The Endowment Effect in the Classroom*

Rebekah R. Shrader†
Jadrian J. Wooten‡
Robert E. Rosenman§
Ben O. Smith**
Dustin R. White††

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† Assistant Professor of Economics, California State University, Stanislaus, E-mail: rshrader@csustan.edu
‡ Lecturer of Economics, The Pennsylvania State University, E-mail: jadrian@psu.edu
§ Professor of Economics, Washington State University, E-mail: yamaka@wsu.edu
** Assistant Professor of Economics, University of Nebraska, Omaha, E-mail: bosmith@unomaha.edu
†† Graduate Assistant, Washington State University, E-mail: dustin.r.white@wsu.edu
1. Introduction

Recently one of the authors of this paper observed that students in his/her class seemed uninterested in extra credit on an exam. Many students who finished early and had sufficient time to attempt bonus questions chose instead to sit passively in the class until the end of the period, when exams would be collected. This raised two questions in our minds, “Why would students not be interested in trying to earn extra points on an exam?” and “Is there a way to better motivate student effort (on exams)?”

A potential answer to the second question leads to a possible explanation to the first question. If students are not interested in earning points, maybe they would work more diligently to avoid losing points. Drawing on loss aversion, where losing something one has is worse than never having it at all, this study asks whether students can be motivated by changing the grading perspective. If students are endowed full points at the beginning of a term and lose points from that base if they underperform on individual assignments or exams, will they work harder than if they were to face a traditional points system where they start with zero points and accumulate gains?

Loss aversion was first formalized in Prospect Theory(Kahneman and Tversky, 1979; Tversky and Kahneman, 1991) which argues that context and framing matters. Most strongly, Prospect Theory argues that people place value on a reference point, usually the status quo, and actions are taken in the context of how the outcome might differ from the status quo. A main tenant of Prospect Theory is that the fear of loss from a current endowment will usually surpass the appeal of a gain. For students in a test situation, we believe the endowment effect can be used to motivate effort – a student starting with 100 points might work harder to avoid losing 20 points than a student starting with 0 points would exert to gain 80 points.
A recent NBER study by Fryer et al. (2012) analyzed the endowment effect, but for teachers rather than students. In that study, teachers were given an advanced bonus which they could lose after the school year. The study by Fryer et al. is one of the only field experiments to test endowment effects using high-stake incentives. From the perspective of the students in a 100-level university course, large amount of points for a course grade are also high-stake incentives.

This loss aversion in the classroom can be graphically portrayed as a kink in the value function at the origin, where it is steeper for losing points than it is for gaining points. This graph can be seen in Figure 1, where the y-axis measures a student's change in value, and the x-axis measures a gain or loss of course points, both from the status quo Hence, the status quo is \( x = 0 \), any \( x > 0 \) is a gain, and any \( x < 0 \) is a loss. The value function indicates that individuals forgo a potential gain more willingly than they are to forgo what they already have. For students in a class, this translates to less interest in gaining additional points and more motivation to avoid losing points already awarded. Ownership of the existing points lends another source of value to the students, causing them to work harder to avoid losing points.

2. Literature

Existing research on student performance in the classroom focuses on four particular areas: peer effects, class size, instructor quality, and grading methods. First, past literature has found that a student's peers do in fact have significant impact on his or her academic performance. A number of studies have found that students randomly placed into classes with peers of higher academic ability are positively influenced in their academic achievements (Ammermueller et al. 2009; Carrell et al. 2009; Vardardottir 2013). We include the possibility of peer effects on learning by comparing students who took the course with a friend with students who had no friend in the course.

Class size has also been a potential source of student performance found within past literature. Scholars have hypothesized that smaller class sizes, and thus more instructor attention allocated to each
student, are beneficial to student learning. A number of studies have evaluated the effect class size has on student learning in elementary and secondary education (Cho et al. 2013; Krueger 2003), finding that smaller class sizes are unlikely to significantly aid in student learning. However, Bedard et al. (2008) switched focus from elementary and secondary schooling to university classes, finding that class size does in fact have significant effects on instructor ratings. Their study provides evidence that class size is negatively correlated with reported instructor effectiveness in student evaluations. While the effect of class size on student learning is still inconclusive in the literature, there is evidence that class size will impact students' attitudes toward the instructor, and likely toward the overall course.

Studies have found significant differences in student performance across teachers, but the differences such as teacher education, experience, age, or pay do not correlate to student performance (Aaronson et al. 2007; Carrell and West 2010; Kane et al. 2008). Research has yet to identify a significant bundle of teacher characteristics that directly link to quality education. We address these findings with including fixed effects across instructors in our study, but not specifically addressing instructor characteristics as listed above.

Grading methods have been shown to affect student performance, presumably by motivating more effort. Stricter grading standards positively influence student performance (Betts et al. 2003; Bonesrønning 2004; Figlio et al. 2004). Research has also shown that requiring a higher level of effort, via either assignments or some other mean, yields an overall higher level of student success (Artés et al. 2013; Swinton 2010). In particular, Swinton (2010) finds that assigning a portion of a student's total grade to effort has a positive, endogenous effect on learning. In fact, how an instructor grades has been shown to have direct effects on student effort. Grant et al. (2013) and Oettinger (2002) found that letter grading schemes using the A-F scale yield different effort and studying outcomes than a continuous grading scheme. In a result potentially related to an endowment effect, Grant et al. (2013) found that students do not value the gain from one letter grade to the next as much as a student fears the potential
reduction down a letter grade, even though a student on the upper threshold of a letter grade could easily increase to the next letter grade. This idea of the gain versus loss of a letter grade connects to our study's hypothesis that students fear loss of points more than they value a gain of points.

3. Experimental Design

The data for this experiment comes from Fundamentals of Microeconomics, each of which class uses the same textbook and online assignment package. The experiment was implemented across many sections of the course over multiple semesters. We placed each class into one of two categories - a treatment group of classes in which students receive 1000 endowment points at the beginning of the semester, and a control group of classes in which students started with zero points and gained points as the semester progressed. Students in the control classes had the opportunity to earn up to 1000 points by the end of the term. The students in the treatment group were fully informed that if they miss points throughout the semester, they would lose a respective amount of points from their initial endowment. Meanwhile, the control group experienced the traditional incentive system of earning points.

Syllabi clearly announced the grading scheme for each class. Without releasing a hypothesis on the turnout or any indication of a change in behavior, the students were under full information as to how the grading system will work. It is also important to note that either grading scheme ultimately leads to the same grade for a single student showing same performance, presumably driven by the same effort, ceteris paribus. The grading description from the syllabus of one of the treatment courses can be found in the Appendix. This portion of the syllabus is representative of those used in each course of the treatment group.

As a semester progressed, the courses in the treatment group reinforced the fact that students were indeed losing points. Instead of marking a percentage grade on exams and homework assignments, the instructors for the treatment courses wrote the number of points lost. Each assignment and exam became a threat to a student's points, where in the case of the control group,
each assignment and exam was another possibility to earn more points. This specification to our experimental design is crucial to correctly capture the endowment effect. If the assignments were graded as percentages, but the gradebook were updated as a loss of points, it is likely that students would pay greater attention to the percentage grade and perceive the assignment as if it were in a traditional “points earned” grading scheme. Any inconsistency with this practice of marking the missed points rather than percentages could blemish the results of any such loss aversion experiment.

At the end of the term, the students of each class were asked to fill out a short survey upon exiting the classroom on the day of the final. This survey, which consisted of nine questions, can be found in the appendix. The survey asked about further interest in taking Economics courses, how much time the student spent on average studying for exams, the student’s study habits, any previous exposure to Economics courses, whether the student took the course with a friend or had a friend who had taken the course, general living arrangement, and parents' education levels. To control for any framing effects the ordering of the questionnaire may pose, we randomly distributed different versions of the questionnaire with questions placed in varying orders.

4. Assessment of the Endowment Effect

There are multiple ways to assess whether the endowment effect provides students with extra motivation to put effort into their coursework. The first apparent measure the instructors noticed was a general dislike of the counting down grading scheme, as voiced by a few frustrated students. While this frustration from the students may have been shortly unpleasant, the instructors in this treatment group also noted that this is a version of care. Increasing complaints from the students with regard to an assignment or exam grade is evidence of decreasing apathy.
One appealing method of assessing the success of the initial endowment of points is to analyze student grades. Previous research has shown that it is dangerous to use grades as information, since there are many factors unrelated to student productivity that will affect one’s grade (Grant 2007). While this may be the case, it may be valuable to analyze student performance on a standardized portion of the final exam across both the treatment and control groups. The authors plan to enrich this work by obtaining the rights to this data in the near future.

Without looking at raw grades as a measure of student performance, which has shown to be problematic in a number of ways in any case, we can assess success of the endowment effect by overall attitude toward the field of Economics at the end of the semester. Many individuals admittedly dislike Economics because they have little knowledge on the subject. Swinton (2010) has found that in freshman and sophomore level courses in particular, effort has a very strong, significant and positive effect on learning. Since evidence shows that a student who puts more effort into coursework will learn more, *ceteris paribus*, we can expect that if loss aversion increases student effort, it would in turn also increase student learning. This study assumes that a student who learns more will develop interest and an appreciation for the subject at a higher rate than a student who learned less throughout the course. With this assumption, we can use the question regarding further interest in Economics as a measurement of whether loss aversion did indeed increase student effort.

The question regarding further interest in Economics asks: "Would you ever consider majoring or minoring in Economics?" The answers include "Yes" (A), "No" (B), or "No, but I would be interested in taking an upper level Economics course" (C). Both A and C indicate a positive level of continued interest in Economics. Under our above stated assumption, the students who experienced the "counting down" grading method (i.e. the treatment group) will more likely experience further interest in Economics and thus choose A or C as their answer to this question. This question will be our dependent variable in our econometric model.
The dependent variable is defined as continued interest in Economics, labeled as *YesMoreEcon* in the upcoming tables. Since this is a dichotomous outcome (i.e. \( Y_i = 1 \) if student \( i \) answers A or C to this question, or \( Y_i = 0 \) otherwise), we run a logistic regression to find the logged odds ratios relating to the outcome of \( Y_i = 1 \).

The independent variables for this regression are as follows:

**Time spent studying:** Defined as *LowStudy* for less than one hour, 
*MediumStudy* for above one and less than five hours, 
and *HighStudy* for more than five hours

**Group Study:** The student answered "Yes" to studying in a group at all

**Previous Econ:** The student answered any number of options having taking an Economics course prior to this semester, including high school

**With Friend:** The student answered "Yes" to taking this course with a friend

**Prior Peer:** The student answered "Yes" to having a peer who previously took this course

**On Campus:** The student answered to living on campus

**Mom Beyond HS:** The student's mother has a degree beyond high school

**Dad Beyond HS:** The student's father has a degree beyond high school

**Fall:** The course was during a fall semester

**Class Size:** The number of students in the course at the end of the semester

**Nicer Classroom:** The course was in a relatively nice classroom, equipped with dual projectors and more spacious seating

**Instructor specific fixed effects:** Instructor #5\(^7\) is the base

**Time of Day:** The course was either *Early* if it began before 10am, *Middle* if it began after 10am and before 2:45pm, or *Late* if it began after 2:45pm

**Counted Down:** The course was in the treatment group who graded via "counting down" and taking the initially endowed points away as the semester progressed

5. Data

\(^7\) The participating instructors have been randomized and coded for confidentiality.
Summary statistics of the dependent and independent variables can be found in Table 1. Since the majority of these variables are binary, the mean of these variables indicate the percentage of students who fall into the respective category (e.g. answering "Yes" to that particular question). Notice that about 39% of all the participating students reported furthered interest in Economics, only over 94% of the students reported to study more than an hour on average for each exam, about 22% of the students took this course with a friend, and about 15% of the participating students were in the treatment group of "Counting Down."

Eight sections have been involved in this experiment to date. These sections span across two semesters, and the class sizes range from 83 to 314 students. Students were asked to voluntarily submit their short questionnaire upon leaving the final exam; gathering these answers on the day of the final exam captured responses from potentially all of the students in these courses, including those who might choose to skip class during the semester. Across our entire sample period, we received response rates of the questionnaires above 50% in all but one course. We ended up with 157 complete responses from students in the treatment group, and 898 complete responses from the control group. In total, we have 1055 complete survey responses from the students in this study’s experiment.

The authors of this study are currently in the process of obtaining further data for these listed courses, as well as data and questionnaire responses from courses participating in the fall 2014 semester. This data, once obtained, will likely include students’ [anonymously coded] grades throughout each of these courses, specific field of study, GPA at the time, SAT/ACT scores, ethnicity and gender, credits taken before this course, birthdate, high school name and zip code, participation in University sports, and any certificates or awards earned.

6. Results
This study hypothesizes that students graded under the endowment effect will put forth more effort than students graded under a traditional scheme. This follows from the theory of loss aversion, where individuals dislike losing points they already own more than they enjoy gaining new points. As to avoid losing points students were endowed at the beginning of the semester, they should work more diligently to keep these points. Upon putting more effort to keep these points, studies have shown that these students should in turn learn more about the course material. Our study's assumption states that this higher level of learning will cause these students to finish the term with a greater interest and appreciation for the field of Economics.

Using logistic regression techniques, we found significant results for each specification of our model with the dependent variable, YesMoreEcon. Table 3 shows three differing specifications of the model, Logit 1, Logit 2, and Logit 3. Each of these include four instructor fixed effects, with Instructor #5 as the base. As seen in Table 2, Instructor #5 was one of the two professors who joined the treatment group in counting down grade points. This instructor’s fixed effect is currently swallowing the treatment effect, since Instructor #5 only taught one semester in this experiment. With this in mind, our treatment effect comes from the difference in grading methods by Instructor #4. This instructor has its own fixed effect to control for instructor unique characteristics. The authors have monitored the teaching and grading methods of the instructors, and Instructor #4 held true to the high standard of consistency between classes that we requested for this experiment.

The only obvious issues that might arise with the treatment effect coming from the classes of Instructor #4 are the change in classrooms between semesters as well as change in class size. When including class size as an explanatory variable in our model, the coefficients with the other variables were qualitatively identical, and the class size was highly insignificant. The classroom for which the treatment group for Instructor #4 used was relatively newer; it had dual projector screens and more spacious seating than the control group for this same instructor. However, another instructor in the
control group, Instructor #1, also taught in each of these classrooms in separate semesters. To deal with the possibility of a classroom effect, we ran robustness checks, Logit 1R, Logit 2R, and Logit 3R. The classroom variable included in these checks did not provide any qualitative change to the rest of the model, nor did it have any significance in value. Further, while the coefficient for the relatively nicer class was insignificant, it was also negative in each of the three robustness-checking models.

Our first partial specification, Logit 1, indicates significance of taking this course with a friend to be positively correlated with extended interest in Economics. Our full specification (Logit 3) found each instructor’s fixed effects to have statistical significance when explaining extended interest in Economics, as did the presence of previous course exposure to the field. Of most interest is the explanatory variable, CountedDown, which presents the treatment group at hand. This variable proved to be significant at 99% confidence rate. We further conducted Wald tests to assess the null hypothesis that the independent variables were simultaneously zero. The Wald tests allow us to reject this null hypothesis with 99% confidence for each of the individual independent variables.

In order to analyze to what extent these significant variables affect a student’s tendency to exhibit furthering interest in Economics, we calculate the marginal effects of the coefficients from our Logit models, which we present in Table 4. Noting these marginal effects in our Logit 1 specification, we see that taking the class with a friend increases the probability to be interested in taking another Economics course by 6.5%. Previous literature has shown that a student’s peers do in fact have an effect on the learning process, so it is likely that the academically stronger of the peers positively influenced the other.

Further analysis of Table 4 allows us to consider the impact of our treatment variable of observation, CountedDown. Controlling for instructors and some personal characteristics, students participating in a class that experienced the endowment effect were approximately 31% more likely to be interested in taking another Economics course or adding Economics as a major or minor. If the
endowment effect and loss aversion caused students to value their point “possession,” they were more likely to study harder and exert more effort to maintain their cache. This increased effort likely triggered a higher rate of learning the material, as shown from previous literature. We have assumed this higher rate of learning to generate a higher level of interest in the subject, *ceteris paribus*, and thus an increased desire to continue learning Economics in the future.

7. Conclusion

This study contributes to both the limited area of empirical evidence for loss aversion in field studies, as well as to the current puzzle of how to get students motivated to perform better in large, introductory level courses. This study provides evidence that a simple change in the incentive-based points system may offer this extra motivation for improved performance. Instructors could easily adopt this endowment effect system at very low cost.

Finally, this study of behavioral economics in the classroom can be extended into a multitude of areas. First, we plan to implement an experiment using a hybrid incentive system, which would include a portion of the course’s points given as counting up, and other portions of the grade would be endowed, using the “counting down” method of grading. This may provide evidence whether or not it would be more valuable to focus on particular assessment categories rather than the entire semester grade. These assessment categories could easily be an endowed pool of participation points the beginning of the semester, an endowed pool of exam points, or an endowed pool of homework points. Further, professors who may have been hesitant to test the loss aversion method of grading may be more confident to attempt a hybrid version of this experiment.

Additionally, it often seems to professors as if students are willing to work diligently for bonus points, while oftentimes putting in very little effort toward exams or large assignments. This provides evidence of mental accounting; the students are placing higher value on extra credit points than for
equally weighted points in other assignment categories. Clearly, the classroom is an area rich with potential studies in behavioral economics.
References


Tables

### Table 1. Summary Statistics

<table>
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<tr>
<th>Variable</th>
<th>Observations</th>
<th>Mean</th>
<th>Standard Deviation</th>
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<th>Max</th>
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### Table 2. Response Rates

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<td></td>
<td>Spring 2014</td>
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<td>218</td>
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<td></td>
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<td>205</td>
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<td>83</td>
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<td>Up</td>
<td>194</td>
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<td>43.75%</td>
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### Table 3. Logistic Regressions

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<td>LR Chi2</td>
<td>25.89</td>
<td>26.21</td>
<td>26.82</td>
<td>27.17</td>
<td>29.07</td>
<td>29.65</td>
</tr>
</tbody>
</table>

Note: Statistical significance is denoted by * at the 10% level, ** at the 5% level, and *** at the 1% level.

### Table 4. Marginal Effects Explaining Further Interest in Economics

<table>
<thead>
<tr>
<th>Marginal Effects</th>
<th>L1, dy/dx</th>
<th>L2, dy/dx</th>
<th>L3, dy/dx</th>
</tr>
</thead>
<tbody>
<tr>
<td>WithFriend*</td>
<td>0.065*</td>
<td></td>
<td>0.056</td>
</tr>
<tr>
<td>Instructor1*</td>
<td>0.348***</td>
<td>0.348***</td>
<td>0.353***</td>
</tr>
<tr>
<td>Instructor2*</td>
<td>0.356***</td>
<td>0.357***</td>
<td>0.365***</td>
</tr>
<tr>
<td>Instructor3*</td>
<td>0.363***</td>
<td>0.364***</td>
<td>0.369***</td>
</tr>
<tr>
<td>Instructor4*</td>
<td>0.128</td>
<td>0.134*</td>
<td>0.138*</td>
</tr>
<tr>
<td>CountedDown*</td>
<td>0.316***</td>
<td>0.306***</td>
<td>0.317***</td>
</tr>
<tr>
<td>PreviousEcon*</td>
<td></td>
<td>0.061**</td>
<td>0.055*</td>
</tr>
</tbody>
</table>

Note: Statistical significance is denoted by * at the 10% level, ** at the 5% level, and *** at the 1% level.

*dy/dx is for discrete change of dummy variable from 0 to 1.
Appendix

Example Grading Portion from Syllabus:

How Grading Works:

In this class you don’t gain points you lose them. Everyone starts with 1000 points and you lose from that pool. For instance, your two best exams are worth 125 points each. Suppose there are 125 questions on one of the exams and you get ten wrong, your score would be -10.
Questions for participant

1. How much do you study for each exam on average? Please mark one answer.
   a. Less than 1 hour
   b. Between 1 hour and 3 hours
   c. More than 3 hours, but less than 5 hours
   d. More than 5 hours, but less than 7 hours
   e. More than 7 hours, but less than 9 hours
   f. More than 9 hours
   g. I do not study for exams

2. How did you tend to study for exams in this course?
   a. With a group
   b. Alone
   c. Mix of group and individual studying
   d. I did not study for the exams

3. What type of exposure to economics did you have before this course?
   a. College level Principles of Macroeconomics
   b. Traditional economics course in high school
   c. Advanced Placement (AP) economics in high school
   d. International Baccalaureate (IB) economics class in high school
   e. I am retaking Principles of Microeconomics
   f. I have never taken an economics course before this one

4. Did you sign up for this course with a friend?
   a. Yes
   b. No

5. Do you know somebody who took this course previously?
   a. Yes
   b. No

6. What are your current living arrangements?
   a. On-campus residential housing (dorm room)
   b. On-campus apartment housing
   c. Off-campus apartment/house within 1 mile of the university
   d. Off-campus apartment/house beyond 1 mile of the university

7. Highest completed degree or equivalent of father:
   a. Did not finish high school
   b. High school degree
   c. Associate’s or trade degree
   d. Bachelor’s degree
   e. Master’s degree
   f. PhD or other advanced degree
   g. Other _______

8. Highest completed degree or equivalent of mother:
   a. Did not finish high school
   b. High school degree
   c. Associate’s or trade degree
   d. Bachelor’s degree
   e. Master’s degree
   f. PhD or other advanced degree
   g. Other _______

9. Would you ever consider majoring or minoring in Economics?
   a. Yes
   b. No