will investigate the effect of teacher's on student's grades.

Literature Review

All universities set a core curriculum. This core curriculum usually includes a general math, science, writing, and/or history. These core courses are often set in place because they provide the basic toolsets to succeed in college. However how strong they are as tools depends on how well they've been understood. Take for example a student in the Business major. In their first year, they would be expected to take basic algebra. This would give the student an understanding of functions, polynomials, factoring and linear equations—foundational skills necessary for courses such as Business Calculus or Business Statistics. Now the student several different course outcomes possible which are A, B, C, D, F or Withdraw. If that student received an F their first attempt and then on their second time passed with a C, there would be evidence to say that the student will have trouble passing Business Statistics. This is because students who don't master foundational skills have trouble continuing on in subsequent classes. What's more is there may be a correlation between a student's outcome in basic algebra and their likelihood of graduating. Our aim in this paper is to determine if there is a correlation between core course outcomes and a student's success rate within the Business Major and then, with enough evidence, create an indicator system for students to know whether they're on track for success within their major.

Our first step is identifying key Business Courses that would have an impact on a student's success. At the University of Oregon, there is a set of mandated courses required for a student to graduate. These courses include Math 111-112, Math 241-243, BA 101, Writing 121-122 (123), EC 201-202, ACTG 211, ACTG 213, (with some exception; Math 241-242 can be substituted for Math 251-252). Each of these courses is a keystone for a student's progress. The 100 level courses would be indicators to Freshmen as the 200 level would be indicators for

Sophomores. However we have yet to see identify what outcomes serve as an indicator that a student will not graduate and what indicates success. Below are some previous literature on introductory course outcomes and their impact on graduation as well as specific course outcome effects on graduation that can help identify these effects.

BA 101 is an introductory course to the Business major. It is the first sequence taken by Business major to get into the major. Although we have not found literature on introductory business, there is a study done on an introductory Psychology course and its subsequent effects.

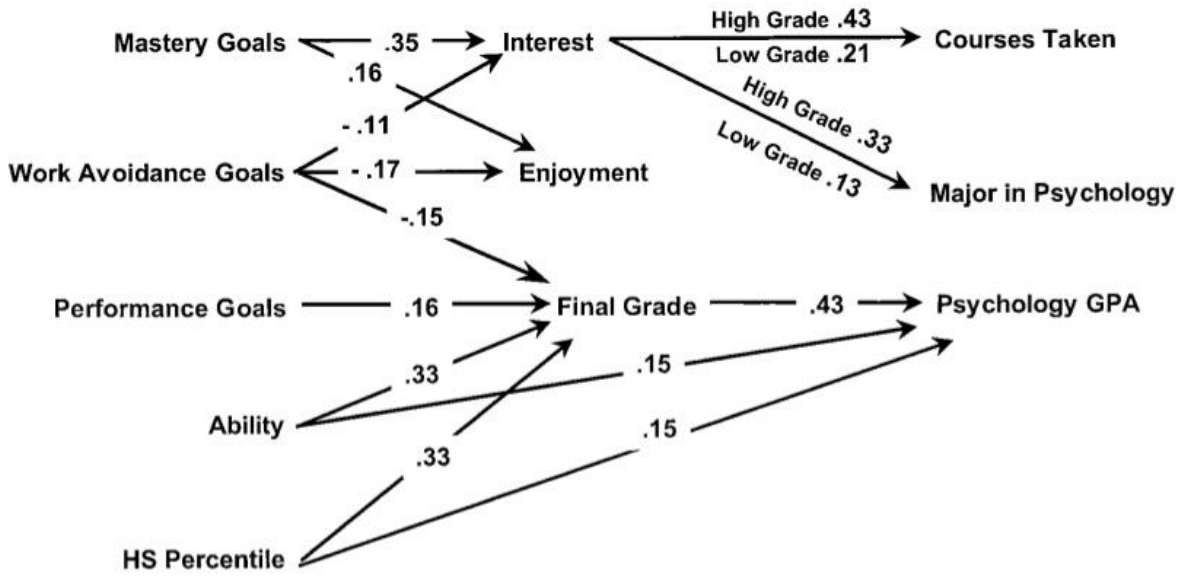
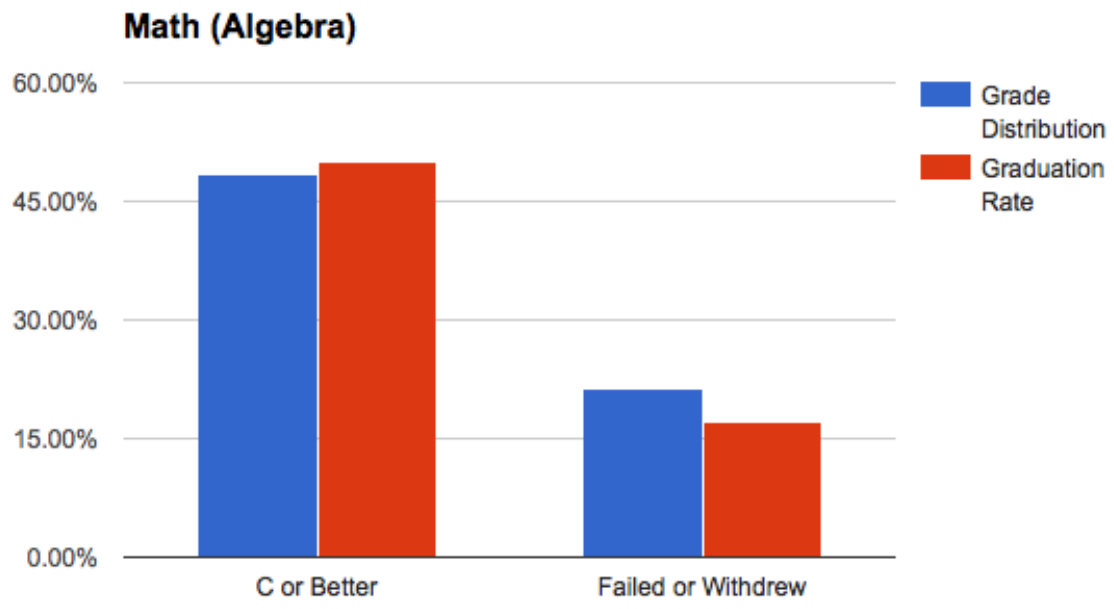


Figure 4. Direct, indirect, and mediated effects on the long-term psychology-relevant outcomes. For clarity of presentation, significant gender, instructor, and missing-data code effects are not shown. The paths with two coefficients indicate that the significant effect of interest was qualified by interactions with final grade such that the effect of interest on courses taken was stronger for students with higher grades in Introductory Psychology (β = .43) than it was for students with lower grades (β = .21). Similarly, the effect of interest on major was stronger for students with higher grades in Introductory Psychology (β = .33) than it was for students with lower grades (β = .13). HS = high school.

In this study, Harackiewicz (2002), the initial introductory course outcome had a high correlation with the overall major GPA. This would suggest that students who initially perform well in an introductory course have both the demonstrated skills and effort to continue the path and overall graduate in the major. What's more is that the course outcome had more significance than SAT scores (what ability was measured by) and HS Percentile. This would also suggest that there may

be a certain aptitude for different majors and this aptitude influences a student's success in that given major. This study motivates our hypotheses that performance in specific intro level Business courses and prereqs may be good predictors of success as a Business major.

Another core class within the Business major is math. Math is important to the development of a student as shown in Nora (2005).



An introductory course grade of passing or better seems to correlate to a high likelihood of graduation. We can also gather that there is much the same for those who failed; it often implied that the student wouldn't go on to graduate even if students retook the course. There has been an increasing amount of research done on student's and their math scores, however within our field of interest, Business, there has been a strong link between a student's success and math. One study (Ballard 2004) demonstrated that with increased mathematical skills, students scored

higher within an Introductory Economics course. Within this table, the t-statistic for math-quiz score, ACT Math score, Calculus, and Remedial Math course were the highest correlated to the student's grade. Furthermore, they demonstrated within the study that students who received less than 50% on a class assessment of algebra were highly unlikely to receive a C or better within the course. What this implies for us is that math is a core concept to Economics and since Economics is a core course to earning a Business degree, we may find graduation rates highly depend on previous math ability as measured by math grades within collegiate courses.

TABLE 4. Regression Results (Dependent Variable = Percentage Correct)

	All students		All but first-semester freshmen	
Variable	Coefficient	*t* statistic[a]	Coefficient	*t* statistic[a]
Male	1.76	2.77***	1.82	2.61***
Class[a]				
Sophomore	3.21	1.85*	3.12	1.78*
Junior	4.43	2.43**	4.30	2.32**
Senior	2.88	1.26	3.10	1.35
Other	15.41	4.07***	15.83	4.12***
Race[b]				
Hispanic	–0.41	–0.16	–0.87	–0.44
Black	–1.75	–0.98	1.13	0.38
Asian/Pacific Islander	1.17	0.90	1.74	1.16
Other	0.07	0.03	0.87	0.37
Hours worked at paid job per week	–0.10	–3.06***	–0.11	–3.05***
Hours in activities (incl. sports)	–0.08	–1.67*	–0.04	–0.80
Hours study per week	0.11	3.10***	0.09	2.03**
Economics in high school	–0.38	–0.62	–0.27	–0.38
Micro principles taken before	1.21	0.75	0.85	0.50
Taken macro principles	–0.91	–2.28**	–0.92	–2.22**
GPA[c]			3.75	12.33***
GPA 1.99 or less				
GPA 2.0–2.49				
GPA 2.5–2.99				
GPA 3.0–3.49				
GPA 3.5–4.0				
Required for major	0.11	0.23	0.22	0.38
Calculus taken	2.83	3.99***	3.08	3.95***
Remedial math course required	–1.59	–2.02**	–1.74	–2.05**
Math-quiz score	0.72	3.66***	0.63	2.95***
ACT math score	0.58	5.26***	0.51	4.17***
ACT English score	0.26	3.04***	0.26	2.45***
Took course in 1999	0.86	1.41	1.00	1.64*
Constant	40.89		23.81	
R^2	0.2919		0.2905	

Note. Significance levels are indicated as * $p = .10$; ** $p = .05$; and *** $p = .01$.
[a]In the regressions for all students (on the left side of the table), the reference category is freshmen (who do not yet have a college GPA). In the nonfreshman sample, the reference category is second-semester freshmen (who have a college GPA).
[b]The reference category is white.
[c]In the regressions for nonfreshmen (on the right side of the table), every student has a value for GPA. However, in the regressions for all students (on the left side of the table), a substantial number are first-semester freshmen, who do not yet have a GPA. Therefore, in these regressions, we employed a set of dummy variables, in which the excluded category is first-semester freshmen.

There are six grade marks, three of them (D, F or withdraw) hold the student back until they can get a better grasp at the concepts in the course. Repeating courses is a benefit to students, allowing them the option to continue on in college when they face difficult courses. However, there is an added challenge that if a student cannot pass a rudimentary course, then there will be a continued difficulty in passing advanced courses within that subject. A study at Sacremento State (IR 2009) shed some light on what this might mean for a student. Students who reported no repeats had a graduation rate of 44.6%. Students who reported 1-3 repeats however had a slight decrease in their graduation rate by 0.1%. However students who reported more than 3 repeats dropped significantly to a 36.8%

graduation rate. The study would indicate that students who repeat more than 3 courses should be identified to be at risk of not graduating.

With our literature review, we have an introduction into the courses and their course outcome effects for the Business major. We have seen that introductory course grades matter within Psychology and we expect that this trend should continue in Business. Next we're seeing that math ability correlates directly to an introductory Economics course grade and that students with strong math abilities should correlate to higher success in the Business major. Another note about the Psychology study is that graduation rates could be highly correlated with initial college course outcomes. We will try to add to this literature by showing which keystone courses can identify a successful Business major and if there are other variables at play.

Hypothesis

Pre-Business majors need a total of 11 courses to apply as a Business major. We have grouped those courses by major into is there is a Math requirement of 3 courses, a Writing requirement of 2 courses, and a Business requirement of 6 courses. Within the Business requirement we have a sub requirement of Economics with 2 courses, Accounting with 2 courses and General Business with 2 courses. Each course serves a purpose in preparing students for advanced Business classes. However our hypothesis is two part. First introductory Business courses such as BA101 will be the most effective indicator of a successful Business student. Second, math courses such as MATH241-243 will be the second best indicator of a student's academic success in the Business school.

Introductory major courses require very basic levels of math, reading and writing skills. We believe that higher levels of math, reading and writing skills help a student's grade, but don't capture everything needed to identify success. Rather there is an aptitude for any given major that isn't captured. This aptitude is shown as a student's interest in the major and his work ethic within the course. This argument comes from the study on Psychology students and their introductory courses don by Harackiewicz (2002). From this study we see that an introductory course grade is 66 percent dependent on previous ability. However, 15 percent is also dependent on the student's performance goal. This is measured by a questionnaire in Harackiewicz (2002) that identified a student's desire for higher education, parent's education and previous work. This was used to identify how motivated a student was coming into college. The course also accounted for 44 percent of a student's end grade result. This study shows that where a student starts academically seems to show where they will go. We believe the same result will be seen in this study as well.

Our next highlight course is math. Literature shows that math is a leading factor of a student's academic success. (Rose 2001) We've further found that Economic class grades depend highly on Math scores (Ballard 2004) which would lead us to believe that Business would be highly correlated to Math as well. Since higher level Business courses depend on statistics and calculus, a student's understanding of these can severely hurt or help a student succeed. Our theory is that with higher math skills, a student will have a higher chance of succeeding.

Business majors' success will depend on math and introductory coursework. We will evaluate their effects, respectively, through individual regressions and plan to identify an effect in relative terms compared to others. Our hope is to see that these courses represent the greatest effect in comparison of other courses. Additionally we hope to see other significance in gender, resident, and international variables. These variables when accounted for separately will give us a better picture of not only each individual classes impact, but on what other factors contribute to a student's success in Business.

Data Description

Data provided for this research project came from the University of Oregon and contains information about student academics and backgrounds. The data is a 10 year population of Pre-Journalism/Pre-Business Majors from Fall of 2005 to Fall of 2015. All variables are explained in the tables below. Our population contained 11,780 students with 88,280 classes these students took. Courses provided for pre-Business majors provided were BA 101, EC 201, EC 202, ACTG 211, ACTG 213, MATH 241, MATH 242, MATH 243, WR 121, WR 122, WR 123, BA 240. Courses provided for Pre-Journalism Majors were J100, J101, J201, WR 121, WR 122, and WR123. Unfortunately out of the 11780 students, we only identified 6000 business students and 2080 journalism students since the dataset was provided combined.

A note on the summary statistics (College Board). The average SAT M/V combined score is 1080. The population here shows a mean of 1090 which shows little difference. However for the ACT, the combined score is a 24. The average is a 20 nationally which is the difference between the 70th and 50th percentile. Further research will investigate the significant difference in scores between ACT and SAT.

Our data came incomplete with missing variables in HS GPA, SATM, SATV, ACTM, and ACTE. Of the students, 64 were missing HS GPA, SAT M, SAT V, ACT E, and ACT M (these were mainly international students) and 1466 were missing SAT M, SAT V, ACT E and ACT M (mainly international students again). This data is important to our regression so we used future academic scores to predict their HSGPA and SAT scores. Through normal distributions we calculated the average score and the standard deviation. We estimated HS GPA's by converting Cumulative GPA's over. Then we used calculated and given SAT's to calculate missing HS GPA values. Lastly we took all the HS GPA's and converted them to

SATV and SATM. Then we converted all ACTM and ACTE to SATM and SATV as well. Our calculation of grad time was based on entry term and graduation term. Lastly in our analysis, students who were in the class 2013 or above were removed from the regression due to their unknown status (graduated, enrolled or withdrawn).

Name	Type	Notes
ID	number(8)	Random identifier
TERM_ADM	char(6)	Admit term as a degree-seeking UG
GENDER	char(1)	Gender (F/M/N/blank)
ETHN	char(1)	Federal ethnicity code (see lookup tab)
BIRTH_YR	char(4)	Year of birth
HSGPA	number(10,6)	High School GPA (raw - not necessarily 0-4 scale)
SATM	number(3)	SAT Math
SATV	number(3)	SAT Verbal
ACTM	number(2)	ACT Math
ACTE	number(2)	ACT English
STYPE	char(1)	Student type (see lookup tab) at time of UG admission
RES	char(1)	Residency (N/R) at time of UG admission
INTL	char(1)	International Flag (Y/blank) at time of UG admission
TERM_GRAD	char(6)	Graduation (UG) term
GRAD_MAJOR1	char(4)	Degree major 1
GRAD_MAJOR2	char(4)	Degree major 2
GRAD_MAJOR3	char(4)	Degree major 3

Name	Type	Notes
ID	number(8)	Random identifier
TERM	char(6)	Transcript term
SUBJ	char(4)	Subject Code
COURSE	char(5)	Course Number
CRN	char(5)	Course Reference Number
INSTRUCTOR	char(180)	
GRADE	char(3)	
MAJOR1	char(4)	Major 1 during term of course
MAJOR2	char(4)	Major 2 during term of course
MAJOR3	char(4)	Major 3 during term of course
CUM_GPA	number(6,2)	Cumulative GPA through term prior to course

Term codes are based on the year of the fall term for the academic year:	
199501	Fall 95

199502	Winter 96					
199503	Spring 96					
199504	Summer 96					

Federal Ethnic Code	Federal Ethnic Description
1	Hispanic or Latino
2	American Indian or Alaska Native
3	Asian
4	Black or African American
5	Native Hawaiian or Other Pacific Islander
6	White
7	Two or more races
8	Nonresident alien
9	Race and ethnicity unknown

Student Type Code	Student Type Desc
0	GED
1	From High School 0 Transfer Hr
2	From Hi Sch w/Transfer Hrs

Codes	Description
Stype1	Student type based on transfer hours (1=student w/ transfer hours, 0=student w/o transfer hours)
Busgrad	Dummy variable based on Business Graduation
Gradtime	Amount of time needed to graduate

BA101Instructor	BA101 course grade dependent on Instructor

Summary of Data

. summarize

Variable	Obs	Mean	Std. Dev.	Min	Max
id	11,780	5890.5	3400.737	1	11780
term_adm	11,780	201038.5	310.5728	200501	201501
gender	0				
ethn	11,780	5.833531	1.757633	1	9
birth_yr	11,780	1991.878	3.192466	1967	1998
hsgpa	11,682	3.517468	.3272561	1.63	4.74
satm	8,541	555.6141	79.08752	240	800
satv	8,541	539.4989	82.49296	200	800
mathability	0				
verbalabil-y	0				
actm	3,809	23.95301	4.091412	13	36
acte	3,810	23.6147	4.816735	7	36
stype	11,780	1.174618	.3818857	0	2
res	0				
intl	0				
term_grad	6,090	201217.8	226.6527	200702	201602
grad_major1	0				
grad_major2	0				
grad_major3	0				
wr121	8,397	3.093557	.8300113	0	4.3
wr122	7,899	3.205368	.7835719	0	4.3
wr123	1,236	3.084871	.9548712	0	4.3
wr122123	0				
ba101	9,062	2.886979	.9279724	0	4.3
ec201	8,295	2.549958	1.056005	0	4.3
ec202	7,422	2.559687	1.047066	0	4.3
math241	4,909	2.256305	1.315059	0	4.3
math242	3,923	2.348942	1.22765	0	4.3
math243	5,054	2.72404	1.098733	0	4.3
actg211	0				
actg213	3,829	2.700757	1.034265	0	4.3
ba240	3,119	2.344822	.9101935	0	4.3
j101	2,822	3.207335	.9159964	0	4.3
j102	3,503	2.878761	.9936894	0	4.3
j201	5,366	2.925345	.7819341	0	4.3

Empirical Specifications

The basic step in this part is to use regression analysis to predict course grade based on high school performance, get the roadblock courses, look at the instructor's effect on course grade and graduation time. The first part of regressions we use is to find the roadblock courses by adding high school GPA, SAT math and verbal score, resident dummy, international student dummy, and gender dummy:

$$\text{Gradtime} = \beta_0 + \beta_1\text{BA101} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{BA240} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{EC201} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{EC202} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{ACTG211} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{ACTG213} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{WR121} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{WR122123} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{Math241} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{Math242} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$
$$\text{Gradtime} = \beta_0 + \beta_1\text{Math243} + \beta_2\text{HSGPA} + \beta_3\text{logSATm} + \beta_4\text{logSATv} + \beta_5\text{RES} + \beta_6\text{INTL} + \beta_7\text{GENDER} + \Phi$$

Then, we attempt use linear regressions to find the probability that students can pass the core course based on their grade from the other core course. The regressions we use to find the correlation between two courses or the correlation between course grades and high school performance in the basic model:

$$Math241 = \beta_0 + \beta_1 logSATm + \mu$$
$$Math241 = \beta_0 + \beta_1 HSGPA + \mu$$
$$Math242 = \beta_0 + \beta_1 Math241 + \mu$$
$$Math243 = \beta_0 + \beta_1 Math242 + \mu$$
$$Graduation = \beta_0 + \beta_1 logSATm + \mu$$
$$Graduation = \beta_0 + \beta_1 Math243 + \mu$$
$$Graduation = \beta_0 + \beta_1 logSATv + \mu$$

$$Graduation = \beta_0 + \beta_1 HSGPA + \mu$$
$$ACTG211 = \beta_0 + \beta_1 BA240 + \mu$$
$$BA240 = \beta_0 + \beta_1 BA101 + \mu$$
$$ACTG213 = \beta_0 + \beta_1 ACTG211 + \mu$$
$$Graduation = \beta_0 + \beta_1 ACTG213 + \mu$$
$$Graduation = \beta_0 + \beta_1 WR122123 + \mu$$
$$Graduation = \beta_0 + \beta_1 EC202 + \mu$$
$$WR122123 = \beta_0 + \beta_1 WR121 + \mu$$
$$WR121 = \beta_0 + \beta_1 HSGPA + \mu$$
$$EC201 = \beta_0 + \beta_1 logSATv + \mu$$
$$EC201 = \beta_0 + \beta_1 HSGPA + \mu$$
$$EC202 = \beta_0 + \beta_1 EC201 + \mu$$

In these regressions above, Graduation is dependent dummy variable Graduation = 1; if not, then Graduation = 0), and all the courses have the values from {0, 0.7, 1, 1.3, 1.7, 2, 2.3, 2.7, 3, 3.3, 3.7, 4, 4.3}. Once we get the β_1, β_1's are the probability numbers for the arrows in the basic model.

Then, we attempt to use regression analysis to predict the core course grade based on high school performance (SATm, SATv, HSGPA). And we take logarithm of SAT math and verbal score because the actual score is in the hundred level, so that there's a big gap between range of course score and range of SAT score. These regressions are:

$$logEC201 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$
$$logEC202 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$
$$logBA101 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$
$$logMath241 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$
$$logMath242 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$
$$logMath243 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$
$$logWR121 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$
$$logWR122123 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$
$$logACTG211 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$
$$logACTG213 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \mu$$

Since there's a concern that if we predict course grades only based on high school performance, then some students may have different performance in the university and high school, so in the next step we add grades in one or two courses taken in the university before or almost the same time. These regressions are:

$$logEC201 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 BA101 + \mu$$
$$logEC202 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 EC201 + \mu$$
$$logBA101 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 EC201 + \mu$$
$$logMath241 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 EC202 + \mu$$
$$logMath242 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 Math241 + \mu$$
$$logMath243 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 Math242 + \mu$$
$$logWR121 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 BA101 + \mu$$
$$logWR122123 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 WR121 + \mu$$
$$logACTG211 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 Math241 + \mu$$
$$logACTG213 = \beta_0 + \beta_1 logSATm + \beta_2 logSATv + \beta_3 HSGPA + \beta_4 ACTG211 + \mu$$

After that, we attempt to use regression analysis to look at the effect on graduation time. Those effects are high school performance and core course grades, and we also take considerations of student type. Those regressions are:

$$Gradtime = \beta_0 + \beta_1 HSGPA + \beta_2 SATm + \beta_3 SATv + \beta_4 Gender + \mu$$
$$Gradtime = \beta_0 + \beta_1 logWR121 + \beta_2 logWR122123 + \beta_3 logBA101 + \beta_4\ logEC201 + logEC202 + logACTG211 + logACTG213 + logMath241 + logMath242 + logMath243 + \mu$$

After that, we run the regressions to look at the instructor's effect on course grades and graduation time. Those regressions are:

$$\text{Gradtime} = \beta_0 + \beta_1 \text{BA101*Instructor}_1 + \beta_2 \text{BA101*Instructor}_2 + \beta_3 \text{BA101*Instructor}_3 + \beta_4 \text{BA101*Instructor}_4 + \beta_5 \text{BA101*Instructor}_5 + \beta_6 \text{BA101*Instructor}_6 + \mu$$

$$\text{BA101} = \beta_0 + \beta_1 \text{instructor}_1 + \mu$$
$$\text{BA101} = \beta_0 + \beta_1 \text{instructor}_2 + \mu$$
$$\text{BA101} = \beta_0 + \beta_1 \text{instructor}_3 + \mu$$
$$\text{BA101} = \beta_0 + \beta_1 \text{instructor}_4 + \mu$$
$$\text{BA101} = \beta_0 + \beta_1 \text{instructor}_5 + \mu$$
$$\text{BA101} = \beta_0 + \beta_1 \text{instructor}_6 + \mu$$

Methodology

This research relies on Linear Regression Model and Least Squares Dummy Variable model to predict fundamental course grades based on SAT score, ACT score and high school GPA, find the roadblock courses and estimate the effect of fundamental course outcomes on graduation rates in the Lindquist Business School. Regression analysis will be conducted on data from 2005 to 2015: 10-year course grades, graduation rates and SAT (and ACT) score from University of Oregon or other resources. The core courses we use are: EC201, EC202, MATH241, MATH242, MATH 243, WR121, WR122 (123), ACTG211, ACTG213, BA101, BA240. We choose these courses because these are requirements for pre-business students who can easily get discouraged during the first two years when some fundamental courses become to their roadblocks, so our first step is to find the roadblocks courses based on linear regression model.

First, we attempt to find the roadblock courses by using a linear regression model, with graduation time (number of years to graduate) as the dependent variable and grades of core courses, SAT math and verbal score, high school GPA, and we also add gender, international student, and resident dummy variables. We have two types of student in the data: some students come to UO with transfer credits from high school, other students come to UO with 0 transfer credits. Since in this regression, we care more about number of years to graduate, so we should use two separate regressions to find the correlation between course grade and graduate time. Then compare the regressions we get for these core courses and find the roadblock courses in Business school.

Some students choose to learn several courses such as ACTG 211, ACTG 213, MATH 241, MATH 242 and MATH 243 at the second year, so we find a way to predict grades in these courses. The way is to predict the course grades based on high school performance: SAT math, SAT verbal and high school GPA. In the predicted model, we take the logarithm of the dependent variable which is course grades and also take the logarithm of the independent variables which are SAT math, SAT verbal and high school GPA. Perhaps there's a concern that some students may have different performance in university compared to high school performance. So after the first predicted model, we add one or two classes students take in the previous time or around the time to predict course grades, because we believe that it will be more precise to predict course grade by adding course grade in the previous term and it may get rid of the bias that some students have different performance in high school and university.

In the previous model, the dependent variable is graduation, a dummy variable that when student graduates then it is equal to one; if not, then 0. However, in this model we predict years to graduate based on high school performance and we add student type effect and resident effect, so the dependent variable becomes Gradtime which is number of years that students graduate after they get admission, and the independent variables are SAT score and high school GPA. We also use logarithm of dependent variable and independent variables, because it's easier to look at the effect in the percent level. Moreover, we attempt to look at the effect of core course grades on graduation time, so the independent variables are logarithm of WR 121, WR 122(123), BA 101, EC 201, EC 202, ACTG 211, ACTG 213, MATH 241, MATH 242, MATH 243. The dependent variable is Gradtime, we separate students into two groups: one group includes students who came to UO with transfer hours, the other one includes students who came to UO

without transfer hours, because transfer hours should influence students' graduation time more or less.

Then, we attempt to use linear regression to explore the instructors' effect on BA101. The reason why we choose BA101 is that most professors have more than 200 students, making outcomes more precise. Also, these professors in BA101 actually have taught this course for years, and BA101 is the most fundamental course in Business School. First, we run the regressions separately to look at the correlation between students' grades and instructors. The dependent variable in each regression is BA101, and independent variable is one instructor, and we want to use the regression to look at the average letter grade that each professor gives to students. And then, we focus on the instructors' effect on graduation time to look at what happened to students' graduation time after they take that professor's course. Actually, the purpose that we explore the instructors' effect by using course grade and graduation time to be dependent variables is to find the discrepancy: good grades may not push graduation time earlier, there's a discrepancy between grades in one course and likelihood of graduation. We focus on the effect of fundamental courses, so there's a probability that different professors can influence students' performance in the following courses, and we attempt to look at the influence by using linear regressions.

Next, we want to look at graduation rates for different-level students in each fundamental course. Since it's a large sample for ten-year data, we divided students in every course into six groups: group 1 includes students who get A from the course, group 2 includes students who get B from the course, group 3 includes students who get C from the course, group 4 includes students who get D from the course, group 5 includes students who get F/W from the course. The

attempt to have this step is to find the significance of getting A, B, C, D, F/W in each fundamental course.

Results & Analysis

Overall

Table 1: First-Year Fundamental Course Effect on Graduation time

VARIABLE	Graduation Time
International student	0.0483
	(0.0323)
Gender	0.171***
	(0.0248)
logSATm	-0.0881
	(0.108)
logSATv	0.00345
	(0.0951)
High School GPA	-0.0962**
	(0.0428)
Resident	0.107***
	(0.0257)
logWR121	-0.223***
	(0.0636)
logWR122+123	-0.153**
	(0.0643)
logBA101	-0.217***
	(0.0589)
logEC201	-0.0487
	(0.0457)
logEC202	-0.170***
	(0.0458)
Student Type	-0.0801**
	(0.0402)
Constant	5.478***
	(0.604)
Observations	2,387
R-squared	0.103

From Table 1, the coefficient for Gender is 0.171 with 99% significance level, so that if the student is male (gender=1), the graduation time may be postponed by 0.171 years which is

more than 1.5 month. And the coefficient for High School GPA is -0.096, so that if High school GPA increases by 1 unit, then graduation time will be 1 month earlier. Also, the coefficient for resident is 0.107 with 99% significance level, if the student is resident (resident=1), the graduation time may be postponed by 0.107 years which is also more than 1 month. The coefficient of Student type is -0.08, meaning that if students come to UO with transfer credits then they can graduate almost 1 month earlier. The coefficient for logWR121 is -0.223, meaning that 10% increase in letter score of WR121 result in 0.0223 years earlier to graduate, which is 8 days. The coefficient for logWR122+123 is -0.153, meaning that 10% increase in letter score of WR122+123 result in 0.0153 years (5.5 days) earlier to graduate. Also, the coefficient for logBA101 is -0.217, meaning that 10% increase in letter score of BA101 result in 0.0217 years (8 days) earlier to graduate. The coefficient for logEC202 is -0.170, meaning that 10% increase in letter score of EC202 result in 0.017 years (6 days) earlier to graduate. From the regression result analysis above,

In this model, we use the Log Linear Model in which the interpretations are difficult to understand, so we also run the regressions in Linear model. In the linear model, which is Table #, the coefficient for WR121 is -0.108, meaning that 1 unit increase in letter score of WR121 result in 0.108 years earlier to graduate, which is more than 1 month. The coefficient for WR122+123 is -0.033, meaning that I unit increase in the letter score of WR122+WR123 courses can result in 12 days earlier to graduate. The coefficient for BA101 is -0.0578, meaning that 1 unit increase in the letter score of BA101 can result in 21 days earlier to graduate. The coefficient for EC201 is -0.0848, meaning that 1 unit increase in the letter score of EC201 can result in 1 month earlier to graduate. Also, the coefficient for EC202 is -0.0329, meaning that 1 unit increase in letter score of EC202 result in 12 days earlier to graduate. Table 2 is the summary of the regression analysis.

Table 2 The First-Year Course Effects on Log Linear Regression Model & Linear Regression Model

Model	**Log Linear Regression Model**	**Linear Regression Model**
Gender (female)	1.5 month earlier	2 months earlier
High School GPA	1 month earlier	2 months earlier
Non-Resident	1 month earlier	1.4 months earlier
With Transfer credit	1 month earlier	1 month earlier
LogWR121/WR121	10% increase in letter score result in 8 days earlier	1 unit increase in letter score--1.3 months earlier
LogWR122+123/WR122+123	10% increase in letter score result in 5.5 days earlier	1 unit increase in letter score result in 12 days earlier
LogBA101/BA101	10% increase in letter score result in 8 days earlier	1 unit increase in letter score result in 21 days earlier
LogEC202/EC202	10% increase in letter score result in 6 days earlier	1 unit increase in letter score result in 12 days earlier

Table 3: Second-Year Fundamental Courses Effect on Graduation time

VARIABLES	Graduation Time
International student	-0.0117
	(0.0459)
Gender	0.138***
	(0.0313)
logSATm	-0.226
	(0.141)
logSATv	-0.0423
	(0.110)
High School GPA	-0.0714
	(0.0536)
Resident	0.128***
	(0.0318)
logMath241	-0.0676
	(0.0586)
logMath242	0.0354
	(0.0560)
logMath243	-0.168***
	(0.0562)
logACTG211	-0.0508
	(0.0578)
logACTG213	-0.0669
	(0.0685)
Student Type	-0.0611
	(0.0437)
Constant	5.975***
	(0.786)
Observations	1,220
R-squared	0.065

Table 3 in the above shows the second-year fundamental course effect on graduation time. Most independent variables are insignificant, only Gender, Resident and Math243 are significant. The coefficient for Gender is 0.138, meaning that female students can graduate 1.6 months earlier than male students. Non-resident students can graduate 1.5 months earlier than resident students because coefficient for Resident is 0.128. The coefficient for logMath243 is -0.168, meaning that 10% increase in the letter score of Math243 result in 0.0168 years earlier in

graduation time, which is 6 days. However, other variables except these three are insignificant, so that we run a new regression by using the Linear Regression Model.

Table 4: Second-Year Fundamental Courses Effect on Graduation time by Linear Regression Model

VARIABLES	Graudation Time
Gender	0.145***
	(0.0313)
logSATm	-0.143
	(0.136)
logSATv	-0.0711
	(0.108)
High School GPA	-0.103*
	(0.0526)
Resident	0.122***
	(0.0288)
Math241	-0.0221
	(0.0163)
Math242	0.00298
	(0.0152)
Math243	-0.0843***
	(0.0167)
ACTG211	-0.0254
	(0.0167)
ACTG213	-0.0627***
	(0.0174)
Student Type	-0.0934**
	(0.0428)
Constant	5.989***
	(0.752)
Observations	1,538
R-squared	0.112

In the Table 4 above, the coefficient for Gender is 0.145, meaning that female students can graduate 1.7 months earlier than male students. The coefficient for High School GPA is -0.103, meaning that when High School GPA goes up for 1 unit students can graduate 1.2 months earlier. Non-resident students can graduate 1.5 months earlier than resident students. The

coefficient for Math243 is -0.0843, meaning that 1 unit increase in letter score of Math243 result in 1 month earlier to graduate. Also, the coefficient for ACTG213 is -0.0627, meaning that 1 unit increase in the letter score of ACTG213 can result in 23 days earlier to graduate. And student with transfer credits can graduate 1 month earlier than students without transfer credit. Table # is the summary of the effects on graduation time we get from Log Linear Regression model and Linear Regression model.

Table 5: Second-Year Course Effect on Log Linear Regression Model & Linear Regression Model

Model	**Log Linear Regression Model**	**Linear Regression model**
Gender (female)	1.6 months earlier	1.7 months earlier
Non-resident	1.5 months earlier	1.5 months earlier
logMath243/Math243	10% increase in the letter score of Math243 result in 6 days earlier	1 unit increase in letter score of Math243 result in 1 month earlier
ACTG213	-	1 unit increase in the letter score of ACTG213 can result in 23 days earlier
With Transfer Credits	-	1 month earlier

Table 6: The Fundamental Course Effect on Graduation Dummy variable

VARIABLES	Graduation
EC201	0.0334**
	(0.0158)
EC202	0.0604***
	(0.0171)
Math241	-0.00684
	(0.0134)
Math242	0.0206*
	(0.0119)
Math243	0.0193
	(0.0135)
WR121	0.0650***
	(0.0188)
WR122123	0.0895***
	(0.0189)
BA101	0.0161
	(0.0221)
ACTG211	0.0323**
	(0.0140)
ACTG213	0.105***
	(0.0141)
Constant	-0.559***
	(0.0858)
Observations	1,166
R-squared	0.257

Above we have highlighted the different courses and their various effects on graduation as a 0,1 variable by using Binary Linear Regression Model. Because the dependent variable is Graduation, a dummy variable, so the coefficient for the independent variables are all marginal effects. The course with the highest marginal effect is WR122+123, which is 0.0895, and the

course with the second highest marginal effect is WR121, which is 0.0650. So, in this model, writing courses, WR121and WR122+123 are good indicators to graduation.

Business Courses

Our data supports the conclusion that BA101 is the most important course for Business majors. We can see that the graduation time is most strongly affected by BA101 as an A is the difference in graduating 4.7 years whereas an F predicts you'll graduate in 5.5 years if at all. Further analysis in BA 101 Figure B shows the represented affects each group had. An A in BA101 increased the likelihood to 68% graduation rate and a B to 38% graduation rate. A letter grade of C, D, or F all decreased graduation down to approximately 5 to 10 percent. Since a C is passing, there may be need to reconsider what it means since the C group had the same graduation rate as a D or an F.

EC 201 and ACTG 213 were the second most critical to a student's graduation timeline. The coefficient on both variables were 0.111 and so the effect of an A meant a student took 0.444 years less to graduate. These courses should be considered the key courses to a student in their second year of the Business major. A student struggling to maintain a C in either of these courses brings their graduation rate to roughly 60 percent. This is on par with the overall graduation of the University however a letter grade of a D or an F brings their graduation rate to roughly 10 to 15%. Students should consider these courses as an indicator for their success in the Business major.

EC 202 and ACTG 211 were significant were important to a student's success as well. They should be considered the easier of the two courses, but although they are still critical, should be watched secondary to EC 201 and ACTG 213. This doesn't imply that students who

succeed early in EC 201 will have an easier time in EC202, rather that the grade distribution and graduation rate in EC 202 is more forgiving or rather there isn't a steep dropoff in graduation rate when a student hits a C. The same goes for ACTG211.

BA240 was considered insignificant to a student's graduation. We believe that this is the case because students who are taking BA240 probably have already succeeded at identifying themselves as strong students and have done well in all other courses. Students who have not done as well will most likely self identify and drop out prior to taking this course.

Math Courses

Math 243 had the most significance on a student's graduation. Its effect was 4th overall with a value of 0.119. This would imply that an A would take 0.476 years less compared to an F. Also a student who gets a C in this course still has a strong chance of doing well graduation considering their graduation rate is 46% (this is compared to the Business graduation average of 33%). We believe that Math 243 is key to a student's graduation because statistics is heavily used in Business. Students who self identify as poor in math should take time to focus on Math 243 in their second year since it's critical to their future success.

Writing Courses

WR 121 had the second most impact on a student's graduation. A student who received an F in WR 121 would be expected to graduate in 7.3 years whereas an A would bring them to 6.5 years without accounting for gender, SAT ability and HS GPA. Considering BA 101 and WR 121 are classes taken the first year of college, this may explain why they are such a big impact on a student's graduation time. Rather if students were mandated to take other courses such as History or Biology, we would see the same results.

WR 122 and 123 had the third most important impact on a student's graduation. The effect we believe we're seeing here as well is that WR 122 and 123 are first year courses and thus capture most of the students who drop out. However it's still important for students to take into account that WR122-123 are important indicators for a first year student and where the place among other students.

SAT/HS Effects

Table 7: The High School Performance Effects on Graduation Time

VARIABLES	Graduation Time
logSATm	-0.0592
	(0.0809)
logSATv	-0.152**
	(0.0729)
logHSGPA	-1.205***
	(0.109)
Student Type	-0.123***
	(0.0252)
Constant	6.778***
	(0.447)
Observations	6,089
R-squared	0.040

The regression can be written as

$$\textit{Gradtime} = 6.778 - 0.059\textit{logSATm} - 0.152\textit{logSATv} - 1.205\ \textit{logHSGPA} - 0.123\ \textit{Stype} + \beta$$

The coefficient for High school GPA is -1.205, meaning that when high school GPA goes up by 10%, students can graduate 1.5 months earlier. And the coefficient for logSATm is -0.059, meaning that 10% increase in SAT math can result in 0.0195 years earlier to graduate, which is 2 days. Also, the coefficient for SAT verbal is -0.152, meaning that 10% increase in SAT verbal score can result in 5.5 days earlier to graduate. The coefficient for student type is -0.123, meaning that students with transfer hours can actually graduate 1.5 months earlier.

Instructor Effects

In our regression on important classes, we identified that BA101 is foundational to a student's success and so we ran a regression to see if some teachers helped students graduate more quickly than others. From our regression we first identified the difference in grades between each professor. Taking a course with Professor A earned an average grade of 3.14 whereas taking a course with Professor D earned an average grade of 2.65. The difference between these teachers is 0.5 which itself is significant. When we further analyze however, we see that students who took courses with Professor D stayed for 0.3 years less whereas Professor A was only 0.2 years less. It may be that there is an inverse relationship where students given high grades often take longer to graduate. This may be attributed to students who are given lower grades are forced to think harder on the material and therefore learn it better. Considering we've only analyzed one set of teachers for BA101, at best we can conclude there should be further research on the relationship between an average grade given out and the average time taken to graduate.

Another point of interest, as mentioned in the introduction, is the teacher-gender effect on student's grades. In our table, we show that taking a female instructor for BA 101 improves grade outcome for all genders. That is the average GPA for a male teacher and male student would be a 2.9. For a baseline male teacher and a female student, the average GPA is a 2.8. However if both the male student and the female student took the course with a female teacher, then their grades would go up to a 3.15. This difference is 0.25 however for females the difference is 0.35 which is more significant. Two interesting changes are identifiable. First,

female teachers help the disparity between male and female students. With male teachers, male students do better. However with female teachers, both types of students do equally as well. Another note is that female teachers raise course grades by 0.3 overall. This could represent better attainment of knowledge or grade inflation. More research is needed here to understand the mechanics. Overall a recommendation could be made to hire more female business teachers to help female students equalize the difference in Business school grade outcomes between genders.

Table 8: The BA101 Instructor Effect on Graduation Time

VARIABLES	Graduation Time Without Transfer Credit	Graduation Time With Transfer Credit
BA101InstructorA	-0.242***	-0.197***
	(0.0155)	(0.0337)
BA101InstructorB	-0.316***	-0.333**
	(0.0416)	(0.139)
BA101InstructorC	-0.212***	-0.169***
	(0.0143)	(0.0301)
BA101InstructorD	-0.408***	-0.300**
	(0.0727)	(0.122)
BA101InstructorE	-0.259***	-0.199***
	(0.0173)	(0.0382)
BA101InstructorF	-0.246***	-0.129***
	(0.0149)	(0.0317)
Constant	4.657***	4.311***
	(0.0427)	(0.0951)
Observations	4,086	700
R-squared	0.076	0.062

Table 9: The Instructor Effect On BA101 Letter Score

VARIABLES	BA101	BA101	BA101	BA101	BA101	BA101
Instructor A	0.287***					
	(0.0342)					
Instructor B		0.0837**				
		(0.0345)				
Instructor C			-0.141***			
			(0.0196)			
Instructor D				-0.262***		
				(0.0401)		
Instructor E					-0.0168	
					(0.0327)	
Instructor F						0.119***
						(0.0233)
Constant	2.862***	2.880***	2.948***	2.903***	2.889***	2.860***
	(0.0102)	(0.0102)	(0.0129)	(0.0100)	(0.0103)	(0.0111)
Observations	9,062	9,062	9,062	9,062	9,062	9,062
R-squared	0.008	0.001	0.006	0.005	0.000	0.003

Table 10: The Instructor-Gender Effect On BA101 Letter Score

	1	2	3	4
VARIABLES	ba101 (female)	ba101 (male)	ba101 (female)	ba101 (male)
lsatm			2.131***	1.529***
			-0.127	-0.106
lsatv			0.503***	0.580***
			-0.117	-0.0947
stype1			0.155***	0.124***
			-0.0377	-0.0342
intl			-0.130***	0.0344
			-0.0433	-0.0355
res			0.0367	0.0510*
			-0.0326	-0.0261
ba101f	0.349***	0.247***	0.371***	0.244***
	-0.0534	-0.0444	-0.0493	-0.0423
Constant	2.803***	2.899***	-13.71***	-10.48***
	-0.0164	-0.013	-0.686	-0.562
Observations	3,577	5,484	3,577	5,484
R-squared	0.012	0.006	0.164	0.105

Table 11: Dummy Interaction of Instructor Effect On BA101 Letter Score

VARIABLES	ba101
0ba101m#0gender	0
(female teacher/female student)	0
0ba101m#1gender	-0.00494
(female teacher/male student)	-0.0661
1ba101m#0gender	-0.349***
(male teacher/female student)	-0.0529
1ba101m#1gender	-0.252***
(male teacher/male student)	-0.052
Constant	3.151***
	-0.0504
Observations	9,061
R-squared	0.01

Gender Effects

From our regressions we see many gender differences in the patterns of correlations. The first is that SAT M and SAT V is a better predictor for females' course grades than for males'. Another interesting note is in the second regression. Women face a higher chance of graduation in the business major, however men have 2 significant courses (ACTG 213 and WR 122/123) that if calculated without make the two equal. This might indicate that females are stabler in college and a bad grade is easily overcame whereas for men a roadblock course can present a bigger challenge for men. These effects should be investigated more thoroughly.

Table 12: Predicted First-Year Core Course Outcome Based on High School Performance (Male)

VARIABLES	**logEC201**	**logEC202**	**logBA101**	**logWR121**	**logWR122123**
logSATm	0.588***	0.396***	0.424***	0.0766**	-0.0212
	(0.0445)	(0.0471)	(0.0347)	(0.0314)	(0.0305)
logSATv	0.224***	0.312***	0.247***	0.243***	0.185***
	(0.0374)	(0.0397)	(0.0294)	(0.0285)	(0.0261)
logHSGPA	0.895***	0.914***	0.910***	0.567***	0.530***
	(0.0563)	(0.0587)	(0.0436)	(0.0420)	(0.0385)
Constant	-5.275***	-4.634***	-4.295***	-1.577***	-0.526***
	(0.276)	(0.295)	(0.210)	(0.203)	(0.190)
Observations	3,146	2,829	3,803	3,281	3,563
R-squared	0.198	0.179	0.225	0.096	0.075

Table 13: Predicted Second-Year Core Course Outcome Based on High School Performance (Male)

VARIABLES	logBA240	logMath241	logMath242	logMath243	logACTG211	logACTG213
logSATm	0.240***	0.805***	0.501***	0.416***	0.480***	0.542***
	(0.0679)	(0.0679)	(0.0744)	(0.0578)	(0.0603)	(0.0547)
logSATv	-0.0213	-0.102**	-0.103*	0.0744	0.215***	-0.00475
	(0.0565)	(0.0519)	(0.0577)	(0.0465)	(0.0503)	(0.0451)
logHSGPA	0.350***	0.794***	0.706***	0.834***	0.716***	0.716***
	(0.0929)	(0.0772)	(0.0847)	(0.0721)	(0.0732)	(0.0672)
Constant	-0.975**	-4.558***	-2.542***	-3.148***	-4.368***	-3.320***
	(0.431)	(0.432)	(0.477)	(0.362)	(0.382)	(0.349)
Observations	1,192	1,856	1,540	2,046	2,103	1,707
R-squared	0.030	0.130	0.077	0.118	0.123	0.144

Table 14: Predicted First-Year Core Course Outcome Based on High School Performance (Female)

VARIABLES	**logec201**	**logec202**	**logba101**	**logwr121**	**logwr122123**
logsatm	0.751***	0.707***	0.580***	0.0799***	0.0442*
	(0.0488)	(0.0524)	(0.0431)	(0.0301)	(0.0267)
logsatv	0.0534	0.107**	0.139***	0.203***	0.198***
	(0.0433)	(0.0448)	(0.0379)	(0.0292)	(0.0250)
loghsgpa	0.873***	0.760***	1.059***	0.593***	0.375***
	(0.0749)	(0.0789)	(0.0655)	(0.0481)	(0.0401)
Constant	-5.249***	-5.159***	-4.842***	-1.336***	-0.795***
	(0.307)	(0.328)	(0.262)	(0.203)	(0.165)
Observations	2,232	1,914	2,424	2,438	2,900
R-squared	0.224	0.208	0.263	0.111	0.082

Table 15: Predicted Second-Year Core Course Outcome Based on High School Performance (Female)

VARIABLES	logba240	logm241	logm242	logm243	logactg211	logactg213
logsatm	0.319***	0.792***	0.712***	0.514***	0.646***	0.656***
	(0.0969)	(0.0938)	(0.105)	(0.0752)	(0.0852)	(0.0753)
logsatv	-0.255***	-0.110	-0.191**	0.0172	0.172***	0.0145
	(0.0809)	(0.0692)	(0.0771)	(0.0598)	(0.0664)	(0.0574)
loghsgpa	0.441***	0.858***	0.782***	0.599***	0.594***	0.831***
	(0.155)	(0.131)	(0.152)	(0.113)	(0.132)	(0.116)
Constant	-0.103	-4.469***	-3.365***	-3.096***	-5.026***	-4.313***
	(0.584)	(0.563)	(0.634)	(0.466)	(0.524)	(0.461)
Observations	625	967	787	1,065	993	814
R-squared	0.039	0.133	0.097	0.102	0.134	0.195

Table 16: The Fundamental Course Effect on Graduation & Gender Effect

VARIABLES	Graduation	Graduation
logec201	0.152**	0.176*
	(0.0712)	(0.106)
logec202	0.0929	0.217**
	(0.0658)	(0.110)
logm241	-0.148**	0.108
	(0.0600)	(0.0875)
logm242	0.00988	-0.0136
	(0.0581)	(0.0832)
logm243	0.0462	-0.201**
	(0.0578)	(0.0930)
logwr121	0.160*	0.261*
	(0.0875)	(0.143)
logwr122123	0.364***	0.107
	(0.0886)	(0.134)
logba101	0.0765	0.0822
	(0.0958)	(0.133)
logactg211	0.0857	0.0869
	(0.0628)	(0.0881)
logactg213	0.333***	0.119
	(0.0742)	(0.101)
Constant	-0.524***	-0.247
	(0.143)	(0.223)
Observations	582	290
R-squared	0.184	0.141

Conclusion

Our results show that BA 101, WR 121-123 and then MATH 243 are the most important courses to a Pre-Business major.

BA101 is an important early indicator course for Business majors. An early C or D can indicate that a student will have a hard time moving on. In light of the requirements of the Lindquist School of Business which require a 3.0 GPA, this makes sense as a student who receives a C is on path to receive a 2.0. However students who receive a C and are set on continuing down the path to become a Business major should be identified by an advisor to warn them of the difficulty. If the student has exceptional grades in other courses, then they may still do well, but if their GPA is below a 2.0 by the end of year 1, reconsidering their major should be a strong option. Even students who received a B should consider their pathway as a 38% graduation rate is quite low which is seen in BA 101 Figure B. Switching majors to Economics, General Social Science, Political Science, or Sociology seem to be viable options for many students.

The next course we identified was WR121-123. This course is a first year requirement for all majors. Given the effect is large in WR121 Figure A compared to other courses, we believe that this is because it is a first year course and required for all students, so the effect is not necessarily related to the fact that these are writing courses. If instead history or biology was required, we believe we would see the same effects for those. What writing may capture though is if students are successful early on in developing the habits and skills necessary to graduate. However, the takeaway is that students who are in their first year of college should focus on BA101 and then WR121-123 since these are the key roadblock courses.

Lastly we found MATH243 to be the third most important course. This effect of -0.119 years of grad time per letter grade in Math 243 Figure A lines up with our previous beliefs as business courses require strong math skills. We believe that if we had data showing MATH111-112 we would find a more significant effect compared to WR121-123. Our literature shows that math courses have more of an effect than writing courses. However this can't be confirmed without more research and so with the information currently, we strongly recommend students focus on Math 243 within their second year of Pre-Business. This most likely is due to the fact that statistics and probability models play a large role in future business courses such as ACTG and FIN.

Overall our hypothesis lined up with the results. The only significant difference is in the Writing courses as they're a better predictor of graduation than Math courses. Our recommendation, if any, to increase Business graduation is to identify students who don't succeed early on in BA101 or WR121. First year students who struggle to maintain a B average will have a difficult time getting into the major, and if they do, graduating. Next second year students should focus heavily on MATH 243 as it tends to be the second year roadblock course. This would seem to imply that students should plan to do well in MATH 111-112 if they intend to continue to do well in MATH 243. Further identifying students who come into school with low SAT's or HSGPA should be encouraged to reconsider their plan as a Business major. This is not to force students away from Business, but to push them towards other close majors that they may be more successful in.

We believe the low graduation rate within the Lindquist School of Business could be improved with a strong advising program at the University of Oregon. If low success students were identified prior to beginning their pre-Business track, then this would effectively bring

down the percentage of students who are unable to graduate. The advising program details would be requiring pre-Business majors to meet with an advisor if they have any of the following 1) below 3.0 GPA coming into their second year 2) a C or lower in BA101 3) a C or lower in Writing 121-123 4) scores in the bottom third of SAT's and HS GPA 5) a D or lower in MATH 243. Overall our analysis has confirmed a lot of what's been stated before for college majors, but concretely seeing the effects can help future students or advisors know where they place. Hopefully future literature will investigate how to implement an advising program and the logistics of how it would work.

Appendix

Business Courses

(ACTG211):

ACTG211 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
actg211	-0.0852***	-0.0516*
	(0.0113)	(0.0268)
preacthsgpa	-0.283***	-0.369***
	(0.0468)	(0.115)
logpsatm	0.0217	-0.295
	(0.119)	(0.295)
logpsatv	-0.236**	0.0804
	(0.101)	(0.248)
res	0.157***	0.0244
	(0.0289)	(0.0672)
intl	0.0529	-0.313
	(0.0360)	(0.273)
gender	0.176***	0.0756
	(0.0278)	(0.0635)
Constant	6.211***	6.861***
	(0.663)	(1.568)
Observations	2,672	501
R-squared	0.092	0.071

ACTG211 Figure B

VARIABLES	busgrad	busgrad	busgrad	busgrad	busgrad	busgrad
actg211group1	0.320***					0.708***
	(0.0222)					(0.0432)
actg211group2		0.272***				0.621***
		(0.0170)				(0.0411)
actg211group3			-0.117***			0.361***
			(0.0170)			(0.0409)
actg211group4				-0.451***		
				(0.0448)		
actg211group5					-0.502***	0.00173
					(0.0225)	(0.0437)
o.actg211group4						-
Constant	0.554***	0.516***	0.645***	0.618***	0.671***	0.167***
	(0.00867)	(0.00962)	(0.0102)	(0.00824)	(0.00827)	(0.0391)
Observations	3,552	3,552	3,552	3,552	3,552	3,552
R-squared	0.055	0.067	0.013	0.028	0.123	0.235

(ACTG213):

ACTG213 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
actg213	-0.117***	-0.0714**
	(0.0139)	(0.0304)
preacthsgpa	-0.150***	-0.349***
	(0.0495)	(0.107)
logpsatm	0.0323	-0.216
	(0.125)	(0.274)
logpsatv	-0.272***	0.116
	(0.102)	(0.225)
res	0.150***	0.0754
	(0.0300)	(0.0630)
intl	0.0157	-0.361*
	(0.0378)	(0.204)
gender	0.168***	0.0887
	(0.0288)	(0.0576)
Constant	6.035***	6.077***
	(0.691)	(1.492)
Observations	2,144	398
R-squared	0.093	0.101

ACTG213 Figure B

VARIABLES	busgrad	busgrad	busgrad	busgrad	busgrad	busgrad
actg213group1	0.211***					0.731***
	(0.0204)					(0.0764)
actg213group2		0.208***				0.676***
		(0.0161)				(0.0754)
actg213group3			-0.219***			0.402***
			(0.0180)			(0.0759)
actg213group4				-0.566***		
				(0.0835)		
actg213group5					-0.535***	0.0648
					(0.0303)	(0.0795)
o.actg213group4						-
Constant	0.705***	0.653***	0.806***	0.752***	0.785***	0.185**
	(0.00904)	(0.0108)	(0.00945)	(0.00823)	(0.00813)	(0.0746)
Observations	2,777	2,777	2,777	2,777	2,777	2,777
R-squared	0.037	0.057	0.051	0.016	0.101	0.208

(BA101):

BA101 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
ba101	-0.216***	-0.137***
	(0.0147)	(0.0346)
preacthsgpa	-0.213***	-0.276***
	(0.0405)	(0.0867)
logpsatm	0.0128	-0.0576
	(0.101)	(0.212)
logpsatv	-0.0838	0.0827
	(0.0865)	(0.187)
res	0.185***	0.0971*
	(0.0244)	(0.0506)
intl	0.0182	-0.143
	(0.0318)	(0.202)
gender	0.217***	0.121**
	(0.0232)	(0.0476)
Constant	5.566***	5.080***
	(0.558)	(1.178)
Observations	4,086	700
R-squared	0.118	0.080

BA101 Figure B

VARIABLES	busgrad	busgrad	busgrad	busgrad	busgrad	busgrad
ba101group1	0.424***					0.673***
	(0.0132)					(0.0327)
ba101group2		-0.0175				0.361***
		(0.0130)				(0.0321)
ba101group3			-0.370***			0.0733**
			(0.0154)			(0.0335)
ba101group4				-0.379***		0.00264
				(0.0381)		(0.0456)
ba101group5					-0.383***	
					(0.0353)	
o.ba101group5						-
Constant	0.265***	0.394***	0.459***	0.397***	0.399***	0.0155
	(0.00702)	(0.00874)	(0.00687)	(0.00650)	(0.00650)	(0.0310)
Observations	5,686	5,686	5,686	5,686	5,686	5,686
R-squared	0.154	0.000	0.092	0.017	0.020	0.220

(BA240)

BA240 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
ba240	-0.0292*	-0.101**
	(0.0165)	(0.0453)
preacthsgpa	-0.197***	-0.222
	(0.0671)	(0.156)
logpsatm	-0.0587	-0.285
	(0.163)	(0.395)
logpsatv	-0.105	-0.500
	(0.137)	(0.308)
res	0.0574	-0.115
	(0.0386)	(0.0793)
intl	0.150***	-0.253
	(0.0394)	(0.196)
gender	0.115***	0.0589
	(0.0337)	(0.0788)
Constant	5.421***	9.985***
	(0.882)	(1.901)
Observations	1,129	169
R-squared	0.058	0.173

BA240 Figure B

VARIABLES	busgrad	busgrad	busgrad	busgrad	busgrad	busgrad
ba240group1	0.373***					0.805***
	(0.0254)					(0.100)
ba240group2		0.0382				0.578***
		(0.0274)				(0.100)
ba240group3			-0.272***			0.363***
			(0.0266)			(0.100)
ba240group4				-0.559***		
				(0.109)		
ba240group5					-0.505***	0.0716
					(0.0569)	(0.111)
o.ba240group4						-
Constant	0.482***	0.589***	0.685***	0.609***	0.626***	0.0500
	(0.0144)	(0.0153)	(0.0147)	(0.0127)	(0.0127)	(0.0983)
Observations	1,490	1,490	1,490	1,490	1,490	1,490
R-squared	0.126	0.001	0.066	0.017	0.050	0.197

(EC201)

EC201 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
ec201	-0.117***	-0.0871***
	(0.0106)	(0.0258)
preacthsgpa	-0.254***	-0.326***
	(0.0379)	(0.0846)
logpsatm	0.0697	-0.153
	(0.0944)	(0.218)
logpsatv	-0.126	-0.134
	(0.0815)	(0.190)
res	0.139***	0.0719
	(0.0230)	(0.0495)
intl	0.0445	-0.0949
	(0.0295)	(0.198)
gender	0.189***	0.116**
	(0.0216)	(0.0477)
Constant	5.255***	6.982***
	(0.530)	(1.208)
Observations	3,909	655
R-squared	0.096	0.094

EC201 Figure B

VARIABLES	busgrad	busgrad	busgrad	busgrad	busgrad	busgrad
ec201group1	0.409***					0.493***
	(0.0171)					(0.0187)
ec201group2		0.218***				0.297***
		(0.0135)				(0.0154)
ec201group3			-0.190***			-0.00508
			(0.0148)			(0.0164)
ec201group4				-0.323***		-0.170***
				(0.0347)		(0.0331)
ec201group5					-0.300***	-0.142***
					(0.0276)	(0.0270)
Constant	0.319***	0.315***	0.420***	0.389***	0.394***	0.235***
	(0.00646)	(0.00727)	(0.00701)	(0.00632)	(0.00637)	(0.0112)
Observations	6,000	6,000	6,000	6,000	6,000	6,000
R-squared	0.087	0.042	0.027	0.014	0.019	0.179

(EC202)

EC202 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
ec202	-0.0926***	-0.0684**
	(0.0113)	(0.0268)
preacthsgpa	-0.253***	-0.288***
	(0.0386)	(0.0852)
logpsatm	0.0828	0.0216
	(0.0965)	(0.217)
logpsatv	-0.161*	-0.0661
	(0.0827)	(0.188)
res	0.121***	0.0452
	(0.0235)	(0.0510)
intl	0.0460	-0.112
	(0.0294)	(0.178)
gender	0.192***	0.0859*
	(0.0219)	(0.0474)
Constant	5.318***	5.296***
	(0.539)	(1.208)
Observations	3,628	564
R-squared	0.086	0.063

EC202 Figure B

VARIABLES	busgrad	busgrad	busgrad	busgrad	busgrad	busgrad
ec202group1	0.366***					0.660***
	(0.0181)					(0.0329)
ec202group2		0.204***				0.503***
		(0.0159)				(0.0315)
ec202group3			-0.328***			0.154***
			(0.0157)			(0.0317)
ec202group4				-0.411***		-0.0229
				(0.0400)		(0.0458)
ec202group5					-0.394***	
					(0.0335)	
o.ec202group5						-
Constant	0.387***	0.392***	0.574***	0.481***	0.487***	0.0925***
	(0.00837)	(0.00953)	(0.00906)	(0.00783)	(0.00787)	(0.0294)
Observations	4,111	4,111	4,111	4,111	4,111	4,111
R-squared	0.091	0.039	0.096	0.025	0.033	0.215

Math Courses

MATH241 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
math241	-0.0809***	-0.0774**
	(0.0109)	(0.0309)
preacthsgpa	-0.202***	-0.150
	(0.0470)	(0.123)
logpsatm	0.0374	-0.0127
	(0.124)	(0.323)
logpsatv	-0.280***	-0.0389
	(0.0998)	(0.266)
res	0.114***	-0.0241
	(0.0285)	(0.0751)
intl	-0.0659*	-0.237
	(0.0379)	(0.254)
gender	0.178***	0.124*
	(0.0278)	(0.0710)
Constant	6.224***	5.025***
	(0.676)	(1.767)
Observations	2,432	372
R-squared	0.083	0.057

MATH241 Figure B

VARIABLES	busgrad	busgrad	busgrad	busgrad	busgrad	busgrad
math241group1	0.257***					0.523***
	(0.0216)					(0.0496)
math241group2		0.186***				0.451***
		(0.0193)				(0.0486)
math241group3			-0.0579***			0.277***
			(0.0186)			(0.0482)
math241group4				-0.326***		
				(0.0502)		
math241group5					-0.400***	-0.0181
					(0.0225)	(0.0502)
o.math241group4						-
Constant	0.454***	0.452***	0.523***	0.514***	0.570***	0.188***
	(0.00956)	(0.0102)	(0.0107)	(0.00884)	(0.00915)	(0.0461)
Observations	3,264	3,264	3,264	3,264	3,264	3,264
R-squared	0.042	0.028	0.003	0.013	0.089	0.142

MATH242 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
math242	-0.0813***	-0.0197
	(0.0120)	(0.0267)
preacthsgpa	-0.183***	-0.201*
	(0.0497)	(0.114)
logpsatm	0.0250	-0.160
	(0.129)	(0.284)
logpsatv	-0.277***	0.0841
	(0.105)	(0.245)
res	0.113***	0.0651
	(0.0304)	(0.0678)
intl	-0.0273	-0.297
	(0.0382)	(0.237)
gender	0.162***	0.0606
	(0.0295)	(0.0634)
Constant	6.172***	5.251***
	(0.702)	(1.625)
Observations	2,145	330
R-squared	0.077	0.034

MATH242 Figure B

VARIABLES	busgrad	busgrad	busgrad	busgrad	busgrad	busgrad
math242group1	0.209***					0.550***
	(0.0230)					(0.0312)
math242group2		0.134***				0.482***
		(0.0211)				(0.0298)
math242group3			0.00855			0.387***
			(0.0190)			(0.0280)
math242group4				-0.388***		0.00667
				(0.0509)		(0.0531)
math242group5					-0.436***	
					(0.0267)	
o.math242group5						-
Constant	0.570***	0.578***	0.608***	0.625***	0.666***	0.230***
	(0.0102)	(0.0106)	(0.0119)	(0.00932)	(0.00945)	(0.0244)
Observations	2,775	2,775	2,775	2,775	2,775	2,775
R-squared	0.029	0.014	0.000	0.021	0.088	0.131

MATH243 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
math243	-0.123***	-0.0908***
	(0.0125)	(0.0321)
preacthsgpa	-0.208***	-0.362***
	(0.0492)	(0.118)
logpsatm	0.148	-0.131
	(0.121)	(0.300)
logpsatv	-0.251**	0.338
	(0.100)	(0.258)
res	0.150***	0.0241
	(0.0300)	(0.0712)
intl	0.0443	-0.147
	(0.0347)	(0.224)
gender	0.178***	0.0270
	(0.0278)	(0.0643)
Constant	5.408***	4.178***
	(0.661)	(1.612)
Observations	2,688	440
R-squared	0.095	0.067

MATH243 Figure B

VARIABLES	busgrad	busgrad	busgrad	busgrad	busgrad	busgrad
math243group1	0.243***					0.609***
	(0.0186)					(0.0544)
math243group2		0.0934***				0.491***
		(0.0176)				(0.0539)
math243group3			-0.146***			0.324***
			(0.0190)			(0.0545)
math243group4				-0.441***		
				(0.0559)		
math243group5					-0.432***	0.0330
					(0.0307)	(0.0595)
o.math243group4						-
Constant	0.504***	0.537***	0.609***	0.581***	0.604***	0.139***
	(0.00968)	(0.0105)	(0.00980)	(0.00849)	(0.00857)	(0.0523)
Observations	3,420	3,420	3,420	3,420	3,420	3,420
R-squared	0.048	0.008	0.017	0.018	0.055	0.121

Writing Courses

WR121 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
wr121	-0.173***	-0.168***
	(0.0165)	(0.0421)
preacthsgpa	-0.240***	-0.211**
	(0.0410)	(0.101)
logpsatm	-0.136	-0.163
	(0.101)	(0.244)
logpsatv	-0.100	-0.175
	(0.0910)	(0.229)
res	0.179***	0.0574
	(0.0253)	(0.0577)
intl	0.132***	-0.108
	(0.0319)	(0.219)
gender	0.160***	0.113**
	(0.0237)	(0.0563)
Constant	6.562***	7.289***
	(0.571)	(1.321)
Observations	4,039	476
R-squared	0.087	0.095

WR122123 Figure A

VARIABLES	Gradtime w/o transfer hours	Gradtime w/ transfer hours
wr122123	-0.139***	-0.158***
	(0.0160)	(0.0343)
preacthsgpa	-0.280***	-0.295***
	(0.0374)	(0.0768)
logpsatm	-0.108	-0.131
	(0.0942)	(0.195)
logpsatv	-0.113	-0.113
	(0.0840)	(0.176)
res	0.165***	0.0587
	(0.0229)	(0.0449)
intl	0.0904***	-0.0687
	(0.0314)	(0.191)
gender	0.163***	0.110**
	(0.0219)	(0.0447)
Constant	6.524***	6.896***
	(0.524)	(1.053)
Observations	4,522	724
R-squared	0.080	0.101

Table 17: Linear Model for Second-Year Fundamental Courses Effect on Graduation time

VARIABLES	Graduation Time
International student	0.0437
	(0.0327)
Gender	0.173***
	(0.0256)
logSATm	-0.0151
	(0.111)
logSATv	0.00738
	(0.0968)
High school GPA	-0.167***
	(0.0445)
Resident	0.118***
	(0.0269)
WR121	-0.108***
	(0.0186)
WR122123	-0.0330*
	(0.0190)
BA101	-0.0578***
	(0.0198)
EC201	-0.0848***
	(0.0147)
EC202	-0.0329**
	(0.0149)
Student Type	-0.0863**
	(0.0425)
Constant	5.324***
	(0.622)
Observations	2,663
R-squared	0.127

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