The Economic Impact of Prior Exam Performance on Current Effort Investment Decision

Tin-Chun Lin*

School of Business and Economics
Indiana University – Northwest
Gary, IN 46408, USA

* Corresponding author: **Tin-Chun Lin** is an associate professor of economics at Indiana University – Northwest. School of Business and Economics, Indiana University – Northwest, 3400 Broadway, Gary, IN 46408, USA. Phone: 1-219-980-6634; Fax: 1-219-980-6916; Email: tinlin@iun.edu.

The Economic Impact of Prior Exam Performance on Current Effort Investment Decision

Abstract

We developed three hypotheses and a case study involving a sample of 203 students enrolled in four introductory microeconomics classes during the spring semesters of 2007 and 2009 to examine the effects of prior exam performance on increments for current in- and out-of-classroom efforts toward future exams. We found that students' prior exam performance is an important and significant signal of students' decisions to invest more or fewer in-/out-of-classroom efforts on the next exam. These findings also indirectly imply that many students may behave like producers in evaluating their previous production outcome and then deciding on a level of effort to invest in current production. In addition, we found that weaker students relative to stronger students could invest fewer efforts when they received poor exam grades. Comparing weaker students with stronger students, weaker students would be more likely to behave like producers.

Keywords: In-classroom effort; Out-of-classroom effort; Prior exam performance; Producer behavior; Cost-benefit analysis.

JEL codes: A20; A22; C20; C23

1. Introduction

Economics faculty have reported that students who did poorly on a midterm exam (D or lower grade) studied less and missed more classes in the next exam period, while students who did well (B or higher grades) studied harder and attended class more frequently in the next exam period. Normally, we would expect that students who did poorly would study harder and attend class more often in order to get a better grade on the next exam, while students who did well (especially an A grade) might not spend more time because they might decide that their current efforts were sufficient. However, these students behaved in an opposite direction and so their behavior seems to be illogical. Therefore, to explain this phenomenon (i.e., the opposite behavior) we may look to producer behavior. That is, the “opposite” behavior makes us reasonably suspect that many students could behave like producers who assess their future expected sales according to their current sales and cost-benefit analysis. If producers who had great sales in past periods expect an increase in future sales, they could increase their investment to achieve greater future sales.

Students have been acknowledged to be economic individuals who respond to education issues via economic behaviors that include both consumer and producer behaviors. As a producer, each student engages in exercises based on cost-benefit analysis and then invests his/her in-classroom effort (i.e., attendance) and out-of-classroom effort on gaining knowledge. Those efforts are evaluated via exams and papers to which grades are assigned. Grades given without inflation are assumed to precisely reflect a student’s knowledge production. After observing their previous production outcome, students analyze their previous costs/benefits and then decide how much effort (including in-classroom effort and out-of-classroom effort) to invest in current production. In other words, students’ prior exam performance may signal their decision whether to invest more or fewer in-classroom/out-of-classroom efforts on the next exam. There may be two possible effects—positive or negative. A positive and significant effect implies that students may behave like producers. That is, students who do well on a midterm exam may feel encouraged and invest more in-/out-of-classroom efforts on behalf of the next exam. On the other hand, a negative or insignificant effect implies that students may not behave like producers. These two effects may coexist at the same time in a class. Some students may have a positive effect while some students may have a negative or insignificant effect. Thus, the overall effect will depend on which effect is dominant.

In addition, producers may have bottom-line targeted sales that can ensure no negative profits. If their current sales are above their bottom-line targeted sales, they may be more optimistic about future sales and hence could increase their investment to accomplish greater future sales. On the other hand, if their sales are below their bottom-line targeted sales, we might expect to see lower future investments because they would be more pessimistic about future sales. Thus, the greater the difference between last sales and bottom-line targeted sales, the larger their current investment increments would be. Similarly, students also have bottom-line targeted grades, which are their GPA (grade point average). Logically, we would expect to see a negative effect—the greater the difference between last exam grades and bottom-line targeted grades, the smaller the investment in incremental efforts. However, if students behaved like producers, then we would see an opposite result (i.e., a positive effect), which is the greater the difference between last exam grades and bottom-line targeted grades, the greater the investment in incremental efforts.

A traditional way to study students' behavior in class would be to investigate the impact of class attendance on exam performance (e.g., Anikeeff, 1954; Brocato, 1989; Devadoss and

Foltz, 1996; Marburger, 2001, 2006; Rodgers, 2001; Rocca, 2003; Stanca, 2006; Chen and Lin, 2008; and Dolnicar, Kaiser, Matus, and Vialle, 2009). Nevertheless, in this paper we adopt an opposite direction to study students' behavior—investigating the impacts of prior exam performance on increments of current class attendance (i.e., in-classroom effort) and out-of-classroom effort. Although this has not been broadly investigated and discussed, a few previous studies had done some similar investigation, such as Jones (1984), Cohn and Johnson (2006), and Krohn and O'Connor (2005). Jones (1984) examined four models of attendance and grades. It is stated that Jones's achievement model in which lower grades will discourage students from attending classes relates directly to the present paper. However, the Cohn and Johnson (2006) study apparently does not support Jones's achievement model. In addition, Krohn and O'Connor (2005) employed the standard approach and found that students responded to higher midterm exam scores by studying less. It should be noted that Krohn and O'Connor (2005) studied whether the student would invest more or less effort than other students, while in this paper we study whether the student would invest more or less effort than the same student did before. For that reason, we use differencing data.

The main purpose of this paper is to examine students' "opposite" behavior—that is, behavior that does not appear to be logical. In this paper we also split data according to stronger and weaker students to see how these two groups behave differently—whether or not stronger students invest more efforts when they receive weak exam grades, and weaker students invest fewer efforts, which will be an important result as we seek to understand why it is that some students do very well and others do not, and what we can do about it.

Therefore, we developed three research questions: (1) Do students behave like producers? (2) Why would students behave like producers? (3) Would it be good or bad news for higher education if students behave significantly like producers? In light of these three questions, we formulated three hypotheses:

Hypothesis 1: Students' prior exam performance will be a significant signal of their decision whether to invest more or fewer in/out-of-classroom efforts on behalf of the next exam.

Hypothesis 2: The difference between prior exam grade and bottom-line targeted grade will be a significant signal of their decision whether to invest more or fewer in/out-of-classroom efforts on behalf of the next exam.

Hypothesis 3: Weaker students, relative to stronger students, will be more likely to invest fewer in/out-of-classroom efforts on behalf of the next exam when they get weak exam grades.

This paper is organized as follows. First, data measurement information is presented and econometric models are built to test the hypotheses. Second, empirical results are reported. Third, a thoughtful discussion is presented. Finally, conclusions are offered.

2. Method

Data Measurement

To conduct this experiment, the following four factors needed to be held constant. They were:

(1) *Teacher's instructional style and teaching materials*. This case study involved four classes (two sections in each semester), so a teacher's instructional style and teaching materials had to be held constant. For this reason, only one teacher can be chosen in order to ensure the same instructional style and teaching materials. More importantly, this also

enables us to better understand why effort-investment behaviors differ across students given the same instructor and grading policy.

(2) *Incentive to attend class*. Students were given complete freedom to decide to attend or not attend class. Hence, there were no mandatory attendance policies, no attendance bonus, and no quizzes. Both mandatory attendance policies and quizzes enforce students' class attendance while an attendance bonus encourages students to attend class. In addition, both punishment due to mandatory attendance policies and a bonus change students' original grades, which lead to a bias.

(3) *Quality of classroom*. The same classroom was used for two different sections each semester so that the instructor could maintain the same instructional style. The classroom has a chalkboard, an over-head projector, and high-tech equipment, including a computer.

(4) *Same exams for all sections*. The same exams (including midterm exams and final exam) were used with all sections so that results would be consistent. In addition, all exams were collected when students turned in their answers. Therefore, it was not possible for students to get information from a previous year's exams.

In spring 2007 and spring 2009, 203 business students in introductory microeconomics classes participated in this case study. In each semester two classes met twice a week. Note that no additional weekly review/tutorial classes were provided by graduate students for this course. Daily attendance was taken, but there was no penalty for skipping class. In addition, there were two midterm exams and one final exam. The final exam was cumulative (i.e., comprehensive). Each exam was one-third of the final grade.

The following variables were used in this study:

1. *Attendance record*. Daily attendance was taken in each exam period. Note that there were ten classes (including the exam day) between exam periods.
2. *Three exam scores*. Each student's three exam scores were recorded and used to proxy a student's exam performance. The scores were on a100-point-scale.
3. *Bottom-line targeted grade*. A student's grade point average (GPA) can be adopted to proxy his/her bottom-line targeted grade, because GPA, regardless of a student's major, is a measure of a student's motivation and scholarly ability. It is most likely that students may refer it to set their bottom-line targeted grades. In addition, GPA is a 4-point-scale and exam scores were a 100-point-scale, thus, we need to convert exam scores into a 4-point-scale by using the following scale:

Exam Scores (100-point-scale)	Grades (4-point-scale)
$scores \geq 90$	A = 4.00
$87 \leq scores < 90$	A- = 3.67
$84 \leq scores < 87$	B+ = 3.33
$80 \leq scores < 84$	B = 3.00
$77 \leq scores < 80$	B- = 2.67
$74 \leq scores < 70$	C+ = 2.33
$70 \leq scores < 74$	C = 2.00
$67 \leq scores < 70$	C- = 1.67
$64 \leq scores < 67$	D+ = 1.33
$60 \leq scores < 64$	D = 1.00
$scores < 60$	F = 0.00

Students' GPAs were offered by the register office.

In addition to these three variables, two more variables required student self-reports. A questionnaire was developed. A few minutes before each exam began the questionnaire was handed out by a proctor to each student. Since no question was confidential, all students were required to write down their names so that these self-reported data could be matched with non-self-reported data. Before the questionnaire was distributed to students, they were told that this survey was for a research project and would not affect their grades. These variables are described below.

4. *Frequency of studying for the class.* Students were asked: Overall, approximately how long did you study for the class during this exam period? There were five choices for these questions. *1* = I study 1–5 hours before the test; *2* = I study 6–10 hours before the test; *3* = I study 11–15 hours before the test; *4* = I study 16–20 hours before the test; *5* = I study more than 20 hours before the test. It should be noted that students were not asked to write down the number of hours devoted to studying for the class because they might not precisely remember how many hours they studied for the class in each exam period, but it might be easier for them to recall how often they studied for the class in each exam period. In addition, some may point out that bias is possible in self-reported data on frequency of studying since students may deliberately upward-bias self-reporting in this context. In fact, bias would neither exist nor be significant since these are differencing data. Suppose a student deliberately upward-biased his self-reporting in the context, say 3, 4, and 5 for Exams I, II, and III, respectively (assuming the actual scale would be 2, 3, 4). After differentiating the data, the difference becomes 1 (= 4 – 3) and 1 (= 5 – 4), which are the same as 1 (= 3 – 2) and 1 (= 4 – 3).
5. *Working hours per week.* Students were asked to write down their working hours per week.

Table 1 reports means and standard deviations for the variables used in this study. In addition, the reliability (i.e., Cronbach's alpha) of exams was measured. Cronbach's alpha was 0.84, which is high and indicates strong internal consistency among these exams. Further, it should be noted that the grades for each exam were original grades—that is, there were no curves.

Econometric Models

According to the hypotheses expressed earlier, econometric models were developed to investigate the impacts of prior exam performance and difference between prior exam grade and bottom-line targeted grade on current in-classroom/out-of-classroom efforts increment. The regression models were created in a linear form, such as:

$$EFT_t - EFT_{t-1} = \alpha_0 + \alpha_1 EXA_{t-1} + \alpha_2 WHR + \varepsilon_1 \text{, and} \tag{1}$$

$$EFT_t - EFT_{t-1} = \beta_0 + \beta_1 \left(GRD_{t-1} - GPA\right) + \beta_2 WHR + \varepsilon_2 \ , \tag{2}$$

where t = 2 and 3; $EFT_t = ATD_t$ or STD_t; ATD_t = total number of attendance during the current exam period (i.e., in-classroom effort); STD_t = frequency of studying for the exam during the current exam period (i.e., out-of-classroom effort); EXA_{t-1} = prior exam scores on a 100-point-scale; WHR = working hours per week; GRD_{t-1} = prior exam grades on a 4-point-scale; GPA = grade point average = bottom-line targeted grade; and $\varepsilon_1, \varepsilon_2$ = stochastic disturbance with a mean 0 and a variance σ^2.

In this formulation, the null hypothesis is that the parameters estimated by coefficients α_1 and β_1 are zero, while the alternative hypothesis is that the parameters are not zero. If students behave like producers, $\alpha_1 > 0$ and $\beta_1 > 0$ and the effect should be statistically significant in the model.

It should be noted that the variable of working hours per week is included in the models because this variable indirectly identifies a student's opportunity cost of attending the class and studying for the course, which could influence a student's decision in effort increment investment. Without adding this variable, a specification error may exist in the models. This variable is a time-invariant variable and is expected to exert a negative effect on a student's effort increment. Other variables such as behavioral variables (e.g., motivation to complete one's degree, motivation to get a good grade, graduate school aspirations, importance of success in life, student perception of instructor, perception of grading difficulty, perception of teaching and learning style congruence, self-conception of one's ability, and etc.) are not displayed in the models because students' behavioral data require confidentiality and anonymity, which means that students' responses that were collected as behavioral data would not be able to match non-self-reported data (i.e., exam scores, attendance, and GPA). However, we are able to split data into stronger and weaker students based on GPA. It is reasonable to believe that stronger students are more motivated, while weaker students are less motivated. This approach allows us to see how these two groups behave differently according to different motivations.

3. Empirical Results

Hypothesis 1

For Hypothesis 1, the results for Equation (1) for current in-classroom and out-of-classroom efforts increment are presented in Columns (1) and (3) of Table 2. As shown in Column (1) of Table 2, students' prior exam performance exerted a positive and significant effect on current in-classroom effort increment at the 5% level. The point estimate indicated that each additional 10 points in the prior exam performance could increase the increment in students' current in-classroom effort (i.e., attendance) by approximately 0.1 classes.

In addition, as shown in Column (3) of Table 2, students' prior exam performance exerted a positive and significant effect on current out-of-classroom effort increment at the 10%

level. The point estimate indicated that each additional 10 points on the prior exam performance could increase students' current out-of-classroom effort (i.e., frequency of studying for exam) increment by approximately 0.04 frequency-scale.

Consequently, these results indicate that the better the prior exam performance, the greater the extent of efforts expended both in and out of the classroom toward achieving good test scores. Hence, Hypothesis 1 was supported.

Hypothesis 2

For Hypothesis 2, the results for Equation (2) for current in-classroom and of out-of-classroom efforts increment are presented in Columns (2) and (4) of Table 2. As that table shows, while the difference between the prior exam grade and bottom-line targeted grade did not exert a significant effect on current in-classroom effort increment at any significant level (though the coefficient is positive), the difference between prior exam grade and bottom-line targeted grade exerted a positive and significant effect on current out-of-classroom effort increment at the 10% level. The point estimate indicated that each additional 10 points in the difference between prior exam grade and bottom-line targeted grade could raise students' current out-of-classroom effort increment by approximately 0.5 frequency-scale.

In short, these results imply that the greater the difference between prior exam grade and the bottom-line targeted grade, the greater the extent of efforts expended either in or out of the classroom toward achieving good test scores. Thus, overall, Hypothesis 2 was supported.

Hypothesis 3

In hypothesis 3, we split data into stronger and weaker students based on GPA. We did not use a dyadic approach to measure weaker and stronger students. Instead, we created three groups based upon GPA, measuring the top versus the bottom and ignoring the middle group.

This approach allows us to avoid students who are at the margin. Students whose GPA is higher than or equal to 3.0 are in the group of stronger students, while students whose GPA is lower than or equal to 2.5 belong to the group of weaker students. Students whose GPA is between 3.0 and 2.5 (not including 3.0 and 2.5) belong to the group of mediocre students. The results for these two groups (stronger and weaker) from Equations (1) and (2) are presented in Tables 3 and 4. As Table 3 shows, both prior exam performance and difference between prior exam grade and bottom-line targeted grade did not exert significant effects on increments in current in-classroom and out-of-classroom efforts in the group of stronger students. These results indicate that stronger students would be less likely to behave like producers. In addition, another possible explanation for these insignificant effects is ceiling effects—students with perfect attendance cannot attend more frequently and those in the highest study-sequence cannot attain more. In the group of stronger students, many students had both perfect attendance and highest study-sequence, implying that they could not do any better. That is, their efforts would be commensurate with earlier efforts. Therefore, the ceiling effects would exert insignificant effects on in/out-of-classroom efforts increment.

For the group of weaker students, as shown in Table 4 both prior exam performance and difference between prior exam grade and bottom-line targeted grade exerted positive and significant effects on current increments in in-classroom effort at the 1% level. While prior exam performance did not exert a significant effect on increments in current out-of-classroom effort at any significant level (though the coefficient is positive), the difference between prior exam grade and bottom-line targeted grade exerted a positive and significant effect on increments in current out-of-classroom effort at the 10% level. These results imply that weaker students would invest fewer efforts when they received weak exam grades. Therefore, we might conclude that weaker students relative to stronger students could invest fewer efforts when they received poor exam grades. Comparing weaker students with stronger students, weaker students would be more likely to behave like producers. Consequently, Hypothesis 3 was also supported.

4. Discussion

The results offer sufficient empirical evidence to suspect that a number of students (especially weaker students) might behave like producers—that is, their prior exam performance and difference between prior exam grade and bottom-line targeted grade could signal their decision whether to invest more or fewer in-classroom/out-of-classroom efforts on the next exam. Indeed, their prior exam performance not only acts as a "signal" but also acts as "feedback". The results also indirectly indicated that when students behave like producers, their effort-investment behaviors are dominated by cost-benefit analysis. Certainly, if students do not behave like producers, their effort-investment behaviors would not be dominated by cost-benefit analysis.

Some may question whether the data indicated that students would slack off given poor performance and why someone would work harder if the bottom-line goal was indeed met. According to the evidence in the data, as shown in Table 4 (Hypothesis 3) students might slack off after performing poorly on an exam and feel discouraged about their prospects for making progress. On the other hand, students would work harder (or at least work as the same hard as before) if their bottom-line goals were indeed met because they would feel encouraged to make progress. For example, a student who met his/her initial goal (say B) would be more likely to set a higher goal (say A) for the next exam due to feelings of encouragement and confidence. Thus, the student would work harder to reach A. If the student's initial goal is A and he/she did reach the goal, it is also more likely that the student would work harder to maintain the highest grade "A" for three reasons: (1) the student was encouraged to do so; (2) the student is more interested in the class and has confidence and trust in the instructor; and (3) the student becomes more ambitious when he/she attains the highest grade of "A".

Moreover, some may not grasp the "producer" effect. They may argue, for example, that "*If I made a B in marketing class but made a D in economics class on a midterm, I am not going to spend more time on the marketing class because I have determined that I am doing fine with current efforts but I need more on the economics class. GPA is my bottom line. If I can hang on to the B in marketing but put more effort into the economics, I can improve my overall GPA.*" Normally, we would expect the student to hang on to the B in marketing but put more effort into the economics course in order to improve their overall GPA. However, when students behave like producers, they may view this in the opposite way. First, everyone's time and effort are limited. Thus, putting more time and effort into the economics class may mean putting less time and effort into the marketing class. As a result, can the student still hang on to the B in the marketing class? Second, when a student receives a D in economics, this may indicate that the student is not interested in economics at all and has missed a lot of information (or is completely lost). Hence, to improve his/her economics grade, the student has to increase time and effort on studying economics, but it still may not definitely lead to significant improvement because economics is a difficult subject that involves more mathematical and abstract concepts than may be found in other business areas, such as marketing. For that reason, the student may hang on to the D in economics but put more effort into marketing to improve his/her overall GPA, especially when the student is not an economics major but a marketing major. In other words, economics may, for this student, be a subject that holds greater risk than marketing. A riskaverse person would rather invest more effort on a less risky project than a higher-risk project. In a real conversation between two business students several years ago on campus, student 1 told student 2 that, "*I am not going to spend more time on economics. I am not interested in economics at all. A passing grade is fine with me. I am going to spend more time on marketing because I am making an A in midterms and I want to receive an A for this class.*" Student 1's conversation exactly reflected the producer effect.

Thus, there are three possible potential reasons for students behaving like producers: (1) Students' effort-investment behaviors are dominated by cost-benefit analysis. (2) Generally, students (especially less motivated students) are more easily discouraged and frustrated after performing poorly, while students may seek further progress if performing well and meeting their targeted grades. (3) Economics is commonly acknowledged to be a difficult subject, relative to other business subjects, implying that economics may be a higher-risk project than other business courses.

Additionally, it would not be good news for higher education if students behaved significantly like producers, since this may lead to a bigger gap in performance-inequality between better-performing and poorly-performing students in a class. That is, students who did well initially would be encouraged to make progress all the time, while students who did poorly initially would be discouraged about their possibility of making progress. Thus, this consequence not only could harm poor-performing students' learning motivation but also could damage the relationship between the instructor and poor-performing students, since they always feel discouraged and may lose their trust and confidence in their instructors. "Knowledge" products differ somewhat from other "profitable" products. Hence, it may be inappropriate to regard "knowledge" products as "profitable" products and use cost-benefit analysis to examine decisions about whether to invest more or fewer efforts on the next exam. Simply speaking, students cannot simply disinvest from a class in the same manner they would for an investment. In a totally efficient situation they could, but that is not the case in higher education due to restrictions that include the stigma of a "W" and restrictions due to situations loans.

Indeed, there is a possibility that instructors could serve as a significant confound in students' ability to motivate and encourage themselves. In addition, an instructor is a co-producer of the "knowledge" product. Thus, if poorly performing students end up failing at the end of a class, the instructor may be partially responsible for that failure. For example, was the instructor a caring professor who was concerned about students and wanted them to learn? When students were experiencing difficulty with the materials, would the professor contact students and meet with them? Would students comfortably ask questions of and seek guidance from the professor? All in all, were faculty aware of the importance of the need for rapport[1] between faculty and students? As numerous researchers (e.g., Granitz, Koernig, and Harich, 2009; Huff, Cooper, and Jones, 2002) have pointed out, a potent rapport between faculty and students not only can ameliorate students' motivation to learn but also can improve their trust and confidence in using faculty as a learning resource—a condition that has positive benefits for both students and faculty. Another factor is differences in students' learning styles[2]. One professor's instructional method proven effective with better-performing students may not be the most effective method with poor-performing students. Thus, a professor who instructs students and assesses their achievement needs should take into account students' learning styles. Applying the

[1] Rapport is "the ability to maintain harmonious relationships based on affinity for others" (Faranda and Clarke, 2004, p. 274).
[2] Learning style is "the concept that individuals differ in regard to what mode of instruction or study is most effective for them" (Pashler, McDaniel, Rohrer, and Bjork, 2008, p. 105).

concept of aptitude-treatment interaction[3], the professor may act like a doctor who, in treating his/her patients, adopts different instructional strategies (treatments) for particular individuals depending on their specific abilities and needs. That is, as Sternberg, Grigorenko, Ferrari, and Clinkenbeard (1999) pointed out, when the instruction is exactly matched to the aptitudes of the learner, the learner performs better.

5. Conclusion

The data used in this study provided sufficient evidence to support Jones's (1984) achievement model. As we stated earlier in the introduction, the main purpose of this paper is to investigate students' "opposite" behavior. Therefore, the evidence might surprise some readers who expected an opposite result—the lower the prior exam performance, the greater the investment of in- and out-of-classroom efforts on the current exam. Readers may think that students who did not do well on a prior exam would try to study harder and attend class more frequently in order to do better on the next exam. Although this expectation is reasonable, the presumption has to be that students do not behave like producers.

As a matter of fact, students are economic individuals who respond to education issues via economic behaviors that consist of both consumer and producer behaviors. If a student's exam performance is treated like a firm's sales levels, then the student would be expected to assess his/her future expected sales in light of his/her current sales. That is, a student who has had great sales in past periods would look forward to an increase in expected future sales. For that reason, it is likely that the student would increase his/her investment to achieve greater future sales. On the other hand, if the student had lower sales in past periods, s/he may look

[3] In Aptitude-Treatment Interaction (ATI), some individual strategies (treatments) are more or less effective for particular individuals depending upon their specific abilities (Snow, 1989).

forward to a decrease in expected future sales. Therefore, the student may want to reduce his/her investment to save on current costs, but may increase his/her other investments on other sales. This is the foundation of cost-benefit analysis.

If we apply this concept to students' exam performance, then it is not difficult to understand why students' prior exam performance and their changes in in-classroom/out-of-classroom efforts in the current exam period are positively and significantly correlated. Of course, there may be another explanation: students who do well on the prior exam will have more confidence and interest in the class, so they will be more likely to be encouraged to invest more effort (including in-classroom and out-of-classroom) on this class. Indeed, this explanation is still the same as the producer behavior explanation. A producer with great sales in past periods will be more optimistic about current sales and more confident and interested in the current market. This producer will then increase his/her investment in current production.

In addition, the concept of students behaving like producers can be used to explain why the majority oppose a mandatory attendance policy. Students who behave like producers definitely will not wish to invest more time and effort on something that may have lower expected returns (or sales). However, a mandatory attendance policy will force students to attend class, which may conflict with some students' interests. For instance, students who did not do well on prior exams will have fewer incentives to attend future classes—their expectations will be lower and their attitude will be pessimistic. That is, they would rather invest more time and effort on other things that could lead to greater expected returns.

In short, this article asserts that based on performance feedback on prior exams, students will act as producers in that they will efficiently allocate their available assets (time and efforts) in the manner of cost-benefit analyzers. If demand for students' knowledge (by the professor) is driven by their exam scores, subject to a goal constraint, then they will allocate assets to the paper/course in which they are getting the best scores.

Finally, this research has one limitation. We do not have information on students' attendance record, study-sequence, midterm-exams scores, homework grades, and projects in other classes during the same semester in which they were enrolled in the microeconomics class. With this information, we could eliminate the possibility of competing explanations for our results or hidden interactions that would in some way challenge them. In addition, we could learn how students (especially weaker students) feel about economics and whether they view it as a riskier subject than other business subjects. However, the greatest challenge in collecting such data is that doing so requires confidentiality and anonymity, which means that students' responses could not be matched with non-self-reported data. Thus, we will have to develop a strategy that maintains the confidentiality and anonymity of student data and also avoids any possibility of negativity. These will be left to future research on this issue.

References

Anikeeff, M. (1954). The relationship between class absences and college grades. *Journal of Educational Psychology*, 45 (4), 244–249.

Brocato, J. (1989). How much does coming to class matter? Some evidence of class attendance and grade performance. *Educational Research Quarterly*, 13(3), 2–6.

Chen, J. and Lin, T. F. (2008). Class attendance and exam performance: A randomized experiment. *Journal of Economic Education*, 39(3), 213–227.

Cohn, E., and Johnson, E. (2006). Class attendance and performance in principles of economics. *Education Economics*, 14(2), 211–233.

Devadoss, S., and Foltz, J. (1996). Evaluation of factors influencing student class attendance and performance. *American Journal of Agricultural Economics*, 78(3), 499–507.

Dolnicar, S., Kaiser, S., Matus, K., and Vialle, W. (2009). Can Australian universities take measures to increase the lecture attendance of marketing students? *Journal of Marketing Education*, 31(3), 203–211.

Franda, W. T. and Clarke I., III. (2004). Student observations of outstanding teaching: Implications for marketing educators. *Journal of Marketing Education*, 26(3), 271–281.

Granitz, N. A., Koernig, S. K., and Harich, K. R. (2009). Now it's personal: Antecedents and outcomes of rapport between business faculty and their students. *Journal of Marketing Education*, 31(1), 52–65.

Huff, L. C., Cooper, J., and Jones, W. (2002). The development and consequences of trust in student project groups. *Journal of Marketing Education*, 24(1), 24–34.

Jones, H. (1984). Interaction of absences and grades in a college course. *Journal of Psychology*, 116(1), 133–136.

Krohn, G. A. and O'Connor, M. (2005). Student effort and performance over the semester. *Journal of Economic Education*, 36(1), 3–28.

Marburger, R. (2001). Absenteeism and undergraduate exam performance. *Journal of Economic Education*, 32(2), 99–110.

Marburger, R. (2006). Does mandatory attendance improve student performance? *Journal of Economic Education*, 37(2), 99–110.

Pashler, H., McDaniel, M., Rohrer, D., and Bjork, R. (2008). Learning styles: Concepts and evidence. *Psychological Science in the Public Interest*, 9(3), 105–119.

Rocca, K. (2003). Student attendance: A comprehensive literature review. *Journal on Excellence in College Teaching*, 14(1), 85–107.

Rogers, R. (2001). A panel-data study of the effect of student attendance on university performance. *Australian Journal of Education*, 45(3), 284–295.

Snow, R. (1989). Aptitude-treatment interaction as a framework for research on individual differences in learning. In P. Ackerman, R. J. Sternberg, and R. Glaser (ed.), Learning and Individual Differences. New York: W. H. Freeman.

Stanca, L. (2006). The effects of attendance on academic performance: Panel data evidence for introductory microeconomics. *Journal of Economic Education*, 37(4), 251–266.

Sternberg, R., Grigorenko, E., Ferrari, M., and Clinkenbeard, P. (1999). A triarchic analysis of an aptitude-treatment interaction. *European Journal of Psychological Assessment*, 15(1), 3–13.

Table 1
Means and Standard Deviations of Variables

Variables	Mean	Standard Deviation
Scores for exam I	67.12	16.55
Scores for exam II	77.52	15.18
Grade Point Average	2.75	0.60
Working hours per week	29.18	13.03
Attendance in the 1st exam period	9.12	1.25
Attendance in the 2nd exam period	8.50	1.88
Attendance in the 3rd exam period	8.62	1.98
Frequency of studying for 1st exam	2.92	1.12
Frequency of studying for 2nd exam	3.19	1.16
Frequency of studying for 3rd exam	2.92	1.22

Table 2
Estimates of $ATD_t - ATD_{t-1}$ and $STD_t - STD_{t-1}$ for All Students

Explanatory Variables	Explained Variable: $ATD_t - ATD_{t-1}$		Explained Variable: $STD_t - STD_{t-1}$	
	(1)	(2)	(3)	(4)
Constant	-1.0439***	-0.1858	-0.1015	0.2169**
	(-2.56)	(-1.02)	(-0.50)	(2.40)
EXA_{t-1}	0.0104**		0.0038*	
	(2.30)		(1.69)	
$GRD_{t-1} - GPA$		0.0945		0.0492*
		(1.55)		(1.65)
WHR	0.0015	-0.000017	-0.006**	-0.0063**
	(0.26)	(-0.001)	(-2.07)	(-2.20)
R^2	1.3%	0.6%	2.2%	2.2%
$\overline{R}^2$	0.8%	0.1%	1.7%	1.7%
F-Statistic	2.68	1.23	4.58	4.45
Observations	406	406	406	406

(t-value) *** denotes statistical significance of the t-statistic at the 0.01 level; ** denotes statistical significance of the t-statistic at the 0.05 level; * denotes statistical significance of the t-statistic at the 0.1 level.

Table 3
Estimates of $ATD_t - ATD_{t-1}$ and $STD_t - STD_{t-1}$ for Stronger Students ($GPA \geq 3$)

Explanatory Variables	Explained Variable: $ATD_t - ATD_{t-1}$ (1)	(2)	Explained Variable: $STD_t - STD_{t-1}$ (3)	(4)
Constant	0.1968	-0.3435	0.1704	0.2582**
	(0.68)	(-1.42)	(0.49)	(2.22)
EXA_{t-1}	-0.006		0.001	
	(-0.77)		(0.26)	
$GRD_{t-1} - GPA$		-0.0985		0.0334
		(-1.04)		(0.74)
WHR	0.0045	0.0046	-0.0058	-0.0055
	(0.55)	(0.57)	(-1.46)	(-1.42)
R^2	0.7%	1.0%	1.5%	1.7%
$\overline{R}^2$	0.01%	0.01%	0.3%	0.6%
F-Statistic	0.61	0.86	1.31	1.55
Observations	180	180	180	180

(t-value) ** denotes statistical significance of the t-statistic at the 0.05 level.

Table 4
Estimates of $ATD_t - ATD_{t-1}$ and $STD_t - STD_{t-1}$ for Weaker Students ($GPA \leq 2.5$)

Explanatory Variables	Explained Variable: $ATD_t - ATD_{t-1}$ (1)	(2)	Explained Variable: $STD_t - STD_{t-1}$ (3)	(4)
Constant	-1.7317**	0.1597	-0.0365	0.2544
	(-2.31)	(0.42)	(-0.09)	(1.24)
EXA_{t-1}	0.0257***		0.0039	
	(2.90)		(0.82)	
$GRD_{t-1} - GPA$		0.3013***		0.0978*
		(2.58)		(1.65)
WHR	-0.0092	-0.0111	-0.0114*	-0.0106*
	(-0.77)	(-0.93)	(-1.76)	(-1.66)
R^2	7.8%	6.6%	3.6%	4.9%
$\overline{R}^2$	6.3%	5.1%	2.1%	3.4%
F-Statistic	5.37	4.46	2.37	3.28
Observations	130	130	130	130

(t-value) *** denotes statistical significance of the t-statistic at the 0.01 level; ** denotes statistical significance of the t-statistic at the 0.05 level; * denotes statistical significance of the t-statistic at the 0.1 level.