Research in Economic Education

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I Thought I Got an A! Overconfidence Across the Economics Curriculum

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Abstract: Students often exhibit overconfident grade expectations and tend to overestimate the actual course grade at the completion of a course. Current theories of student motivation suggest such overconfidence may lead students to study less than if they had accurate grade perceptions. The authors report the findings of a survey of students enrolled in economics and quantitative courses at a large public university. They analyze the difference between a student's expected and actual grade and how teacher pedagogies can influence student overconfidence. They find male students and those with lower GPAs exhibit greater overconfidence. Students in lower division classes have a greater tendency to be overconfident than do those in upper division classes. The findings also indicate that grading practices influence overconfidence.

Keywords: grading, motivation, overconfidence, performance, teacher evaluation
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Psychologists have long known that people, in general, and students, in particular, tend to overestimate their abilities. In an educational context, this tendency toward overconfidence is exacerbated among the people who exhibit the lowest skill in recognizing their own incompetence (Kruger and Dunning 1999). In that context, Shafir and Tversky (1992) described what they called *nonconsequentialist* reasoning, which is characterized by an inability to think through the elementary conclusions one would draw in the future if hypothetical events were to

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occur. Faculty members frequently observe such nonconsequentialist reasoning when students, having failed a final exam, say they nevertheless expected a course grade of an A or at worst a B+ when, given their performance on earlier exams and assignments, such grades were higher than the highest possible outcome, even if they had done well on the final. This tendency toward overconfidence has been observed in economics students by Grimes (2002) and Grimes, Millea, and Woodruff (2004), who found that students in principles of economics courses exhibited a pervasive degree of overconfidence with respect to the grades they expected to receive on exams.

The ramifications of overconfidence have emerged as an important topic for economic educators. Millea and Grimes (2002) reported that both expected grades and actual grades influence students' evaluations of their economics professors. Isley and Singh (2005, 28) reported that the average of student evaluations of teaching are higher in classes where students expect higher grades, but they found that it is "the gap between expected grade and cumulative grade point average" rather than expected grade, per se, that is the relevant explanatory variable. Seifert (2004) and Bandura (1993) suggested that for achievement-oriented students, who set goals and adjust their behavior to reach them, overconfidence may result in allocating less time to studying than would be the case if their grade expectations were more accurate.[1]

We attempted to replicate the results of Grimes (2002), using data that reflected the students' ability to correctly predict their final grade in economics and quantitative analysis courses. By controlling for a wide variety of classroom pedagogies and student characteristics, we extended Grimes' work and answered questions concerning what type of pedagogies may reduce overconfidence. Our findings suggest that instructors may be able to influence overconfidence, and to the extent that students are motivated through the desire to achieve high grades, instructors should be aware of the effect of their actions on student overconfidence.

METHODS AND DATA COLLECTION

We analyzed two different types of overconfidence in the context of grade expectations. The first type of overconfidence reflected an inflated view of an ability to accurately predict future performance. Most educational studies on student self-assessment have focused on this definition of overconfidence. Such studies have primarily used either artificial experiments or actual examinations to see how well a student can predict the score or outcome on a quiz, test, or exam. For example, in experimental settings, students have been shown to make relatively poor predictions of their ability to memorize lists and passages from texts (Maki and Berry 1984). However, in less artificial settings (i.e., when the setting is familiar and when the item being predicted is meaningful for the student), Maki (1995) has shown that the ability of students to successfully predict performance will be greater.

The second dimension of overconfidence reflects self-assessment that is overly optimistic. For example, Gaultney and Cann (2001) surveyed students after grades had been reported to them. Although they stated, "most students did get the grade they expected in courses," they also found that, of the 29 percent who were surprised by a grade, 58 percent were surprised "because the grade is lower" than expected (pp. 84–85). In educational settings, this implies that students consistently overestimate the grades they would actually receive. Evidence also suggests that overconfidence may vary systematically with student characteristics and academic discipline (Falchikov and Boud 1989; Grimes 2002).

We examined the ability of students to predict the grade they would earn in classes taught by faculty in the economics department during the fall semester of 2002. During the last week of the semester, students at a large public university took the standard instructor and course evaluation in accordance with university policy. The standard evaluation form was augmented as described below. The survey was conducted in 32 separate courses, representing every class offered by the economics department that semester. The augmented portion of the survey was given immediately after the students completed the standard instructor and course evaluations, and students were told the survey was voluntary and were assured their responses would remain anonymous. Even though we asked students to provide their student identification number (which clearly meant that, in spite of assurances to the contrary, the anonymity of their written evaluations could be compromised), response rates for those present in the classrooms at the time of the survey were greater than 95 percent. A few students declined to fill out the questionnaire, but less than 3 percent of the students who filled out the questionnaire omitted their student identification number. Thus, of a potential enrolled student population of 1,022 in the courses surveyed, we had complete data on 715 students. This 70 percent response rate suggested an absenteeism rate of about 25 percent on the day(s) of the survey. The surveys were conducted during the last week of the semester and probably were a good representation of students finishing a course in economics and quantitative analysis, but because many students would have dropped out prior to the last week of the semester, it probably did not represent the students who initially enrolled in the courses (Becker and Powers 2001).

In the standard instructor and course evaluation form, students were asked to estimate their course grade from A to E. Because this question is asked on all instructor and course evaluations administered at the university, students have had substantial experience with this task. In addition, when students actually receive their grade reports, they get feedback on the accuracy of their earlier predictions. Because predicting grades is a meaningful application and predicting grades is a frequent task for students, comparing expected and actual grades is an ideal method of exploring the nature of student overconfidence (Maki 1995).

After obtaining student responses, we surveyed faculty about the different grading practices used during the semester and about the amount of feedback given to students regarding their grades. Faculty provided us with actual grades for each student. We calculated a measure, which reflected the ability of students to accurately predict their true grades, by simply calculating the difference between the actual and expected grade for each student, where an A had a value of 4.0 and an E had a value of 0.0. Because students did not have the option of using plusses and minuses when queried regarding their expected grade, we ignored plusses and minuses in the actual grades. Following Grimes (2002), we

TABLE 1. Actual Grade vs. Expected Frequency

Expected grade	Actual grade A	B	C	D	E	Total (expected)
A	153	63	4	1	0	221
B	38	164	111	15	0	328
C	0	22	93	29	6	150
D	0	0	4	5	4	13
E	0	0	1	1	1	3
Total (actual)	191	249	213	51	11	715

called the difference between expected and actual performance *overconfidence*. Possible values for our measure of overconfidence lie between negative and positive four.

A contingency table representing overconfidence is shown in Table 1. Although Gaultney and Cann (2001) reported that *after the fact* 71 percent of students reported getting the grade they expected, only 58 percent of students in our survey were able to correctly *predict* their grade. One-third of students in our survey exhibited a degree of overconfidence, and their predicted course grade was greater than the actual grade they ultimately received. A significant portion, 9 percent, actually underpredicted their grade.

This inability to predict grades is particularly pronounced at the lower end of the grading scale. At the university where the study was conducted, students who score below a grade of C receive no credit for the class. Of the 62 students who received a D or E grade, and therefore received no credit, only 6 students correctly predicted their grade. Approximately 90 percent of these students expected to pass the class but were ultimately unsuccessful.

STATISTICAL ANALYSIS

Prior to a more detailed analysis of student overconfidence, we asked if the level of overconfidence was similar among the classes or if overconfidence differed among the classes surveyed. If overconfidence did not differ between classes, further discussion of how instructors influenced overconfidence was not warranted.

To analyze the student-level data, we use a binary-choice model to predict overconfidence. Although it is possible to analyze the data in an ordered multinomial framework, where students may correctly predict their grade or be over or underconfident, we suspected that underconfidence and overconfidence were dissimilar enough that modeling them separately was most appropriate. Because students who earn a grade of A do not have the opportunity to be overconfident, we dropped these observations from our sample. This left us with 524 observations, 44 percent of which represented students who were overconfident.

Using a logistic regression, where the dependent variable had a value of 1 if the student was overconfident and 0 otherwise, we tested the null hypothesis that overconfidence was independent of class as opposed to the alternative that overconfidence and class section were not independent. The explanatory variables in this preliminary analysis were binary dummy variables, representing 31 of the 32 classes surveyed. We restricted the coefficients on all 31 dummy variables to be equal. We compared the likelihood function from this restricted regression with the unrestricted regression, where all slope coefficients were allowed to vary. The χ^2 test statistic was equal to 42.74, and with 31 degrees of freedom, the null hypothesis was rejected with a *P* value equal to .07.

This hypothesis test led us to suspect that course section and overconfidence were related. To further explore this possibility, we conducted a more detailed analysis of how overconfidence varied in the different course sections. Starting with the 32 class-level observations, we first omitted four observations where the class size was 6 students or smaller (all other classes had more than 10 students). For the remaining 28 observations, we calculated the average level of overconfidence in each class (%OVERCONFIDENCE) and correlated this with a preliminary set of instructor and class characteristics. We examined if average overconfidence was different for lower and upper division classes (LOWER = 1, if lower division) and for economics and quantitative analysis classes, (ECON = 1 if an economics class). We began to discover the effect of instructor characteristics on overconfidence by looking at the average level of overconfidence in classes taught by adjunct versus tenure-track faculty (ADJUNCT = 1, if taught by an adjunct instructor) and by average student rating of faculty on the end-of-term student evaluations of instructors (RATING). Responses to this question varied from a low of 1.0 to a high of 7.0. We controlled for average class grade point average (GPA), the average hours studying per class (STUDY), and the percentage of the class that was male (MALE), both factors that have been linked to grade expectations overconfidence by prior researchers (Beyer 1999; Kruger and Dunning 1999). We estimated

$$\begin{aligned}\%\text{OVERCONFIDENCE} &= \alpha_0 + \alpha_1(\text{LOWER}) + \alpha_2(\text{ECON}) \\ &+ \alpha_3(\text{ADJUNCT}) + \alpha_4(\text{RATING}) + \alpha_5(\text{GPA}) + \alpha_6(\text{STUDY}) \\ &+ \alpha_7(\text{MALE}) + \text{E}.\end{aligned} \tag{1}$$

The results of estimating a linear model are presented in Table 2. With 20 degrees of freedom, we could reject the null hypothesis that all slope coefficients were zero at a *P* value of .01. Instructor rating was positively correlated with higher levels of overconfidence, and classes with higher average study time tended toward higher levels of overconfidence. From this initial analysis of the data, we concluded that (1) overconfidence was likely to vary between classes, and (2) instructors had the ability to influence overconfidence. We now turn to a more complete analysis of the data, using student-level responses.

Prior to a more detailed estimation of the model, we confronted the problem of sample selection. We were particularly concerned about the bias introduced by students still enrolled in the course but absent on the day the instructor and course evaluation were administered. These students provided no information regarding

TABLE 2. Regression Results Using Class-Level Data (Dependent Variable: %OVERCONFIDENCE)

Variable[1]	Estimated coefficient	*t* ratio
Constant	.66	1.33
LOWER	.03	.42
ECON	–.05	–1.01
ADJUNCT	–.08	–1.15
RATING	.06	1.75*
GPA	–.20	–1.31
STUDY	.04	1.88*
MALE	.32	1.50
n = 28	Unrestricted LLF = 25.1	*P* value = .01
	Restricted LLF = 15.9	

Notes. [1]The unit of observation is individual courses: RATING, GPA, STUDY, MALE, and %OVERCONFIDENCE represent the average value for each of the 28 classes.
* Significant at the .05 level in a two-tailed *t* test.

their expected grade so we had no observations regarding overconfidence for this group. Because we only observed overconfidence if the student was in attendance on the day course evaluations were conducted, we used a bivariate probit model with sample selection to predict (1) the probability of a student being in attendance and completing our survey and (2) the probability of overconfidence. We estimated the following equations:

$$\text{COMPLETE} = \beta_0 + \beta_1(\text{MALE}) = \beta_2(\text{GPA}) = \beta_3(\text{AGE}) + \beta_4(\text{GRADE}) + \beta_5(\text{LOWER}) + \beta_6(\text{ECON}) = E_1. \quad (2)$$

$$\text{OVERCONFIDENCE} = \alpha_0 + \alpha_1(\text{MALE}) + \alpha_2(\text{TOTAL HOURS}) + \alpha_3(\text{SEMESTER HOURS}) + \alpha_4(\text{AGE}) + \alpha_5(\text{GPA}) + \alpha_6(\text{STUDY}) + \alpha_7(\text{ABSENT}) + \alpha_8(\text{ADJUNCT}) + \alpha_9(\text{LOWER}\hat{\text{O}}) + \alpha_{10}(\text{ECON}) + \alpha_{11}(\text{RATING}) + \alpha_{12}(\text{FINAL\%}) + \alpha_{13}(\text{MIDTERM\%}) + \alpha_{14}(\text{PAPER}) + \alpha_{15}(\text{HOMEWORK}) + \alpha_{16}(\text{CURVE}) + E_2. \quad (3)$$

The bivariate probit model with sample selection produced estimates of the overconfidence equation that corrected for the bias that would otherwise be present because of the sample selection (Greene 2003). Definitions, means, and standard deviations of the data used to estimate both the COMPLETE and OVERCONFIDENCE equations are given in Table 3.

To predict the probability of completing the survey, we used six covariates that reflected a mixture of student characteristics and class characteristics. We considered the grade received by students in the class (GRADE) and the student's overall grade point average (GPA). We considered the age of the student (AGE)[2] and whether the student was male or female (MALE). We included a dummy variable indicating whether the class was lower or upper division (LOWER)[3] and

TABLE 3. Definitions, Means, and Standard Deviations

Variable	Definition	Mean	SD
	Student demographics		
MALE	1, if male; 0 otherwise	.71	.45
TOTAL HOURS	Total credit hours completed	74.3	38.1
SEMESTER HOURS	Credit hours for current semester	13.32	5.24
AGE	Age of student	23.01	4.29
GPA	Grade point average A = 4.0	2.96	.53
STUDY	Hours per week spent studying for class	3.75	2.82
ABSENT	Absences per semester	2.20	2.08
GRADE	Actual grade received	2.54	.47
	Instructor and class characteristics		
ADJUNCT	1, if adjunct instructor; 0 otherwise	.26	.44
LOWER	1, if lower division class; 0 otherwise	.87	.33
ECON	1, if economics class; 0, if quantitative analysis class	.65	.47
RATING	Overall student evaluation of instructor 1(low)–7(high)	5.37	1.46
	Pedagogies		
FINAL%	Percentage of grade based on final exam	.20	.10
MIDTERM%	Percentage of grade based on midterms	.47	.18
PAPER	1, if paper is included in grade; 0 otherwise	.40	.50
HOMEWORK	1, if homework is included in grade; 0 otherwise	.24	.44
CURVE	1, if instructor curves grades; 0 otherwise	.28	.45

another dummy variable indicating whether the class was in economics or quantitative analysis (ECON).[4]

To explain overconfidence, we explored three groupings of explanatory variables: student demographics, instructor and class characteristics, and teacher pedagogy. First, we discuss student demographic variables. We collected information from students on their gender (MALE = 1, if male, 0 otherwise), on their cumulative credit hours earned at the time the study was conducted (TOTAL HOURS), on the number of credit hours enrolled in during the current semester (SEMESTER HOURS), and on their age (AGE). There is some evidence that men outperform women in introductory economics classes (Lumsden and Scott 1987), but our interest lay elsewhere. Although some authors have found a relationship between gender and grade *expectations* (e.g., Beyer 1999), we had no *a priori* expectation for the sign of the estimated coefficient associated with this variable. Authors of empirical studies have suggested that with increased experience, students become more accurate in their ability to self-assess and that overoptimistic assessment declines with greater experience (Boud and Falchikov 1989; Falchikov and Boud 1989). On the basis of prior research, we expected the estimated coefficients on TOTAL HOURS and AGE to be negative. We suspected that as SEMESTER HOURS increased, overconfidence would also increase. Enrolling in a greater number of classes reflects a student's perceived ability to excel in coursework and a greater likelihood of over confidence.

We gathered data from university records on the students overall GPA. Following the research of Kruger and Dunning (1999), we speculated that more capable students would have more accurate expectations and would exhibit less overconfidence than would students with lower GPAs, although an alternative was suggested by Isley and Singh (2005), who posited that students with higher GPAs might also have higher grade expectations.

We gathered two pieces of information on student behavior: hours spent studying per week (STUDY) and the number of absences in class during the semester (ABSENT). Although substantial evidence suggests a positive correlation between attendance and course performance and student learning (e.g., Park and Kerr 1990; Romer 1993, Durden and Ellis 1995; Marburger 2001), Grimes (2002) did not find a significant relationship between absenteeism and overconfidence. We expected students who were more informed to have a more accurate perception of their grade, thus we expected STUDY to be negatively related to overconfidence and ABSENT to be positively related to overconfidence.

We gathered four types of information on instructor and class characteristics. We considered whether the faculty member was an adjunct instructor or full-time faculty member (ADJUNCT = 1, if the teacher was a part-time faculty member and 0 otherwise) and if the class subject was economics or quantitative analysis (ECON = 1 if economics, 0 otherwise). We noted whether the class was at the lower or upper division level (LOWER = 1 if lower division, 0 otherwise). Finally, we included the student evaluation of the instructor (RATING), which was measured on a Likert scale from 1 (low) to 7 (high). Although students are asked to rate instructors on a variety of factors, the correlation between student responses tends to be large; therefore, we used the overall instructor rating as our measure.

We expected adjunct faculty, who are not as available to answer student questions regarding grades, to generate higher overconfidence. Past evidence (Falchikov and Boud 1989) indicated that overconfidence varies by academic discipline and type of course, and as a result, we included LOWER and ECON to test if lower division and economics classes had a different tendency toward overconfidence than did upper division classes and quantitative analysis classes. Finally, recent evidence (Isley and Singh 2005) indicated a positive correlation between student evaluations of instructors and overconfidence, and we expected the coefficient on RATING to be positive.

Third, we looked at multiple class pedagogies that could influence overconfidence. We were aware of no prior evidence suggesting how grading practices impact overconfidence. Initially, we suspected that practices such as curving grades generate greater uncertainty as to how grades will be assigned and lead to higher overconfidence. We suspected that increasing the relative importance of well-defined grading practices such as tests, papers, homework, and final exams would reduce uncertainty regarding how grades are determined and reduce overconfidence. The grading practices we investigated primarily reflected the weight of the different grading elements in a students' grade rather than the frequency of feedback regarding different grading elements. It may be that frequency of feedback affects overconfidence in a different manner than does the relative weight of the grading instrument.

We calculated what percentage of the course grade was determined by the final exam (FINAL%) and what percentage of the course grade was determined by the midterm and quizzes, (MIDTERM%).[5] We gathered information on whether the class required a paper or project, (PAPER = 1 if yes, 0 otherwise) and if homework was part of a student's grade, (HOMEWORK = 1 if yes, 0 otherwise). Finally, we asked if the faculty member graded on a curve (CURVE = 1 if yes, 0 otherwise).

RESULTS

Estimated results for the bivariate probit model with sample selection are presented in Table 4. Marginal effects for each equation represent the expected change in the probability the dependent variable equals one, for a single unit change in the explanatory variable.

Our results indicated that men appear to be more overconfident than women, a finding similar to that of Grimes (2002). This occurs in spite of the fact that men are less likely to complete the survey. Students who have taken more credit hours are no better able to predict actual grades than students with less experience, and older students are no better able to predict their grade or more likely to have completed the survey than younger students. The estimated coefficient on SEMESTER HOURS is positive and significant in the overconfidence equation, thus, as the number of credit hours taken during the semester increases so does overconfidence.

Students with high GPAs were significantly more likely to have completed the survey than students with lower GPAs; however, we found no statistically significant relationship between GPA and overconfidence. We found that students who spent a greater amount of time studying expected higher grades relative to the grades they actually received compared with students who spent less time studying. The number of absences a student had in the course (ABSENT) appeared to have no relation to overconfidence. As one would expect, students who earned higher grades in class were significantly more likely to be present when the survey was conducted.

Turning to the marginal effects of the student demographic variables on overconfidence, men were 9 percent more likely to overestimate their grade than were women (Table 4) and a one-credit-hour increase in the current semester's enrollment resulted in a 1 percent increase in the probability of overconfidence. A one-hour

TABLE 4. Estimation Results, Using Bivariate Probit with Sample Selection

Variable	Dependent variable OVERCONFIDENCE n = 524			Dependent variable COMPLETE n = 787		
	Estimated coefficient	t ratio	Marginal effect[1]	Estimated coefficient	t ratio	Marginal effect[a]
CONSTANT	–2.16**	–3.31	—	–1.76**	–3.5	—
			Student demographics			
MALE	.27**	2.30	.09	–.06	–.58	–.02
TOTAL HOURS	–.0007	–.46	–.003	—	—	—
SEMESTER HOURS	.03*	1.87	.01	—	—	—
AGE	.01	1.03	.005	.02	1.28	.009
GPA	.11	1.25	.04	.37**	4.08	.12
STUDY	.05**	2.80	.02	—	—	—
ABSENT	.02	1.10	.008	—	—	—
GRADE	—	—	—	.36**	7.39	.12
			Instructor and class characteristics			
ADJUNCT	–.02	–.06	–.009	—	—	—
LOWER	.37*	1.83	.12	–.25	–1.36	–.09
ECON	–.02	–.12	–.005	.16	1.5	.06
RATING	.06**	2.03	.02	—	—	—
			Pedagogies			
FINAL%	–.007	–1.03	–.003	—	—	—
MIDTERM%	–.006*	–1.68	–.002	—	—	—
PAPER	–.11	–.86	–.04	—	—	—
HOMEWRK	.09	.70	.03	—	—	—
CURVE	.28**	2.30	.12	—	—	—

Notes. Correlation coefficient between errors = .98**. Unrestricted LLF = –764.77; Restricted LLF = –890.38: χ^2 = 251.22**.

[a]Marginal effects are calculated as the change in probability that the dependent variable equals 1 for a 1-unit change in the explanatory variable.

*Significant at the .10 level in a two–tailed t test. **Significant at the .05 level in a two-tailed t test.

increase in the number of hours studied per week generated a predicted increase in the probability of overconfidence of 2 percent.

Next, we focused on the effects of instructor and classroom characteristics on overconfidence and the probability of completing the survey. We found that there was significantly more overconfidence in lower division than upper division classes, although survey completion rates were not significantly different. Students in lower division classes were 12 percent more likely to overpredict their grades than students in upper division classes. The estimated coefficient on ECON was not significant in either the OVERCONFIDENCE or COMPLETE equations, suggesting that students in economics and quantitative analysis classes are equally likely to be overconfident. No relationship was found between adjunct instruction and student overconfidence.

We found a positive relation between a student's evaluation of the instructor and overconfidence. All else equal, as the instructor evaluation increased by 1 point (on a 7-point scale), the likelihood of overconfidence increased by 2 percent. This is an interesting finding: student evaluations of teaching are positively related to the difference between what students expect to get for a grade and what they actually receive for their grade. This result is similar to that obtained by Isley and Singh (2005), who suggested that student evaluations of instructors are positively related to the difference between expected grade and cumulative GPA.

Finally, we arrive at the effect of teaching policy on overconfidence. In general, increasing the importance of final exams and midterms reduced overconfidence, although only the effect of midterms was significant. Assigning papers and including homework as part of the grade had no significant effect on overconfidence. Increasing the importance of the midterm examination by 1 percent in the student's overall grade resulted in a 0.2 percent decrease in the likelihood of overconfidence.

One common grading practice that tends to be very popular among students is curving grades. We found that curving grades was positively associated with overconfidence. Curving grades increased the probability of overconfidence by 12 percent.

SUMMARY AND CONCLUSION

Given contemporary theories of academic motivation, reliable and accurate student grade expectations are of paramount importance to efficient time allocation for study decisions. For those students who are achievement oriented, accurate grade expectations will result in a reallocation of study time to achieve academic goals. Grimes (2002) found that students in principles of economics courses systematically ovepredicted their scores on in-class exams. He found less overconfidence in older students, students with higher GPAs, and students with higher ACT scores. He found a greater amount of overconfidence in students who were more likely to be absent. We extended this work by looking at how class characteristics and teacher pedagogies can influence overconfidence.

We found that overconfidence is greater for male students and for students who study longer hours. We found greater overconfidence in lower division classes than in upper division classes, and we found a positive correlation between instructor evaluation and grade overconfidence. We also found that instructor grading practices can influence overconfidence. We found that increasing the importance of tests reduced overconfidence and that curving grades increased the likelihood of overconfidence. Our research suggests that, when considering effective classroom pedagogies, instructors should consider the effect of policies on the tendency for students to be overconfident.

NOTES

1. Tregarthen and Rittenberg (2000, 126–30) provided an excellent hypothetical example of efficient allocation of study time, with an emphasis on using marginal benefit and marginal cost curves to find maximum net benefits.

2. The average age of students surveyed was 23.01 years. This relatively high average age reflects the high proportion of students who attend school part time at the university where the study was conducted. In addition, college algebra is a prerequisite for principles of economics courses. This prerequisite limits freshman enrollment and further increases the average age of the sample.
3. Lower-division classes (with the number of different sections of each course in parentheses) are principles of microeconomics (3) and macroeconomics (3), economic history of the United States (4), economics of social issues (5), business calculus (4), and business statistics I (5). Upper-division classes are international trade (1), intermediate microeconomic theory (1), industrial organization (1), introduction to econometrics (1), and business statistics II (4). Fifteen different faculty members taught these 32 courses (or different sections of the same courses).
4. Quantitative analysis courses are business calculus, business statistics I, and business statistics II.
5. The heavy weight of midterms on course grade results in part because many faculty members give more than one midterm.

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