Cooperative Behavior and Gender: Playing for Points in a College Class

by

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Abstract

We examine cooperative behavior in a classroom experiment wherein students can earn valuable extra credit points. The prisoner's dilemma occurs in all 21 class sections of Principles of Microeconomics and Macroeconomics. However, the rate of cooperation is surprisingly high given that the "defecting" strategy weakly dominates the "cooperating" strategy. In terms of personal demographic characteristics, we find evidence that female students are less likely to defect than are male students, international students are more likely, seniors less likely, and persons from rural areas are less likely to defect. In terms of contextual characteristics, defection is more likely in classes with a higher proportion of females, and males are even less cooperative when a female is an instructor, ceteris paribus.

Highlights:

- We examine a one-shot prisoner's dilemma game for extra points towards a class grade.
- We find that women are more cooperative than men.
- Rural residents, U.S. students, and seniors are more cooperative.
- Context matters – males are less cooperative when a female is the instructor.
- Defection is higher in classes with a larger proportion of females.

Keywords: Classroom experiment; prisoner's dilemma; cooperative behavior; gender; rural

JEL Codes: C72, C92, D03

1. Introduction

Cooperative behavior is essential for the growth and stability of a well ordered society. But because humans are motivated by a complexity of desires, it is difficult to model human behavior in interactive situations. Many disciplines including economics (Frank et al. 1993; Belot et al. 2010; Carpenter et al. 2004) political science (Ostrom et al. 1992), biology (West et al. 2007), psychology (Dawes and Messick, 2000; Piff et al. 2012) and sociology (Hu and Liu, 2003) have examined various aspects of cooperative behavior. An important avenue of research involves striving to understand why humans cooperate even when it is not in their best interest to do so. Researchers have explored a variety of ways to investigate cooperative behavioral strategies and outcomes. The primary methods rely on field data and laboratory experiments. Each has its strengths and weaknesses. Field data are derived from real world situations but it is difficult to isolate competing theories. On the other hand, laboratory experiments can be devised to answer particular questions, but can suffer from the non-random nature of the sample because generally individuals volunteer for the experiment.

We present an interesting experiment to analyze cooperative behavior. We use a one-shot prisoner's dilemma game in a classroom setting wherein the potential "payoff" involves extra credit points for students. We are unaware of any attempts to analyze behavior in a prisoner's dilemma game that uses points as the reward.[1] One of the concerns about laboratory experiments is that they often involve small financial payoffs. To obviate this problem some researchers have relied on games with large stakes. For example, van den Assem et al. (2012) utilize data from the "Golden Balls" TV game show because large sums of money are at stake. Although no money is awarded in our game, the "currency" of points is very valuable to students. The stakes in our classroom game can be potentially large because the extra credit points may bump up a student to a higher letter grade. Specifically, Principles of Economics students were asked to complete a simple survey (see Appendices 1 and 2) in which they were asked to choose between two alternatives: two or eight extra credit points (on a 1,000 point scale) for the semester. The survey instructions described what amounts to the payoff matrix: if all students select two points, then all students will receive an additional two points on their next midterm exam. If only a small number of students (two or fewer for classes with fewer than 100 students; three or fewer for larger classes) selects eight points, those students are awarded eight points on the next midterm

[1] Some classroom exercises rewarded points to students for achieving certain objectives (Benson and Stegner, 1997; Peterson, 1995; and Alba-Fernández, et. al., 2006).

exam and all other students receive no points.[2] That is, selecting two points is "cooperative" behavior while selecting eight points might be called "defecting" behavior. Finally, if more than the cutoff number of students selects eight points no one in the class receives extra credit points. These points can be potentially quite valuable. The final semester grade is based on a scale running from zero to 1,000 points. A letter grade of an "F" is given if the semester total number of points is below 600 points, a grade of "D" for 601 to 699, a "C" for 701 to 799, a "B" for 800 to 899, and an "A" for 900 to 1,000 points. Our departmental Principles of Microeconomics and Macroeconomics grading scale is strict[3], meaning, for example, a student who has earned 799 points will receive a "C"; the grade is not rounded up to a "B". The average grade in our Principles of Economics sections is approximately 780 points. (Note: our university uses the standard (in the U.S.) four point grading scale (in which an A=4, B=3, C=2, D=1, and F=0)). Due to this strict grading scale students are eager to earn extra credit points. They consider them very valuable, particularly since they do not know what their final semester number of points will be, and may regret not taking advantage of opportunities to earn them and increase their chance of getting a higher letter grade.[4] Researchers have found that there is a strong correlation between a college grade point average (GPA) and lifetime earnings. Gemus (2010) estimates that a one point increase in GPA leads to a 9% increase in annual earnings over a worklife. This lifetime increase in earnings can be approximately valued by assuming that a college graduate earns the U.S. Census Bureau 2011 mean income of $71,841 annually for men and women age

[2] They survey shown in Appendix 2 was given to classes with enrollment greater than 100 students (i.e., sections 3, 7, 8, 9, 10, 11, and 12) of Principles of Microeconomics and section 7 of Principles of Macroeconomics). None of these classes had more than 100 students in attendance on the day of the experiment, nonetheless those large sections received the survey shown in Appendix 2.

[3] The students all take a common test for Exam 1, 2, 3 and the Final Exam and the same grading scale is used across all sections.

[4] Other than our experiment, there is only one opportunity to earn extra credit points for the course during the semester, i.e., up to 10 points on an extra credit essay question on the final exam.

25-64 years[5], all races, working full time. Assuming the person earns 9% more than $71,841 (i.e. $6,466 more per year) over 40 years, and assuming a net discount rate (discount rate minus wage growth rate) of 2%, the present value of the extra earnings is $176,872. Since one college class represents 1/40 of the total 120 hour college degree, a one point increase in the grade in the Principles of Micro economics or Microeconomics class is worth approximately $4,422 (1/40 of $176,872). While we do not argue that this precise increase in earnings will occur, since there is no guarantee that the extra credit points will bump up the score to the next higher grade, nonetheless it is clear that these extra points are potentially valuable. Thus the financial stakes in this experiment are likely to be much greater than the relatively small financial rewards given in typical laboratory experiments (e.g. $5 to $20[6]).

This paper proceeds in the following manner. In Section 2 we discuss prior research on cooperative behavior in the experimental economics and related literature. In Section 3 we describe how the game is set up and conducted. In Section 4 we give descriptive results and describe our model. In Section 5 we discuss our statistical findings. In Section 6 we offer concluding thoughts.

2. Literature Review

There is a rich literature on cooperative behavior. Many interesting questions have been addressed such as why people cooperate when it is not in their self-interest, why gender might impact the likelihood of defection, whether wealthier individuals are less likely to cooperate,

[5] We ignore an age-earnings profile for sake of simplification.
[6] See for example Andreoni and Vesterlund (2001), where the average reward was $9.60; Holt and Capra (2000), where the reward varied from $2 to $5; and Brown-Kruse and Hummels (1993), where the average award was $14.50.

why nationality or culture affects the likelihood of cooperation, why persons from rural areas might be more likely to cooperate, why age may affect the likelihood of cooperation, and why the context of the game matters. In general there are two categories of characteristics that researchers have focused on: personal demographic characteristics and contextual characteristics.

2.1 Personal demographic characteristics

With respect to gender, there is substantial evidence from the experimental economics literature that men may be more selfish and individualistic, and women more socially-oriented. Sherman's work (1971) is an early example of this. He reports evidence that women are more likely to be cooperative than men. With evidence from a dictator game, Eckel and Grossman (1998) argue that women are more generous than men. Using a trust game, Croson and Buchan (1999) also report evidence of greater generosity among women. Andreoni and Vesterlund (2001) find that women are kinder than men, at least when altruism is relatively expensive. Innocenti and Pazienza (2006) argue that women are more trusting than men. Similarly, Solnick (2001) suggests that although women don't actually seem to be content with less in bargaining situations, both women and men expect that women will settle for less. List (2004) finds that young males are the least generous in public goods experiments. Others, however, present evidence that gender doesn't affect the propensity to lie (Childs, 2012). Chaudhuri and Gangadharan (2007) surprisingly find that men may be more trusting than women. There is in addition substantial evidence of gender differences in the social psychology literature (Charness and Rustichini, 2011).

With respect to income, there is some evidence that individuals of higher socio-economic status may be more likely to defect. Piff et al. (2012) reason that those of higher socio-economic status may be more likely to engage in unethical behavior generally. They argue that increased resources and independence from others cause people to be more self-interested and have less concern for others' welfare, and they report experimental evidence confirming this. A well-known anecdote of this nature comes from Levitt and Dubner's (2005) *Freakonomics*. They describe a salesman who would leave boxes of bagels in break rooms in office buildings in the Washington, D.C. area. He left the bagels and a basket in which customers were expected to leave payments on an honor system basis. He discovered that theft and non-payment were more common on the floors on which executives worked compared to lower-paid employees. However, Holland et al. (2012) present evidence suggesting that poorer individuals may exhibit less altruism, and Hoffman (2011) and Chowdhury and Jeon (2012) show that altruism seems to increase with wealth.

With respect to nationality and culture, there is experimental evidence that other characteristics of students participating in experiments may affect their behavior. Hemesath (1994) finds that Russian students are more likely to cooperate in a prisoner's dilemma game, although Croson and Buchan (1999) find that differences in countries of origin are unimportant determinants of trust. Carpenter et al. (2004) find cooperative behavior varies across the cultures of Thai and Vietnamese participants in a voluntary contribution game.

With respect to age, Hu and Liu (2003) describe prisoner's dilemma games in which Senior college students were more likely to cooperate. van den Assem et al. (2012) find that young males are less cooperative than young females, but the gender effect reverses as older males become increasingly cooperative. List (2004) finds that generosity is positively related to age.

It has often been found that Economics majors free ride more often than other majors (Marwell and Ames, 1981; Frank et al. 1993) but Hu and Liu (2003) found that Economics majors are more cooperative, and Seguino et al. (1996) find no significant effect.

With respect to rurality, Gachter and Herrmann (2011) find that rural residents are more cooperative than urban residents in Russia, but van den Assem et al. (2012) do not find any significant difference in the U.K. In a Reader's Digest (1995) test of returns of lost wallets in the U.S., persons living in small towns generally proved to be more honest than residents of larger cities.

2.2 Contextual characteristics

In Croson and Gneezy's (2009) review of the literature, they find that the context of the games is important. For example, they find that women are more sensitive to the context of the experiment than men. In addition, females are significantly more cooperative in the mixed-sex groups than in all-female groups. Also, Ben-Ner et al. (2004) found that women give significantly less to other women than they do to men or to persons of unknown gender. These findings help to explain why studies on the effect of gender on cooperation have sometimes arrived at conflicting results.

Dufwenberg and Muren (2006) find that behavior varies depending on whether the games are played anonymously. Another contextual feature that may impact behavior is the competitive nature of the game. Charness and Rustichini (2011) present evidence that women are more likely to cooperate when they are observed by other women, while men are less cooperative when observed by other males. People may behave differently when they are observed or when they are in stressful situations. Since males are generally more aggressive than females, conditions which exacerbate or attenuate aggressiveness can lead to differing cooperative behavior. For example, Anderson (2001) finds that aggressive behavior (e.g. violent crime) is more exhibited during hotter times of the year.

3. A Classroom Prisoner's Dilemma Game

We utilize a prisoner's dilemma game to test for cooperative behavior. During the Summer and Fall semesters of 2012, Principles of Microeconomics and Principles of Macroeconomics students in 21 different sections at the University of North Texas were asked to complete a simple survey as described in Section 1. Our game is somewhat unusual in that it has a large number of players – on average, there are 52 students in each class. More typically, dictator and prisoner's dilemma games described in the literature have between 2 and 5 players, although Seguino et al. (1996) discuss a game with as many as 52 players. We also have many more participants (1,099 students) than is typical. Ours is a "one-shot" game. It has a similar "weak" form of the prisoner's dilemma game to the T.V. game show "Golden Balls" (van den Assem et al. 2012). Students were instructed to not talk during the exercise, and to not allow any other student to see their answer. Finally, students were assured that their choice would never be made known to anyone else. Since our students' behavior is not observed by any of the other players, our game is not subject to the effect of being observed by an audience as is the case in "Golden Balls." We conducted this experiment[7] at a point in the semester before the Principles of Microeconomics students covered game theory because we wanted all students to have the same knowledge (more specifically, a lack of knowledge) about game theory since it is not

[7] One of the authors administered the survey in the same manner in each class in an effort to eliminate any differences in the way various instructors would explain the game.

covered in Principles of Macroeconomics. (Some Principles of Macroeconomics students may have had Principles of Microeconomics but generally most students take Principles of Macroeconomics first). Defecting weakly dominates cooperating. Choosing defecting yields a payoff that is at least as large and sometimes larger than choosing cooperating, so there appears to be very little incentive to cooperate. Cooperating is likely to lead to a reward of zero points for an individual student. For example, if one were to assume that all of one's classmates had a 0.9 probability of cooperating (a relatively strong assumption)[8], then in a class of 50 students the probability that one's 49 classmates all cooperate is equal to 0.9^{49} or 0.0051.

The survey also gathered basic information about each student, including gender, major, year in college, and ZIP code of the town in which the student attended high school. We determined each student's median household income in 2010 using their ZIP code and the American Community Survey. We also used the ZIP code to determine the population density for the area in which the student graduated from high school. We create a discrete dummy variable for population densities less than 1,000 persons per square mile (which is the categorization the U.S. Census Bureau uses for rural areas) as a measure of the student's urban or rural roots. We also construct a dummy variable for foreign students but do not have income data for such students.

Since, as noted in Section 2, the context of the game is important, we include several contextual variables. First, we use the percent of the class that is female to test if cooperation is affected by the gender composition, as found by Croson and Gneezy (2009). Second, we create a dummy variable for the gender of the instructor. We are unaware of a teacher gender variable being used in a prisoner's dilemma game. Fourth, we include a dummy variable to distinguish

[8] It is difficult to know what a typical student believed, a priori, was the probability that a typical classmate would cooperate. As it turns out, the average cooperation rate was 83.9%.

between Principles of Microeconomics and Principles of Macroeconomics classes. Finally, the class section specific information includes the semester (Summer or Fall) in which it was taught. We have not seen a discussion of the effect of the semester (Fall, Spring or Summer) on cooperative behavior. We hypothesize that it might be possible that during the summer months in Texas, when the temperatures regularly reach 100 °F, (37.8 °C) that persons may be more irritable and thus be less cooperative.

4. The Model

We model the discrete decision to cooperate or defect using a binary probit model. We assume that students have a latent propensity to cooperate, y^*, where $y^* \in (-\infty,\infty)$. We follow the usual assumption that this latent propensity is a linear function of the student's demographic characteristics and contextual characteristics of the game, x, expressed in the form of $y^* = x'\beta + \varepsilon$, where β is a parameter vector and ε is an unobserved stochastic error term. The latent propensity to "cooperate" is not observed, but the actual choice y (cooperate or defect) is observed where $y = 1$ if the student cooperates and $y = 0$ if the student does not cooperate. The usual procedure is to impose the criterion that $y = 1$ when $y^*>0$ and $y = 0$ otherwise. If the stochastic error term follows a standard normal distribution, i.e., $\varepsilon \sim N(0,1)$, the binary probit model can be expressed as $\Pr(y=1|x) = \Phi(x'\beta)$, where Φ is the standard normal cumulative distribution function.

Since coefficients in a probit model do not lend themselves to an intuitive meaning, we also present the marginal effects, as is the usual practice, where $\partial E[y]/\partial x = \varphi(x'\beta)\beta$, and E is the expectation operator. For models that involve interaction effects we calculate the marginal effect in the manner describe by Greene (2012)[9]. We use the average of the marginal effects which is the preferred method (Green, 2012). For dummy variables, we calculate the discrete change in the probability when the dummy changes from 0 to 1 (Greene, 2012). As discussed by Ai and Norton (2003), the usual method of calculating marginal effects and their standard errors is not valid for interaction terms, so we use their alternative method for calculating the cross partial marginal effect, as computed by Stata.

In our model, the discrete dependent variable is *Cooperate* which equals 1 when an individual student chooses to cooperate and equals 0 when the student chooses to defect. We use the following set of explanatory variables:

- *Male* is a gender dummy variable equal to 1 if the student is male and 0 if female
- *MedianInc* is the median household income for the ZIP code where the student lived when they were a senior in high school (data not available for foreign students)
- *Foreign* is a dummy variable equal to 1 if a student is from a country outside of the United States and 0 if the student is from the U.S.
- *Soph* is a dummy variable equal to 1 if the student is a Sophomore; 0 otherwise (Freshman is the base case)
- *Junior* is a dummy variable equal to 1 if the student is a Junior; 0 otherwise
- *Senior* is a dummy variable equal to 1 if the student is a Senior; 0 otherwise
- *MicroPrinc* is a dummy variable equal to 1 if the student is in a Principles of Microeconomics class and 0 if the student is in Principles of Macroeconomics.

[9] Greene (2012, p. 700) notes that some computer packages will dutifully compute a partial effect using the coefficient on the interactive term, which is a nonsensical result. Furthermore, the partial effect for either of the interacted variables are not likely to be correctly calculated. Fortunately, Stata 12 correctly calculates marginal effects when using interactive factor variables.

- *EconMajor* is a dummy variable equal to 1 if a student is an Economics major and 0 otherwise
- *Rural* is a dummy variable equal to 1 if population density is less than 1,000 persons per square mile for the student's ZIP code.
- *TeacherFemale* is a dummy variable equal to 1 if the instructor is female and 0 if the instructor is male
- *PercFemale* is the percent of a class that is female
- *Summer* is a dummy variable equal to 1 if the class was taught in the Summer semester and 0 if the class was taught in the Fall semester.

The descriptive statistics are shown in Table 1. About 58% of participants are male (*Male*). Median household incomes (*MedianInc*) range from $14,355 to $178,285, with an average of $72,132. 4.5% of the students participating in the experiment are foreign students (*Foreign*). These come from 25 different countries, with China and Saudi Arabia being the most common origins. Nearly 80% are either Freshmen (*Freshman*) or Sophomores (*Soph*); another 15.9% and 4.9% (respectively) are Juniors (*Junior*) and Seniors (*Senior*). Most (62.8%) of our students were enrolled in Micro Principles (*MicroPrinc*) rather than Macro Principles. A relatively small percentage (4.6%) list Economics as their major (*EconMajor*). Roughly 30% of the students were from areas with population densities of less than 1,000 persons per square mile (*Rural*). Just greater than one-third of the participants had female instructors (*TeacherFemale*), and 41.9% of students were female (*PercFemale*). Finally, about 10% of the observations were collected during the summer 2012 term; 90% comes from the Fall 2012 semester.

[INSERT TABLE 1 ABOUT HERE]

5. Results and Discussion

We ran this experiment in 21 different classes; data were obtained for 1,099 students (see Table 2). The incentive to defect is quite strong and it is rare for this experiment to result in extra points being awarded. In one of our Principles of Macroeconomics class section this occurred. The percentage of a class that defected varies somewhat, ranging from 5.4% to 30.8% with an average of 16.1%. The percentage of women who defect is 12.8%, while that of males is 18.4%. [INSERT TABLE 2 ABOUT HERE] .

Although, the prisoner's dilemma occurred in every one of the 21 classes, it is surprising how high the cooperation rate was. In Figure 1, the percent cooperating is shown for rural and urban students according to gender. In general, students from rural areas cooperate (86.9%) more than students from urban areas (82.9%) cooperate. The difference in the cooperation rates between men and women is greater in the urban areas than in the rural areas. In Figure 2, the percent cooperating is shown for foreign and U.S. students according to gender. U.S. females have the highest cooperation rate (88.3%), U.S. males (81.6%) and foreign males (81.3%) have similar cooperation rates, and foreign females have the lowest cooperation rate (66.7%). Figure 3 compares cooperation rates for male and females according to the gender of their instructor. While female students in classes taught by males are slightly more likely to cooperate than male students in male-taught classes (85.3% vs. 83.4%), in classes taught by women female students are much more cooperative (90.1%) than male students (78.2%).

[INSERT FIGURES 1-3 ABOUT HERE]

We present seven variations of models (both the probit coefficients and the marginal effects are shown) in Table 3. In Model 1, the male dummy's (*Male*) marginal effect is -0.066 and is statistically significant, meaning that the probability of cooperating is roughly 6.6 percentage points lower for males than females. The male dummy variable's marginal effect is negative and significant in all of the other models as well. *MedianInc* is not a significant variable. Of the class year dummy variables, only *Senior* is statistically significant. The probability of cooperating is 10.8 percentage points higher for Seniors than Freshmen (and Sophomores and Juniors). The *Senior* dummy variable is positive and significant in all of the models. The *Rural* dummy variable has a statistically significant positive coefficient (0.041) indicating that the probability of cooperating is 4.1 percentage points higher in rural areas, ceteris paribus. The *Rural* dummy is positive and significant in all of the models. The *EconMajor* and *Summer* dummies have no significant effect.[10]

[INSERT TABLE 3 ABOUT HERE]

In Model 2, we add *TeacherFemale* (but do not include instructor fixed effects). The results are similar to Model 1 and the *TeacherFemale* is not significant. In Model 3, we modify Model 2 by interacting *TeacherFemale* with *Male* to create an interactive dummy variable called *Male*TeacherFemale*. The interactive effect is negative (-0.084) and is statistically significant (z-statistic = -1.75) (using the Ai and Norton (2003) method) which indicates that males are even less likely to cooperate when a female is the instructor.[11]

[10] We include fixed effects (not shown) for each instructor in each model, unless otherwise stated.
[11] Ai and Norton (2003) recommend checking the sign of the interactive effect over the range of predicted probabilities for all observations and noting if the sign changes. The sign of the interactive effect for Model 3 is negative over the entire range and is significant for most of the range.

In Model 4, we modify Model 1 by adding the *PercFemale* variable. *Male, Rural*, and *Senior* remain significant. *PercFemale* has a significantly negative coefficient indicating that for each percentage point increase in percent of the class that is female, the probability of cooperating falls 0.00402. This is an interesting contextual finding. Even though an individual female is more likely to cooperate, ceteris paribus, overall cooperation is lower in a class consisting of a greater percent of females. In Model 5, we modify Model 1 by including an interactive term for *Male* and *Summer* (*Male*Summer*) but this effect is not significant.[12]

In Model 6, we use the *Foreign* dummy variable. In this model we cannot use the *MedianInc* or *Rural* variables because we do not have these data on the foreign students.[13] The *Male* and *Senior* variables are still significant and their marginal effects remain negative and positive, respectively. The *Foreign* dummy variable has a statistically significant negative marginal effect, indicating that overall foreign students are less likely to choose to cooperate by 8.2 percentage points . In Model 7, we modify Model 6 by adding the *PercFemale* variable. The *Foreign* dummy variable remains significant and has about the same marginal effect (-0.083). *PercFemale* has a significantly negative coefficient indicating that for each percentage point increase in percent of the class that is female, the probability of cooperating falls 0.0047. This again is an interesting contextual finding. In Model 8, we modify Model 6 by adding an interactive term for *Male* and *Foreign* (*Male*Foreign*). Although the marginal effect of being a foreign student is not statistically significant, the interactive effect has a positive impact of 0.262. This indicates that being a male foreign student increases the probability of a male cooperating. Conversely, this indicates that being a female foreign student decreases the probability of a

[12] We also tried interactive effects for *Male* and *PercFemale* and *Male* and *Senior* but none of these were significant.
[13] This adds 57 observations from international students plus five observations for U.S. students for which ZIP codes could not be determined.

female cooperating.[14] In Model 9 we modify Model 8 by adding the *PercFemale* variable. The results are similar to those in Model 8 and the *PercFemale* variable's marginal effect (-0.449) is similar to that in Model 7.

6. Conclusion

We construct a one-shot prisoner's dilemma game wherein students can earn extra credit points. There are several interesting findings in this experiment. Overall, the prisoner's dilemma tends to occur in all class sections. While defecting does occur, it occurs for only 16.1% of the students which is smaller that might be expected. In other words, roughly 84% of the students cooperated.

We employed several demographic and contextual variables. For the personal demographic characteristics, we find several robust results. First, our results indicate that male students are between 5.5 and 7.2 percentage points less likely to cooperate, a result that is significant at the 95% level or above. Since this was a one-shot game and the choice to cooperate was made anonymously, this experiment gives insight perhaps into female and male innate characteristics. Given, the payoff matrix in this game, there does not appear to be any financial reason for cooperating. Our results are consistent with earlier evidence from the experimental economics literature that suggests women may be more generous, altruistic, kind, or trusting than men.

[14] The sign of the interactive effect for Model 8 is positive over the entire range and is significant for most of the range.

Second, a consistent finding in our models is that Seniors are more likely to cooperate. This finding is somewhat consistent with the van den Assem et al. (2012) finding that older males become more cooperative, with the Gachter and Hermann (2011) and List (2004) findings that more mature participants contribute more in public goods experiments, and with the Hu and Liu (2003) finding that Seniors are more likely to cooperate. Hu and Liu (2003, p. 700) suggest that the likelihood of cooperation increases with maturity: "…the more events one experiences, the more considerate and thoughtful one becomes."

Third, a robust finding is that students who hail from rural areas are more likely to cooperate. Since there is no financially beneficial gain by choosing to cooperate in this game, the positive impact of rurality on the choice of cooperating tends to indicate that the innate and or cultural differences of students hailing from rural areas leads them to be more cooperative. This is consistent with the Gachter and Hermann (2011) finding that rural Russian residents contribute more in public goods experiments. However, van den Assem et al. (2012) did not find a significant rural effect for U.K. residents.

Fourth, interestingly, foreign students are less likely to cooperate. But much of this effect seems to come from the relatively low tendency to cooperate of female, not male, foreign students. Perhaps only competitive females self-select to matriculate to a U.S. university. In an earlier prisoner's dilemma classroom experiment Hemesath (1994) found that Russian students were more likely to cooperate than American students. Although our experiment indicates that Americans are more likely to cooperate, the point here is that behavior in experimental games may vary according to nationality, perhaps due to differing cultural norms. However, we must be cautious in drawing any inferences because our sample contains relatively few foreign students.

We examined the impact of several other personal demographic variables, but did not find them to be significant. Median household income seems to have no discernible effect on the probability of cooperating, and the dummy for majoring in Economics is similarly unimportant.

We find evidence that the context of the game matters. For instance, we found some evidence that males are even less likely to cooperate when a female is the instructor. Interestingly, we also found the probability of cooperating falls as the percent of the class that is female rises, but we did not find the effect was different for men vs. women. The Summer dummy seems to have no impact and there is no difference between students in Principles of Microeconomics and Principles of Macroeconomics.

Our experiment adds to the interesting literature on human behavior analysis. We find that personal characteristics and contextual characteristics affect the choice to cooperate. It is fascinating to find that so many students choose to cooperate when it is not in their self interest to do so. Clearly the weakly dominant strategy in this experiment is to choose defect, particularly since no other student can observe the choice of another student. It is puzzling why U.S. female students, rural students, and Seniors are more willing to cooperate. Future research should continue to explore these issues in an attempt to further understand motives in human behavior.

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TABLE 1
Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Male	1,099	0.581	0.494	0	1
Medianinc ($)	1,037	72,132	28,148	14,355	178,285
Foreign	1,099	0.045	0.206	0	1
Freshman	1,099	0.411	0.492	0	1
Soph	1,099	0.380	0.486	0	1
Junior	1,099	0.159	0.366	0	1
Senior	1,099	0.049	0.216	0	1
Microprinc	1,099	0.628	0.484	0	1
EconMajor	1,099	0.046	0.210	0	1
Rural	1,037	0.295	0.456	0	1
TeacherFemale	1,099	0.346	0.476	0	1
PercFemale	1,099	0.419	0.078	0.281	0.569
Summer	1,099	0.097	0.297	0	1

TABLE 2

Participant Information

Class	Number of "Defectors"	Total Participants	% "Defecting"	% of Females "Defecting"	% of Males "Defecting"
Principles of Microeconomics					
Section 1	9	50	18.0	5.3	25.8
Section 2	7	36	19.4	14.3	22.7
Section 3	6	58	10.3	21.1	5.1
Section 4	8	65	12.3	5.4	21.4
Section 5	4	38	10.5	5.3	15.8
Section 6	8	28	28.6	30.0	27.8
Section 7	12	76	15.8	15.4	16.2
Section 8	6	48	12.5	14.3	11.1
Section 9	17	80	21.3	8.6	31.1
Section 10	8	73	11.0	11.1	10.9
Section 11	15	61	24.6	12.5	32.4
Section 12	15	77	19.5	22.5	16.2
Principles of Macroeconomics					
Section 1	7	57	12.3	6.3	14.6
Section 2	5	30	16.7	11.1	19.1
Section 3	9	39	23.1	23.1	23.1
Section 4	8	53	15.1	7.4	23.1
Section 5	2	37	5.4	6.7	4.5
Section 6	4	41	9.8	12.5	8.0
Section 7	12	76	15.8	12.9	17.8
Section 8	8	26	30.8	33.3	28.6
Section 9	7	50	14.0	5.9	18.2
Total	**177**	**1,099**	**16.1**	**12.8**	**18.4**

TABLE 3
Probit Results

Variable	Model 1		Model 2		Model 3	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Male	-0.2883*** (-2.86)	-0.0655*** (-2.95)	-0.3033*** (-3.04)	-0.0718*** (-3.06)	-0.1718 (-1.40)	-0.0697*** (-3.13)
MedianInc	0.0021 (1.17)	0.0005 (1.17)	0.0022 (1.22)	0.0005 (1.22)	0.0021 (1.17)	0.0005 (1.17)
Foreign						
Soph	-0.0717 (-0.67)	-0.0168 (-0.66)	-0.0549 (-0.52)	-0.0130 (-0.52)	-0.0588 (-0.55)	-0.0139 (-0.55)
Junior	0.1776 (1.19)	0.0390 (1.27)	0.2019 (1.37)	0.0478 (1.37)	0.1983 (1.34)	0.0437 (1.44)
Senior	0.6299** (2.07)	0.1079*** (3.08)	0.5909** (1.98)	0.1398** (1.98)	0.6081** (2.03)	0.1063*** (2.99)
Rural	0.1821 (1.62)	0.0409* (1.68)	0.1829* (1.65)	0.0433* (1.65)	0.1834* (1.65)	0.0416* (1.72)
EconMajor	-0.1281 (-0.60)	-0.0315 (-0.57)	-0.1518 (-0.71)	-0.0359 (-0.71)	-0.1466 (-0.69)	-0.0367 (-0.65)
TeacherFemale			-0.0249 (-0.24)	-0.0059 (-0.24)	0.2169 (1.27)	-0.0086 (-0.35)
PercFemale						
Summer	-0.0213 (-0.11)	-0.0050 (-0.10)	0.0640 (0.37)	0.0151 (0.37)	0.0508 (0.29)	-0.0117 (0.30)
Male*TeacherFemale					-0.3770* (-1.79)	
Male*Summer						
Male*Foreign						

Variable	Model 1		Model 2		Model 3	
Interactive effects						
Male*TeacherFemale						-0.0841 * (-1.75)
Male*Summer						
Male*Foreign						
Instructor fixed effects	yes		no		no	
Observations	1,037		1,037		1,037	
LR χ^2	35.70***		22.00***		25.24***	
Log likelihood	-436.56		-443.41		-441.79	
Pseudo-R^2	0.0393		0.0242		0.0278	

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

TABLE 3 (cont.)
Probit Results

Variable	Model 4		Model 5		Model 6	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Male	-0.3062*** (-3.02)	-0.0710*** (-3.04)	-0.2566*** (-2.45)	-0.0658*** (-2.98)	-0.2309** (-2.40)	-0.0548** (-2.41)
MedianInc	0.0021 (1.17)	0.0005 (1.17)	0.0022 (1.19)	0.0005 (1.20)		
Foreign					-0.3455* (-1.69)	-0.0820* (-1.70)
Soph	-0.0649 (-0.60)	-0.0151 (-0.60)	-0.0736 (-0.68)	-0.0171 (-0.68)	-0.0122 (-0.12)	-0.0029 (-0.12)
Junior	0.1908 (1.27)	0.0443 (1.27)	0.1806 (1.21)	0.0420 (1.21)	0.1861 (1.28)	0.0442 (1.29)
Senior	0.6333** (2.07)	0.1469** (2.07)	0.6291** (2.06)	0.1464** (2.06)	0.5314** (1.95)	0.1261** (1.95)
Rural	0.1897* (1.68)	0.0440* (1.68)	0.1844 (1.64)	0.0429* (1.64)		
EconMajor	-0.1408 (-0.66)	-0.0327 (-0.66)	-0.1334 (-0.62)	-0.0310 (-0.62)	-0.1036 (-0.49)	-0.0246 (-.49)
TeacherFemale						
PercFemale	-1.731* (-1.89)	-0.4016* (-1.89)				
Summer	-0.1798 (-0.81)	-0.0417 (-0.81)	0.3173 (0.83)	0.0001 (0.00)	-0.0121 (-0.06)	-0.0029 (-0.06)
Male*TeacherFemale						
Male*Summer			-0.4506 (-1.09)			

Variable	Model 4		Model 5		Model 6	
Male*Foreign						
Interactive effects						
Male*TeacherFemale						
Male*Summer				-.0885 (-1.12)		
Male*Foreign						
Instructor fixed effects	yes		yes		yes	
Observations	1,037		1,037		1,099	
LR χ^2	39.27***		36.97***		27.81**	
Log likelihood	-434.77		-435.92		-471.21	
Pseudo-R^2	0.0432		0.0407		0.0287	

TABLE 3 (cont.)
Probit Results

Variable	Model 7		Model 8		Model 9	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Male	-0.2544*** (-2.62)	-0.0600*** (-2.63)	-0.2843*** (-2.85)	-.0529** (-2.43)	-0.3053*** (-3.04)	-0.0577*** (-2.66)
MedianInc						
Foreign	-0.3521* (-1.72)	-0.0831* (-1.72)	-0.8011*** (-2.86)	-0.0737 (-1.26)	-0.7927*** (-2.82)	-0.0744 (-1.26)
Soph	-0.0054 (-0.05)	-0.0013 (-0.05)	-0.0245 (-0.24)	-0.0058 (-0.24)	-0.0178 (-0.17)	-0.0041 (-0.17)
Junior	0.2011 (1.38)	0.0474 (1.38)	0.1820 (1.26)	0.0430 (1.26)	0.1965 (1.35)	0.0461 (1.35)
Senior	0.5461** (1.98)	0.1288** (1.99)	0.5596** (2.02)	0.1320** (2.02)	0.5751** (2.06)	0.1350** (2.06)
Rural						
EconMajor	-0.1193 (-0.56)	-0.0281 (-0.56)	-0.1077 (-0.51)	-0.0254 (-0.51)	-0.1226 (-0.58)	-0.0288 (-0.58)
TeacherFemale						
PercFemale	-1.973** (-2.25)	-0.4655** (-2.26)			-1.913** (-2.18)	-0.4492** (-2.18)
Summer	-0.1883 (-0.90)	-0.0444 (-0.90)	-0.0423 (-0.22)	0.0010 (-0.22)	-0.2126 (-1.01)	-0.0499 (-1.01)
Male*TeacherFemale						
Male*Summer						

Variable	Model 7		Model 8		Model 9	
Male*Foreign			0.9450** (-2.26)		0.9189** (2.19)	
Interactive effects						
Male*TeacherFemale						
Male*Summer						
Male*Foreign				0.2624** (2.06)		0.2520** (1.97)
Instructor fixed effects	yes		yes		yes	
Observations	1,099		1,099		1,099	
LR χ^2	32.90**		33.06**		37.81***	
Log likelihood	-468.67		-468.58		-466.21	
Pseudo-R^2	0.0339		0.0341		0.039	

Figure 1: Male and Female Cooperation Rates across Rural and Urban Roots

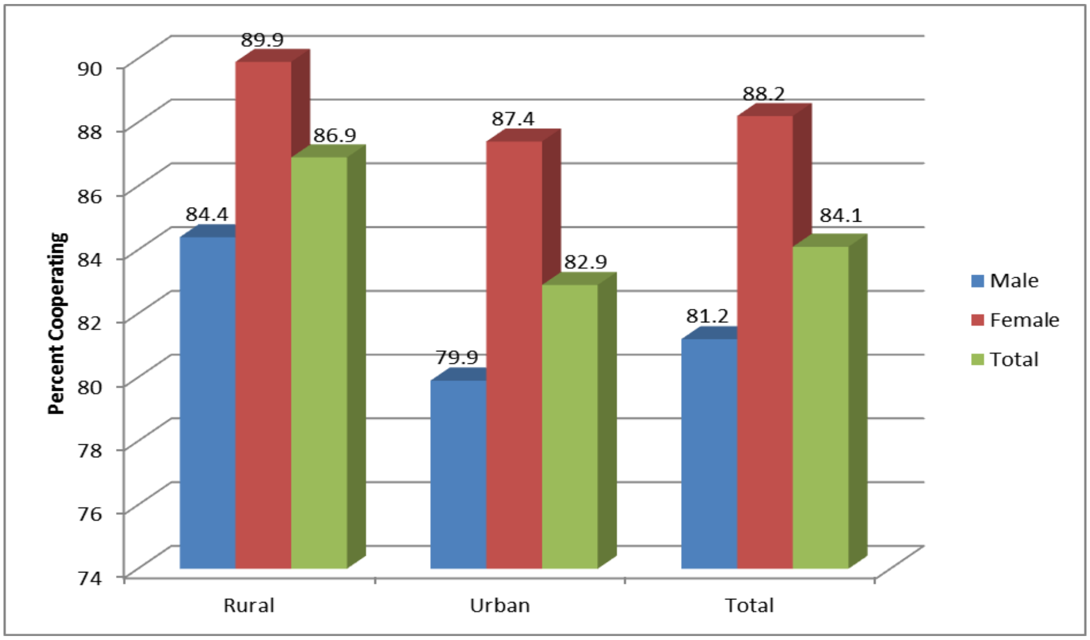


Figure 2: Male and Female Cooperation Rates across U.S. and Foreign Students

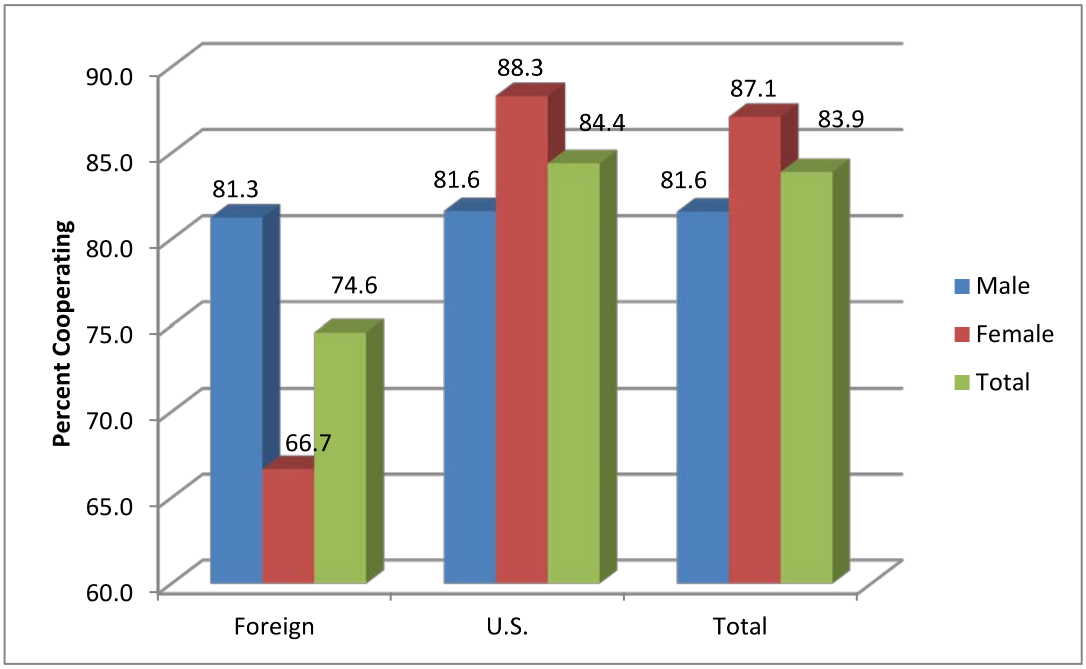
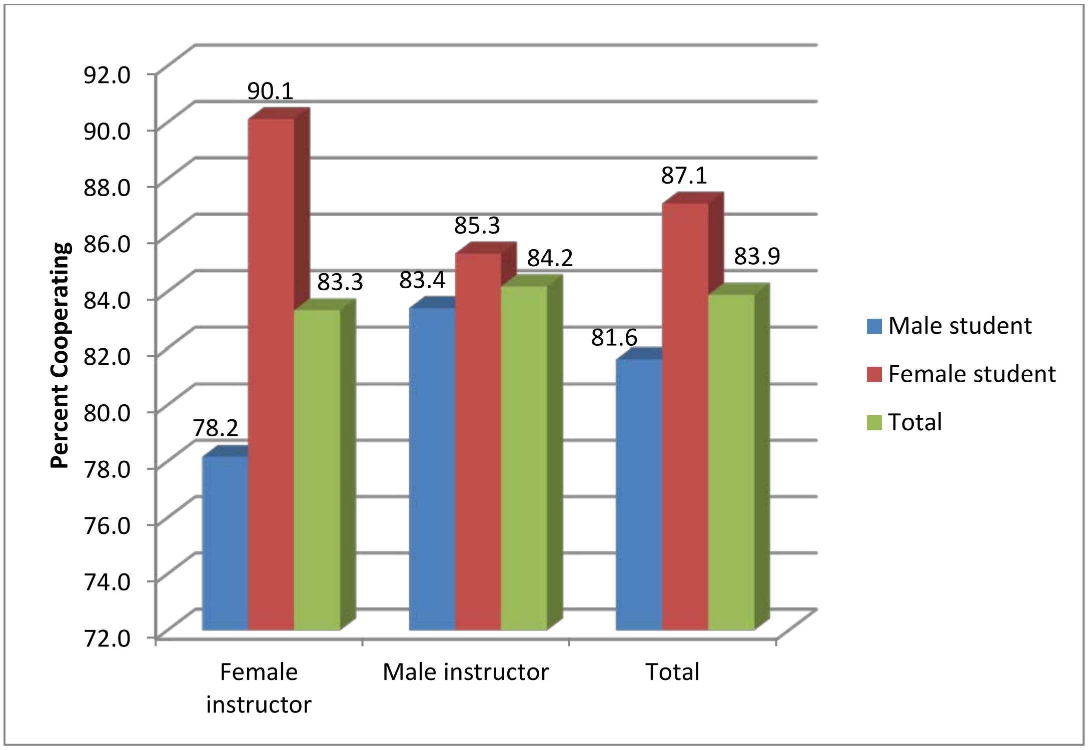


Figure 3: Male and Female Cooperation Rates across Male and Female Instructors



APPENDIX 1: Survey Instrument for Classes with Fewer than 100 Students Enrolled

Students,

This survey is part of a simple economic experiment. There is no obligation to participate, and no cost to you if you decide not to. The potential benefit is real: **extra points added to your second midterm grade.** There is no risk to you, and all information gathered will be kept strictly confidential.

Instructions:

- Do not talk with each other during the experiment.
- Do not look at anyone else's paper nor allow them to look at yours.
- Your answers will never be revealed to anyone else, including other students in this class.

The following is a simple situation. Please read carefully then select either the number 2 or the number 8:

- If everyone writes 2, all students get 2 points added to their second midterm grade.
- If only one or two students write an 8, both of them get 8 points and everyone else gets 0 points.
- If more than two students write an 8, everyone in the class gets 0 points.

Your choice (circle one): 2 points 8 points

Please complete the following information (as noted above, all information will be kept strictly confidential):

Last Name	First Name
Gender (write "M" or "F")	
Major or expected major (please be specific – for example write "accounting" not "business")	
Zip code of town in which you attended your senior year of high school (if you are an international student please list your country of origin and the postal code of your hometown):	

Thanks for your participation!

APPENDIX 2: Survey Instrument for Classes with 100 or More Students Enrolled

Students,

This survey is part of a simple economic experiment. There is no obligation to participate, and no cost to you if you decide not to. The potential benefit is real: **extra points added to your second midterm grade.** There is no risk to you, and all information gathered will be kept strictly confidential.

Instructions:

- Do not talk with each other during the experiment.
- Do not look at anyone else's paper nor allow them to look at yours.
- Your answers will never be revealed to anyone else, including other students in this class.

The following is a simple situation. Please read carefully then select either the number 2 or the number 8:

- If everyone writes 2, all students get 2 points added to their second midterm grade.
- If only one, two, or 3 students write an 8, each of them gets 8 points and everyone else gets 0 points.
- If more than three students write an 8, everyone in the class gets 0 points.

Your choice (circle one): 2 points 8 points

Please complete the following information (as noted above, all information will be kept strictly confidential):

Last Name	First Name
Gender (write "M" or "F")	
Major or expected major (please be specific – for example write "accounting" not "business")	
Zip code of town in which you attended your senior year of high school (if you are an international student please list your country of origin and the postal code of your hometown):	

Thanks for your participation!