Explaining Student Performance in an Undergraduate Agricultural Economics Classroom

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Abstract

Large service courses have become commonplace at land-grant universities. These courses present unique challenges for advisors and instructors. Students possess a wide range of academic abilities, experience with coursework, and other factors that affect their performance; the disparity between strong- and weak-performing students is often pronounced in traditional agriculture-related programs. Predicting student performance a priori can aid advisor decisions and instructor course design, ultimately improving student success rates. The objective of this study is to evaluate the use of registrar data to predict student performance in a large, agriculture-related service course. We use registrar data for 307 students enrolled in Farm and Agribusiness Management over four semesters at Oklahoma State University to parameterize models that predict course performance. Cumulative university grade point average (GPA), major, gender, and performance in prerequisites are significant predictors of student performance, while race, residency status, transfer status, and high school GPA are not. We find significant interaction effects between gender and major, ACT math score, and cumulative GPA; between major and university GPA, grade in agricultural economics prerequisite, and grade in math prerequisite; and between university GPA and prerequisites. University GPA dominates the effects, but agricultural economics students outperform other majors, and grades in the prerequisites notably influence student performance.

Introduction

Student success and performance continues to be a growing concern within American higher education (Seidman, 2005), with implications for the strength and viability of the American Economy (U.S. Department of Education, 2006; Kuh, 2006; Kuh et al., 2007). As academic units struggle to provide consistent course offerings with fewer teaching resources, class sizes have grown tremendously. The high costs associated with low student success rates make prediction of student success important to the admissions and advising process (Glennen et al., 1996). In this context, it is increasingly important for advisors and instructors to identify student needs and abilities before encountering problems to reduce the frequency of course retakes, improve the learning environment for student peers, reduce the demand on instructors' time, and generally alleviate problems that arise when students are not prepared for coursework.

Students arrive at college with vastly different levels of proficiency and preparedness for coursework. The problem is typically pronounced in land-grant universities and for departments that teach traditional agricultural courses (e.g., agricultural economics, animal science, and agricultural education) that often attract poorer and less-well-educated students from rural areas. Students in these degree programs take several multidisciplinary service courses, which usually have very large class rolls. The effect of class size may be even more evident in service courses with a diverse mix of students from various majors, backgrounds, and preparedness for the coursework. The problem manifests in bi-modal grade distributions and large variances in student performance within the same course, which complicate course design, instruction, and advising.

Farm and Agribusiness Management (FAM) is a traditional undergraduate service course that is rooted in economics, but also integrates knowledge and principles from agronomy, animal science, and other agriculture-related majors. In courses with much smaller enrollment, student diversity might lead to a fuller understanding of the material through direct student participation and group exercises. However, the typically large enrollment in FAM encourages a more streamlined approach to instruction and evaluation, including multiple-choice exam questions, PowerPoint lectures, and relatively little time allocated to the individual needs of each student. This teaching style may not fit well with some students' preferred learning styles.

Instructors and administrators are concerned with student success as an important measure of learning and instructor/unit effectiveness (Barkley and Forst, 2004), and administrators are concerned with the high costs associated with poor student retention (U.S. Department of Education, 2006; Kuh et al., 2007; Dyer et al., 1996; Glennen et al., 1996). Consistently poor student performance has negative implications on unit teaching budgets and instructor promotion/retention. To prevent unnecessary waste

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of scarce resources (e.g., instructors' time and classroom space), it is imperative that advisors and instructors correctly predict student success prior to enrollment to improve student success rates in large service courses.

Predictors of Student Performance

Student performance can be difficult to predict given the complex interaction of socioeconomic characteristics, experiences, cognitive abilities, personality, learning style, and other factors. Researchers have applied a wide variety of approaches to this problem by examining factors such as student social networks and sociological, organizational, psychological, cultural, and economic perspectives (Kuh, 2006), or differences in learning styles (e.g., Cano 1999; Rudd et al., 2000). These studies report results that are valuable to understanding conceptual student motivations, but may be methodologically difficult to apply in the individual classroom. However, student information is readily available from university registrar offices, including grades from previous coursework, high school grade point average (GPA), scores from standardized aptitude tests, and basic demographic information. According to prior studies, this type of background data often possesses significant explanatory power when predicting student performance.

Registrar Data

Numerous studies have confirmed that prior academic achievement as measured by GPA is a statistically significant factor in explaining student success in the classroom (Aleamoni, 1977; Martin, 1989; Barkley and Forst, 2004; Nolan and Ahmadi, 2007). For example, cumulative GPA has been found to be a significant factor in classroom performance in undergraduate agricultural economics courses at Purdue University, Washington State University, University of Idaho, and Ohio State University (Martin 1989; Devadoss and Foltz, 1996). Standardized test scores (e.g., SAT and ACT) are also significant predictors of coursework performance. SAT performance, particularly on the mathematics section, is a significant predictor of success in economics coursework (Ballard and Johnson, 2004). However, standardized tests typically provide less explanatory power of classroom performance than high school grades (Astin, 1971; Weitzman, 1982; Barkley and Forst, 2004; Baron and Norman, 1992). Also, SAT performance as a predictor may be overstated when considering the high correlation between socioeconomic characteristics and SAT scores (Rothstein, 2004). As a determinant of academic performance, standardized tests are weakened by gender and racial bias, including the potential for students to be "coached" into higher scores (Crouse and Trusheim, 1991).

Studies on the effects of gender and age on student success report mixed results, depending on course content (e.g., Anderson et al., 1994; Bridges and Casavant, 2002; Zoglmann et al., 2004). Females typically score slightly higher in reading-based courses, whereas males tend to perform better in science and mathematics (Van Harlingen, 1995) and economics courses (Jensen and Owen, 2001; Ballard and Johnson, 2004). In the context of agriculture, however, gender has typically been found to be insignificant in determining academic performance (Devadoss and Foltz, 1996; Barkely and Forst, 2004), although instructor gender biases and instructor-student interactions likely play a critical role in determining student performance (Lipe, 1989; Mutchler et al., 1987). Age has received relatively less attention in the literature. Some studies have found that younger students tend to perform significantly better than older students (Astin, 1971; Dockweiler and Willis, 1984; Koh and Koh, 1999), whereas other studies report no effect of age on performance (Bartlett et al., 1993; Devadoss and Foltz, 1996; Barkley and Forst, 2004).

Studies on the effects of academic major and prior coursework related to the major on student success also report mixed results. Astin (1971) and Barkley and Forst (2004) find that academic major explains a statistically significant amount of variation in classroom performance. Likewise, Mousel et al. (2006) find that major, class (e.g., sophomore), and experience with rural life (e.g., farming) are statistically significant predictors of student performance in an introductory forage crops management course. Nolan and Ahmadi (2007) look at first-year student success in agricultural economics coursework in Australia from 1991 to 2004, and find that both major and grades in related prior coursework are statistically significant predictors of student marks. Martin et al. (2006) find that prior science coursework is the only statistically significant predictor of student success in an introductory animal behavior course, while 22 other variables have very little effect. However, other studies find little evidence of a significant relationship between student performance and either prior coursework or academic major. Martin (1989) uses student success in prerequisites as a predictor of overall student success in an agricultural price analysis course and finds that most prerequisites (all, except for calculus) have no statistically significant impacts. Likewise, Davis et al. (2006) find that prior coursework (e.g. high school chemistry) is not a significant indicator of student performance, but academic major is a significant indicator, as is SAT score, high school rank, and gender.

In summary, prior research finds that while student success can be explained empirically, the factors which formulate into success appear to vary widely from one setting to the next. Hence, the purpose of this paper is to add to this body of literature by investigating factors that explain academic performance in a large undergraduate service course,

Farm and Agribusiness Management (FAM), at Oklahoma State University. In particular, we evaluate the usefulness of registrar data for predicting academic performance since such data is generally available to academic advisors and course instructors, precluding the need to administer surveys. In the following sections, we present an empirical model of student performance in FAM as a function of registrar data, report and interpret the results of the model, and discuss implications of the results for educators.

Methods

We model student performance in AGEC 3423 "Farm and Agribusiness Management" at Oklahoma State University as a function of data available through the university's registrar:

Student performance = f (Grade point averages, Grades in prerequisites, ACT scores, Major, Transfer, Residency, Gender, Race, Age, and Semester).

We employ two empirical, multiple regression models and used generally-accepted statistical techniques to empirically test the conceptual model and provide estimates of the impact of individual factors on student performance. Model 1 includes only main effects terms:

$$GRADE = \beta_0 + \beta_1 GPA\_OSU + \beta_2 GPA\_HS + \beta_3 ACT\_MATH + \beta_4 ACT\_ENG + \beta_5 TRANSFER + \beta_6 GENDER + \beta_7 RACE + \beta_8 AGE + \beta_9 STATE + \beta_{10} AGEC1114 + \beta_{11} MATH + \beta_{12} MAJOR + \varepsilon$$

where GRADE is the student's final grade (continuous variable) in FAM. GPA_OSU is the student's university-wide cumulative GPA in the semester prior to when the class was taken (continuous), GPA_HS is their high school cumulative GPA (continuous), ACT_MATH is the student's math ACT score (continuous), ACT_ENG is the student's ACT score in English (continuous), TRANSFER indicates whether the student transferred into OSU from another school (1 if transfer), GENDER is student's gender (1 if female), RACE is the student's race (1 if non-white), AGE indicates whether the student's age is <22 years old (1 if <22 years old), STATE captures whether the student was an in-state resident when they took the course (1 if in-state), AGEC1114 is the student's letter grade in the economics prerequisite (class of indicator variables), MATH is the student's letter grade in the math prerequisite (class of indicator variables), and MAJOR is the student's major when they took FAM (class of indicator variables). To account for possible minor differences in students grades across the semesters, we include a semester dummy variable.

Model 2 includes the terms from Model 1, plus interactions between several variables: (1) gender interacted with major, ACT math score, and GPA; (2) major interacted with GPA and grades from the two pre-requisites; and (3) GPA interacted with grades in the pre-requisites. This results in the following additional set of terms that are added to Equation 1:

$$\alpha_1 GENDER * MAJOR + \alpha_2 GENDER * ACT_{MATH} + \alpha_3 GENDER * GPA + \alpha_4 MAJOR * MATH + \alpha_5 MAJOR * AGEC1114 + \alpha_6 MAJOR * MATH + \alpha_7 MAJOR * AGEC1114$$

The model was solved using SAS 9.1 statistical software (SAS Institute, 2002). Since many of the explanatory variables were fixed effects, the model was solved as a generalized model with both continuous and fixed effect variables using PROC GLM.

Data

Student classroom performance in FAM was evaluated for four semesters between fall 2006 and spring 2008. A total of 307 students were included in the analysis (Table 1). The course met three times a week in a traditional lecture setting with a single section that contained an average of 87 students over the four semesters analyzed. Course lectures primarily covered the fundamentals of farm and agribusiness management. This required students to be well versed in various topics from their prerequisite courses in microeconomics (AGEC 1114) and elementary calculus (MATH 1483). The course also contained lectures on the agribusiness industry that are more qualitative in nature. The same instructor, the lead author, taught the course in each of the four semesters analyzed. Student grades in FAM were obtained from the instructor. Grades were on a scale of 0-100, with an average of 82.4 points and a standard deviation of 11.6 points (Table 1).

The remaining data used in the analysis were obtained from the Oklahoma State University's Office of the Registrar. Gender and race variables are included in the empirical models. Over the four semesters, there were slightly more females in the class, who comprised 57.9% of the class Most of the FAM students were classified as White, 86.6%, with the remaining 13.4% split among Native American, African American, and Hispanic students. Student age was categorized into two groups, depending on whether the student was over/under the age of 22. Over the four semesters analyzed, 87.9% of the students were under 22 years of age.

FAM is a traditional subject that integrates concepts from several disciplines and has a significant mixture of major and non-major students. A majority (52.5%) of the students in FAM over the four semesters were agricultural economics majors, but a large percentage (38.7%) were animal science majors. Only 8.8% were neither agricultural economics nor animal science majors (e.g., horticulture, agricultural education, agronomy).

The ACT math and ACT English scores are included in the model using reported scores from the student's high school transcript. Where ACT scores are not available, we use SAT scores to ACT-equivalents. Students enrolled in FAM scored, on average, slightly higher on the ACT math than on English. The average value ACT math score was 21.69, a quarter-point higher than English.

All FAM students are required to complete AGEC1114 "Introduction to Agricultural Economics" and a math prerequisite. AGEC1114 reviews fundamental concepts of economic analysis that are applied

Table 1. Description of Explanatory Variables (N=307 students)

Continuous Variables	*Level*	*Mean*	*Std. Dev.*
Final Grade	0-100	82.4	11.6
GPA (Univ,. cum.)	0-4.0	2.96	0.59
GPA (High Sch, cum.)	0-4.0	3.52	0.61
English (ACT)	0-32	21.44	4.50
Math (ACT)	0-32	21.69	3.83
Category Variables	*Class*	*Count*	*% Frequency*
Gender	Female	178	57.9
	Male	129	42.1
Race	White	266	86.6
	Other	41	13.4
Transfer student	No	77	25.1
	Yes	230	74.9
Age	? 22 years	270	87.9
	> 22 years	37	12.1
In-state resident	Oklahoma	261	85.0
	Out-of-state	46	15.0
Major	Ag. Econ.	161	52.5
	Animal Sci.	119	38.7
	Other[z]	27	8.80
AGEC 1114 grade	A	58	18.8
	B	83	27.0
	C	70	22.8
	D or F	13	4.2
	Not taken	34	11.1
	Taken Elsewhere	49	15.9
Math prereq. grade	A	44	16.9
	B	26	10.0
	C	30	11.5
	D or F	20	7.7
	Not taken	74	28.4
	TE	67	25.7
	Tested Out	46	17.6

[z] Includes horticulture, agricultural education, agronomy, etc.

in FAM. The math prerequisite may be met by a number of math courses, including MATH 1583 "College Algebra" and MATH 1483 "Math Functions." These prerequisites teach math skills and economic principles that are used in FAM, including linear algebra, elementary calculus, and the theory of the firm. We recorded students' letter grades in the prerequisites.

Results and Discussion

Two alternative ANOVA models were evaluated to explore model fit and the presence of significant interactions among variables (Table 2). The use of interaction terms in Model 2 allow us to test the significance of effects across variables, e.g. whether grades in a perquisite course such as AGEC1114 had a different effect on male students compared to females. This method was preferred given our objective to investigate academic performance across the diverse mixture of students in FAM.

Both ANOVA models perform well and are statistically significant at the 99% level of confidence (Table 2). Model 1 explains 42% of the variation around the sample mean of class performance ($R^2=0.42$), which is a satisfactory fit for cross-sectional data (Boyer and Hickman, 2007). Adding interaction terms greatly improves model fit. Model 2 explains 57% of the variation ($R^2=0.57$). The remaining variability in classroom performance is likely explained by other factors that were not included in the data, such as study time, effort, preferred learning style, personality characteristics, and teaching style (Martin, 1989).

We report the results of both models in Table 2. In the following section, we discuss the statistically significant parameter estimates from Model 2, which has much better predictive ability than Model 1. The effect of state residency, transfer status, race, age, and high school GPA are not significant in either model ($P>0.05$) and are not discussed further.

GPA

University GPA is the most significant factor explaining classroom performance in FAM, which is consistent with previous research discussed above (Table 2). The effect of university GPA on a typical student's grade is 9.28 points *($P<0.001$)*. [Parameter estimates for the ANOVA models are not reported in the text due to space limitations. The estimates are available from the authors upon request.] This means that a difference of one letter grade (1.0 point) on a typical student's university GPA is worth 9.28 additional points in FAM which would raise the student's grade by nearly one letter in the class. This result is noteworthy since it predicts nearly a one-to-

Table 2. ANOVA Results for FAM Class Performance Models

	Model 1		Model 2	
Factor	*F Stat.*	*P Value*	*F Stat.*	*P Value*
GPA (Cum. OSU)	44.49	<0.0001***	0.02	0.8797 NS
GPA (High sch.)	1.19	0.2771 NS	1.35	0.2457 NS
English (ACT)	0.18	0.6688 NS	0.15	0.6985 NS
Math (ACT)	2.31	0.1296 NS	0.15	0.6945 NS
Major	4.45	0.0125*	6.72	0.0015**
Gender	0.03	0.8721 NS	0.80	0.3709 NS
Race	0.20	0.6518 NS	0.20	0.6518 NS
Transfer	0.32	0.5728 NS	2.08	0.1507 NS
Age	3.37	0.0565 NS	2.09	0.1500 NS
In-state resident	1.95	0.1641 NS	2.66	0.1045 NS
AGEC1114 grade	0.65	0.6631 NS	2.96	0.0130*
Math prereq. grade	0.18	0.9818 NS	2.01	0.0645 NS
*Gender*Major*	-	-	6.23	0.0023**
*Gender*Math (ACT)*	-	-	7.05	0.0085**
*Gender*GPA (OSU)*	-	-	1.54	0.2163 NS
*Major*GPA (OSU)*	-	-	8.650	0.0002***
*Major*AGEC1114 grade*	-	-	2.25	0.0198*
*Major*Math prereq. grade*	-	-	1.12	0.3448 NS
*GPA*AGEC1114 grade*	-	-	2.83	0.0169*
*GPA*Math prereq. grade*	-	-	2.29	0.0358*
Model	8.20	<0.0001***	4.80	<0.0001***
R^2	0.422	-	0.569	-

NS Not significant, * Significant at $P<0.05$, ** Significant at $P<0.01$
*** Significant at $P<0.001$, Using F-statistics

one correspondence between university GPA and classroom performance. High school GPA, however, does not have a significant effect on classroom performance *(P=0.277)*. It appears that this indicator of prior achievement is too obsolete, or perhaps is tainted by differences in high school academic standards that make it difficult to assess cross-sectional comparisons.

Major

Academic major has a significant effect on classroom performance *(P<0.05)*. Students majoring in agricultural economics perform better than both animal science and other students in the class (Table 2). According to Model 2, a typical agricultural economics student performs 3.8 points *(P=0.06)* higher than a typical student from animal science or other disciplines. Martin (1989) finds a similar effect of academic major in an agricultural economics price analysis class in which agricultural economics students perform better than students from other majors.

We also find a significant interaction effect between university GPA and major on performance in FAM *(P<0.001)*. The impact of university GPA on FAM final grade is strongly influenced by major. For a typical agricultural economics student, each GPA point is worth an additional 7.0 points *(P<0.001)* above the overall mean grade in FAM. For animal science majors, each GPA point is worth 5.4 additional points in FAM, and for non-major students a GPA point is worth only 5.3 points *(P<0.001)*. All else being equal, students with different majors but identical university GPA score differently in FAM, and agricultural economics majors perform 1.6 points better on average than non-majors.

In Table 3, we report the impact of prerequisites on students' final grades in FAM, given their major and university GPA. The effect of major is most apparent among the better students with an overall GPA in the A range (3.5 to 4.0). Here, agricultural economics students outperform animal science students by an average of six points, and students from other disciplines by seven points. Academic major among students with university GPA in the B and C ranges has less effect (Table 3). Agricultural economics students with a B average perform three points better than animal science students with similar GPA and four points better than students from other majors. These findings are noteworthy since the effect of major might be expected to diminish among students with high GPA, but apparently even the better students from other majors find taking a course from outside their field of study challenging.

Table 3. Performance in FAM Based on the Interaction between College GPA and Academic Major from Model 2

	Academic Major			
College GPA	*Ag. Econ.*	*Animal Sci.*	*Other*	*Overall*
A (3.5-4.0)	93	87	86	91
B (2.5-3.5)	85	82	81	83
C (2.0-2.5)	75	72	77	74
D (?2.0)	67	-	-	67
Overall	85	80	81	82

Gender

Gender has a significant effect on class performance, but only when it is included as an interaction with academic major *(P<0.001)* and Math ACT *(P<0.001)*. The Gender-Major interaction is particularly interesting. On average, male animal science students perform significantly lower in the class than male agricultural economics students. However, female animal science students outperform female agricultural economics students by 5.1 points *(P<0.01)*, and outperform male animal science students by 9.3 points *(P<0.01)*. The effect of Math ACT score in its interaction with gender is significantly stronger for males than females. For females, higher Math ACT scores actually lead to worse results in FAM *(P=0.009)*, with each additional point on the Math ACT leading to a 0.95 point drop in the FAM final grade compared to male students. The interaction between gender and university GPA is not significant *(P=0.216)*. This implies that all else equal, students' past academic performance at OSU does not depend on gender, and both females and males are expected to perform the same based on their university GPA.

Prerequisites

As expected, prerequisite courses in economics and math are both significant indicators of classroom performance in FAM. The economics prerequisite, AGEC1114, has significant interaction effects with both university GPA *(P=0.02)* and academic major *(P=0.02)* (Table 2). In Table 4, we report two-interaction effects between prerequisite courses, academic major, and university GPA using the ANOVA model results. Interestingly, if a student earns an A grade in AGEC1114, then university GPA has virtually no impact, since the student is expected to receive an A in FAM whether their university GPA is an A or B. No students in our data set earned an A grade in AGEC1114 and had university GPA of C or lower. For students entering the class with a B from AGEC 1114, the effect of university GPA corresponds directly with their expected grade in FAM. Students with a university GPA of A would on average be expected to receive an A in FAM, B students would be expected to receive a B, and likewise C students a C. For students with a C in AGEC1114, their expected grade is either a low B or a C in FAM, and students with a D in AGEC1114 are expected to perform at the C-D borderline in FAM (Table 4).

The interaction between academic major and grade in AGEC1114 reveals that students majoring in agricultural economics are expected to perform significantly better than non-majors given their AGEC1114 grade (Table 4). The effect is particularly strong for students who earn an A in AGEC1114, where agricultural economics students are expected to outperform non-majors by 6.3 points. For students with either a B or C in AGEC1114, two findings emerge. Animal science students under perform agricultural economics students as well as students from other majors by about two points whether they receive a B or C in AGEC1114. In addition, no significant difference is shown in the performance between agricultural economics students and students from other non-animal science majors, with both expected to receive a grade of either an 85 (B in AGEC1114) or 80 (C in AGEC 1114).

The results suggest that agricultural economics students are better able to make use of the prerequisite course than animal science students. This is likely a combination of agricultural economics students retaining more of their knowledge and skills acquired in AGEC1114 and their ability to apply such prior knowledge in a new setting. Possibly, agricultural economics students have a greater intuition for economics than non-major students, or that non-majors are less motivated to perform in non-major coursework.

Prerequisite math coursework has an effect similar to AGEC1114 on performance in FAM (Table 4). A student's grade in prerequisite math is a solid indicator of performance when combined with their university GPA. An A in math indicates that the student should perform well in FAM, with an expected grade no lower than 83.1 for students with a GPA of C. Students with a GPA of either A or B would be in the upper B range in FAM, with expected grades of 89.3 and 87.5, respectively. Students with a B in math also perform well in the class, obtaining a grade more or less commensurate with their GPA. There is some concern for students with a C in math, who under perform in FAM by almost a full letter grade. Students with a GPA of B would be expected to receive only an 80.6 in farm and agribusiness management, and a C math student would receive a 72.2.

Table 4. Performance Based on Major, GPA and Prerequisite Grade from Model 2

		AGEC1114				Freshman Math			
		A	*B*	*C*	*? D*	*A*	*B*	*C*	*? D*
College GPA	*A (>3.5)*	92	92	-	-	89	89	-	-
	B (3.0-3.49)	90	85	81	-	88	84	81	83
	C (2.0-2.99)	-	74	75	71	83	81	72	73
	D (1.0-1.99)	-	-	-	-	-	-	-	-
		A	*B*	*C*	*? D*	*A*	*B*	*C*	*? D*
Acad. Major	*Ag. Econ.*	93	85	80	69	90	84	78	75
	Animal Sci.	86	83	76	-	83	84	76	77
	Other	-	86	80	-	-	86	80	-

Academic major has a significant effect on classroom performance for students with an A in freshman math, with agricultural economics students performing 6.8 points better than non-major students. Agricultural economics students with an above average grade in freshman math may have a better ability to transfer and apply mathematical skills into farm and agribusiness management than non-major students. For the remaining students, academic major does not appear to have a significant impact in predicting how freshman math translates into classroom performance in FAM.

Summary

In this paper, academic performance in a large undergraduate service course (Farm and Agribusiness Management) is predicted using indicators readily available to instructors and academic advisors, including university GPA, academic major, prerequisite course work, gender, and standardized test scores. We report the results of two empirical models, and discuss one in detail. Cumulative GPA, major, gender, and performance in prerequisites are significant predictors of student performance, while race, residency status, transfer status, and high school GPA are not. We find significant interaction effects between gender and major, ACT math score, and cumulative GPA; between major and cumulative GPA, grade in agricultural economics prerequisite, and grade in math prerequisite; and between cumulative GPA and prerequisites.

Predicting performance can be a useful tool to assist instructors and advisors in identifying students vulnerable to poor performance. At Oklahoma State University, freshman advisors provide students with grade predictions for core courses during their first year. Advisors are able to adjust students' coursework based on these expectations. This approach may be useful for non-core and advanced courses as well, including the FAM course discussed here. The empirical model that we present can support course design and advising. For example, the significant effect of prerequisite courses on performance likely indicates poor retention of fundamental principles, which an instructor could address through course review. The effect of low GPA on class performance could be an indicator of student motivation and/or study skills, which could be addressed by careful monitoring of student effort and attendance, and apportioning adequate time out of class to address certain needs. Future research will be required to investigate whether grade forecasts are beneficial to students. Currently, whether students would be motivated to surpass expectations, or whether expectations could be a self fulfilling prophecy leading to underachievement is unclear.

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