Tests of Social Preference Theories with Non-Economics Students and a Real Commodity

Deborah Kerley[1]
Kent D. Messer
William D. Schulze

CORNELL UNIVERSITY

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Abstract

Psychologists have argued that consumers sometimes make judgments based on feelings of disgust arising from social norms. These objects are simply viewed as unacceptable and the rational cost-benefit analysis never comes into play. Alternatively, an economic interpretation would be that the participative risk associated with the commodities is so high that a corner solution is obtained and the commodity is avoided. Understanding the psychology and economics of stigma is important to public goods setting, such as Superfund sites and possible terrorist contamination of water supplies. This research demonstrates that some participants are subject to stigma even in the presence of monetary incentives in both private good and public good voting experiments using spring water that had a dead, autoclaved cockroach dipped into it and removed. Stigmatization also appears to show the endowment effect and unique bimodal distributions of willingness-to-accept and willingness-to-pay. Procedures to reduce the stigma show that some of the stigma can be removed after treatment; however, some participants still choose to avoid consumption. Importantly, in the case of a stigmatized public good, strong social preferences are shown to be present. Consistent with the hypotheses of Charness and Rabin, Fehr and Schmidt, and Bolton and Ockenfels, it appears about half of the participants are concerned about others' values, such as in this research with adult participants drawn from Cornell staff. The analysis strongly supports the efficiency measure shown to be significant both in the work of Charness and Rabin and Engelmann and Strobel. However, unlike previous research with business student participants, we find that equity based preferences are supported as well. Thus, it appears that with stigma both efficiency and equity matter.

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[1] All authors are from Cornell University. Corresponding author is Deborah Kerley, 404 Uris Hall, Ithaca, NY, 14850, drk27@cornell.edu. We would like to give a special thanks to PawPrints, Christian Coerds, Adam Gomez, Chi Bong Ho, Joe LaVerde, Ronald Meise, Melanie Pope, Eliot York, and Rose Zefferino. We would also like to thank George Jakubson, Collin Payne, Christian Vossler, and Brian Wansink for their useful comments. We also wish to gratefully acknowledge support from the Decision Risk and Management Science Program at the National Science Foundation.

1. Introduction

Many private goods and products have been stigmatized at one time or another. Consider the examples of cyanide in Tylenol bottles, exploding gas tanks that plagued the Ford Pinto, Firestone tire failures on the Ford Explorer, and mad cow disease with beef. The costs of stigmatization can be massive: Tylenol, who immediately responded with triple protection on their bottles from cyanide tampering, lost almost $1.4 billion. Many public goods have been stigmatized as well. For example, the public water supply in Woburn, Massachusetts, was contaminated by hazardous wastes, a case that forms the basis for "A Civil Action," a best-selling book and successful movie starring John Travolta. Similarly, radium from manufacturing waste in the 1920's found near homes in Montclair, New Jersey, and hazardous wastes deposited in a landfill near Los Angeles, California, caused quasi-permanent losses in nearby property values even though extensive cleanup costing hundreds of millions of dollars has occurred (Messer et al., *forthcoming*). Many additional examples of technological stigma are described in a book edited by Flynn, Slovic and Kunreuther (2001). This apparent failure of some public and private goods to recover from stigma, even when perfectly safe, causes the study of stigma to become necessary. The experimental literature on disgust, which is imaginative and convincing (see for example, Fallon, Rozin, and Pliner, 1984, Rozin, Fallon, and Augustoni-Ziskind, 1985, Rozin, Millman, and Nemeroff, 1986) does not fully explore the effect of monetary compensation for or payments to avoid stigma, an important condition that Nemeroff and Rozin (1994) indicate may affect people's response to stigma. Fischhoff (2001) defines stigma as follows:

> Stigma is demonstrated by principled refusal to engage in an act that would otherwise be acceptable. It happens when an individual feels that an act is just not done. In this view, stigma is a dichotomous variable. A stigmatized act is

> unacceptable whatever its associated benefits. If deciding what-to-do involves any cost-benefit calculus, then the resulting choice is not stigma driven.

Alternatively, Walker, (2001) argues, "the normal use of the word 'stigma' entails . . . an *un*warranted level of avoidance behavior. Stigma represents a *mis*conception, a *mis*perception of risk, an *over*reaction to some thing."

Economists may argue that all choices involve tradeoffs of costs and benefits and would likely favor the latter definition. They might argue that, when participative risk becomes very large, a significant number of consumers are likely to find that the optimum is a corner solution where the act is avoided. If many consumers agree on this behavior, a social norm may evolve to avoid the act, product, or commodity. Rather than making an explicit tradeoff, widespread avoidance may develop. However, this view ignores the important roles that social context and emotion play in avoidance. It is clear from reading Flynn et al. (2001) that different authors have different definitions of the sources and breadth of the stigma phenomena that leads to avoidance behavior.

Our experiments to understand this avoidance behavior examine sterilized objects that are stigmatized using the procedures developed by Rozin, et al.; however, they provide the economic measures of willingness to accept (WTA) stigma and willingness to pay (WTP) to avoid stigma. Using these measures, various strategies to reduce and even eliminate stigma are explored in an experimental setting for both public and private goods. We show that some participants are subject to stigma even in the presence of monetary incentives in both private good and public good voting experiments using spring water that had an autoclaved cockroach dipped into it and removed. Stigmatized commodities continue to show the endowment effect and unique bimodal distributions of WTA and WTP are found. Procedures to reduce the stigma show that some

stigma can be removed after treatment; however, some participants still choose to avoid consumption after treatment.

Importantly, in the case of a stigmatized public good, strong social preferences are shown to be present. Consistent with the hypotheses of Charness and Rabin (2002), Fehr and Schmidt (1999), and Bolton and Ockenfels (2000), it appears about half of the participants are concerned about others' values when extreme value differences exist, such as in this research with adult participants drawn from Cornell staff. The analysis strongly supports the efficiency measure shown to be significant both in the work of Charness and Rabin (2002) and Engelmann and Strobel (2004). However, unlike previous research with business student participants (Messer et al, 1995), we find that equity based preferences are supported as well. We cannot, however, reject alternative formulations of equity, the Maximin preferences of Charness and Rabin (2002), or the difference formulations of Fehr and Schmidt (1999) and of Bolton and Ochenfels (2000), because of the inherent collinearity of these alternative equity measures. Thus, it appears that with stigma both efficiency and equity matter.

The paper is organized as follows: Section 2 summarizes the literature in experimental psychology investigating the phenomenon of stigma; Section 3 outlines the experimental design and the theoretical motivation for using the Random-Price Voting Mechanism to examine potential role of social preferences; Section 4 describes the results of the experiments; and Section 5 concludes the paper.

2. Evidence of Stigma in the Laboratory

The phenomenon of stigma has been studied primarily by psychologists. In summarizing the existing research, Rozin (2001) identified five key properties of stigma:

1. Stigma is viewed as the result of direct contact.
2. Stigma appears to be permanent (does not go away by itself).
3. Stigma appeared to be insensitive to dose.
4. The exact source of risk is usually unknown.
5. People tend to medicalize the risk.

To our knowledge, there has been no systematic study of stigma in the experimental economics laboratory.

Biological Contaminates. Previous experiments have frequently used potential biological contaminants to invoke stigma. For example, Rozin, Millman, and Nemeroff (1986) asked adults to rank their response to certain situations from "dislike extremely" to "like extremely" on a 200-point scale. In one situation, participants were given glasses of juice. The glasses then had a dry sterilized cockroach dipped into them for about five seconds. The difference in the mean of the drinking of the juice that had been cockroached from the mean of the neutral juice fell by 102 points. Fallon, Rozin, and Pliner (1984) asked participants to imagine that an M & M, a hot dog, a food that the individual "hated", a leaf, a grasshopper, poison, and feces had fallen individually into a glass of a beverage that they loved. The results of this research suggest that in hypothetical situations, once the individual claims that just the idea of drinking the juice is unacceptable to them, 92% of the individuals continued to reject the beverage even after all distaste and danger were removed. Additionally, Rozin, Nemeroff, Horowitz, Gordon, and Voet (1995) asked participants how they would feel if a Q-tip that had been in contact with a sterilized cockroach before being cleaned made contact with different parts of their bodies. As anticipated, the response to the sterilized cockroached Q-tip ranked lower than a plain Q-tip for every body part, seeing as much as a 69.2-drop, on a 200-point scale, in the liking of the situation.

Chemical Contaminates. Chemical contaminates have also been extensively used. Rozin, Millman, and Nemeroff (1986) showed participants two bottles that had never been used and

stated that both contained table sugar. One bottle had a "Sucrose (Table sugar)" label on it and the other had a "Sodium Cyanide" with a red printed "Poison" label. Participants were told both labels had never been on any other bottle. When asked about their level of like for each of the two bottles, the participants reported a mean difference of -30.58, on a 200-point scale, between the cyanide and the sugar labeled bottles. However, when participants put the labels on cups themselves, the mean difference dropped to just -16.5. Rozin, Markwith, and Ross (1990) found similar results when the sugar was put into different pitchers of "Kool-Aid."

Accidental Harm. In addition to the use of cockroaches and other items, Hejmadi, Rozin, and Siegal (2004) asked participants to image that a tack had fallen into lemonade and then was removed without a trace. Participants were then asked to say whether they considered the lemonade unsafe to drink. Contrary to the results of most of the previous research, which had shown that stigma increased with age, in response to the tack, as age increased, the rejection of the lemonade after the tack had been removed decreased. Many of the experiments we describe herein can be associated with the laws of sympathetic magic. The first law is the *law of contagion*, meaning once a first object touches a second object, the second object seems to inherit the properties of the first. The second law of contagion, *similarity*, says that when one object resembles a second, people will tend to think the object attains the traits of the other object (Frazer, 1959 and Mauss, 1972). Rozin, Millman, and Nemeroff (1986) and Rozin, Haidt, McCauley, Dunlop and Ashmore (1999) show that fudge shaped like dog feces is disliked and undesirable to be eaten, even though the fudge itself is perfectly acceptable. (See Rozin, Haidt, McCauley, 2000 for a more thorough summarization of the history, description, and theory of disgust and Haidt, McCauley, and Rozin, 1994, for a disgust scale.)

Remediation. In many of these papers, treatments were undertaken to remove or reduce stigma. In the beverage contamination described earlier (Fallon, Rozin, and Pliner, 1984), participants were asked to imagine that after the foreign object was in the glass, the glass was emptied and then refilled with the beverage they loved, then *wash*ed three times, and again filled with more of their loved beverage. The results of this experiment suggested that as age increased it took more purification steps to get back to the uncontaminated state. However, for the youngest and middle children, they always went back to the original loved state. For the adults, not even washing was sufficient for the feces. The grasshopper, poison, and feces cause the worst original reaction, and require more steps to return to the loved state. Rozin, Fallon, and Augustoni-Ziskind (1985) continue this research by testing if participants would be more willing to drink the liquid if the experimenter first drank some of the liquid. Nemeroff and Rozin (1994) tried to remove the stigma from a sweater that had been in contact with dog feces, where the dog feces left no trace by either sight or smell. Participants were asked how they felt about the sweater after it had undergone physical cleaning. Finally, Rozin (2001) describes experiments where participants refuse to drink juice from a glass if a sterilized cockroach was dipped into it, but they would drink the juice if the cockroach is placed near it. Research found that participants still refused to drink the juice even if it had been in the freezer for one year, showing that stigma is permanent. Also reductions in the duration of time the cockroach was in contact with the juice did little to remove the stigma suggesting that stigma is insensitive to dose.

3. Experimental Design, the Random Price Voting Mechanism and Underlying Theory

All of the experiments were conducted at the Laboratory for Experimental Economics and Decision Research at Cornell University. All of the designs were approved by Cornell's

University Committee on Human Participants. The experiments lasted approximately an hour and a half. In order to provide participants with strong economic incentives and a "reasonable" maximum range for the WTA and WTP, the average earnings for the experiments involving students was $40. For the experiments involving staff, an additional $10 show-up fee was added, thereby making the average earnings $50.

The laboratory was equipped with up to twenty-four computers with privacy shields. Participants were randomly assigned to individual computer terminals equipped with privacy shields. These computers used Excel spreadsheets programmed with Visual Basic for Application to collect the participants' decisions, send these decisions to an Access database, and return any necessary information back to the participants.. Participants were asked to fill out consent forms and asked to begin reading the instructions presented to them when they entered the room. After everyone had read the instructions, an oral PowerPoint presentation was made on summarizing the instructions. Participants were allowed to ask questions on a one-on-one basis to the administrators. No other communication was permitted between participants during the experiment.

Student Experiments. The initial experiments were conducted with 87 participant participants recruited from undergraduate economics courses. The average age of the students was 19.4 years. The WTA sessions were run with 42 participants and the WTP sessions were run with 45 participants. In the first part of the experiment, each participant was given a glass of Poland Spring water on his or her desk. Each participant was given as much additional water as they desired to ensure that by the second part of the experiment the marginal value of an additional incremental amount of water would be negligible. Likewise, subjects were given an opportunity to go to the bathroom between the parts of the experiment.

The first part of the experiment provided participants trained participants on using the Random-Price Voting Mechanism (RPVM). As described in Messer et al, 2005, the RPVM is a public good extension of the Becker-DeGroot-Marshack (1964) mechanism. A key advantage of the RPVM is that the number of subjects in a group setting can be varied, such that, in a setting with only one subject, the mechanism reduces to the traditional incentive-compatible BDM that has been shown to be a transparent mechanism with demand revealing properties (Boyce et al., 1992, and Irwin et al., 1998). Consequently, the RPVM enables within-subject comparisons of behavior in both a private and public setting. In single-shot settings, the RPVM is incentive compatible and can be used to explore other regarding behavior (ORB) observed in voting. The mechanism can also be used all welfare treatments, WTP, WTA, gains, and losses.

In the RPVM, a public good is implemented whenever a majority of participants indicate a minimum WTA less than a randomly selected compensation (or a maximum WTP greater than a randomly selected cost), where all participants, regardless of personal WTA (WTP), will receive this random compensation (or pay the random cost). The coercive nature of the RPVM closely parallels referenda settings. As discussed below, the RPVM enables insight into the preferences and behavior of individuals and how ORB affects choices in public good decisions. Messer et al. (2004, 2005) found private-public value differences consistent with Charness and Rabin (2002) and Engelmann and Strobel (2004) for both heterogeneous induced values and risky situations.

The first part of the experiment consisted of 14 low incentive rounds. In each round, participants were given a personal loss amount of $6, $15, or $24. They were also told, in each round, if they were in a voting group of one or in a voting group of three. The subjects were aware of who was in their groups asked to raise their hands at the beginning of the session as the

group numbers were announced. However, no communication between group members was permitted.

For the WTA session, in each training round, participants were given an initial balance of 10 experimental dollars, where an exchange rate of 33 experimental dollars to one U.S. dollar was applied. Participants were instructed to offer the minimum amount of money they would be willing to accept in order to have to pay their personal loss amount. After all the offers were submitted, a random compensation between 0.00 and 29.99 was chosen. The program was *implemented* if the majority of offers from the group were less than or equal to the determined compensation. In this case, the participants received their initial balance minus their personal loss amount plus the randomly determined compensation. If the majority of offers in a group turned out to be greater than the randomly selected compensation, the program was *not implemented* and the participants earned just their initial balance. Note, if a round had a participant in a voting group of one, their decisions solely determined their outcome for the round.

For the WTP sessions, to equalize the expected earnings, in each training round, participants were given an initial balance of 30 experimental dollars, where an exchange rate of forty-seven experimental dollars to one U.S. dollar was applied. Participants were instructed to offer the maximum amount of money they would be willing to pay to avoid paying their personal loss amount. After all the bids were submitted, a random cost between 0.00 and 29.99 was chosen. The program was *implemented* if the majority of the bids from the group was greater than or equal to the randomly determined compensation. In this case, the participants received their initial balance minus the randomly determined cost. If the majority of the bids in a group

turned out to be less than the randomly selected cost, the program was not implemented and the participants received their initial balance minus their personal loss amount.

At the start of the second part of the experiment, the administrators collected all of glasses of water and placed two three-ounce Dixie cups on each desk. In the front of the room three labeled clear glass jars labeled were placed on a table. As the oral instructions described the protocols for this part of the experiment, participants observed three different "modifications" to the Poland Spring Water:

Spring Water – A jar labeled "SW" was filled with the same Poland Spring water that they were drinking during the first part of the experiment. Participants were told that according to the manufacturer, "Poland Spring® Natural Spring Water comes from protected sources deep in the woods of Maine."

Cockroach-Dipped Water – A jar labeled "CW" was first filled with Poland Spring Water. Then a dead autoclaved cockroach was placed into a brine shrimp net, dipped into the water and removed. The water was then stirred. Participants were told that according to the autoclave's manufacturer, "Getinge's steam sterilizers represent the most comprehensive range of general purpose, high performance sterilizers available. They are designed for sterilizing a broad spectrum of materials involved in industrial processing, research and development, and quality control." Thus, they could expect the cockroach to be as sterile as a surgical instrument.

Filter Cockroach-Dipped Water – A glass jar was first filled with Poland Spring Water and had a dead autoclaved cockroach dipped into it as described above. This was then was pumped through a Sweetwater Microfilter, similar to those commonly used while camping, into another jar labeled "FW". Participants were told that according to the manufacturer, "The

Sweetwater Microfilter eliminates over 99.9999% of all waterborne bacteria and 99.9% of common protozoan parasites such as Giardia and Cryptosporidium."

In the WTA sessions, participants were advised to offer the minimum amount of compensation they would need in order to drink three-ounces of the modified water. In the WTP sessions, participants were advised to bid the maximum amount of money they would be willing to pay to avoid drinking the water. In each design, subjects made six decisions before learned of the compensation or cost that would be used to determine their earnings and whether they had to drink the modified water. Participants submitted their offers (or bids) for each of the modifications of water and for both private, group size of one, and public, group size of three, scenarios. Participants were informed that only one of the treatments would actually end up being implemented. The treatment was selected by having a volunteer subject draw one poker chip out of a bag. The poker chips were lettered A through F. To control for potential order effects, the choices were presented in different orders in different experiment sessions.

In the WTA case, if the majority of offers were *greater than* the random compensation, the participants in that group would receive their initial balance of $10 and would just have to drink the spring water poured directly from the original bottle into the three-ounce cup. If the majority of offers were *less than or equal to* the compensation, the participants in that group would receive the compensation in addition to their initial balance, but they would have to drink the modified water. Likewise, in the WTP case, if the majority of bids were *less than* the random cost, the participants in that group would keep their entire initial balance of $30 and have to drink the modified water. If the majority of bids were *greater than or equal to* the cost, the participants in that group would have to pay the cost out of their initial balance, but would only have to drink a three-once cup of spring water poured directly from the original bottle. This

design ensured that everyone would have to have to drink a glass of water at the same time, to control for the potential embarrassment (or reward) of having to drink the CW. Note, the two different spring waters are only different in the sense that SW is first poured into a glass jar and the other spring water comes directly from the original jug.

Staff Experiments. As a follow-up to the initial experiments involving students, a series of experiments were conducted with 72 Cornell staff members who were recruited via e-mail through the Cornell staff newspaper, PawPrints.[1] The average age of the staff was 37.4 years. The use of staff members was chosen to test if different populations have different reactions to stigma. All sessions were conducted in the evening to avoid selection bias due to work conflicts. WTA sessions were run since they provided the highest average values and therefore suggest the greater response to stigma. Experimental sessions with WTP will be conducted in the future.

These sessions used the same protocols and instructions described previously, except for the changes in the public good treatments. The public treatments were designed to test formally different theories of ORB with a real commodity. In this design, the second part of the experiment only included the private rounds of SW, FW, and CW, where the order of the treatments on the spreadsheets was varied to control for potential order effects. The participants were told that along with these three decisions, five other decisions would later be made, where any one of these eight decisions would result in actual cash earnings and possible drinking of water.

To motivate the design of the public good treatments, consider the following theoretical structure: Let C denote whether the participant drinks (C=0) or does not drink (C=1) cockroach contaminated water, X_i denote a composite commodity with a price of unity for participant i, and

[1] One person in the follow-up questionnaire indicated that they had heard of the experiment beforehand. Thus we dropped this participant from the analysis.

S_i a measure of social preferences to be defined later (S_i=0 in the private good case). Further assume that utility for participant *i* is given by $U^{i,h}(C,W,S_i)$, a positive quasi-concave function of its arguments, where *h* denotes whether the participant is healthy (*h*=1), or sick (*h*=0) and, ceteris paribus, participants are worse off if sick, $U^{i,0}(C,W,S_i)<U^{i,1}(C,W,S_i)$. If r_i is the participative probability for individual *i* such that she will become ill from drinking cockroach contaminated water, then the participant will accept price *P* to drink contaminated water if

$$(1) \qquad r_i U^{,i,0}(0,W+P,0) + (1-r_i)U^{i,1}(0,W+P,0) \geq U^{i,1}(1,W,0),$$

and reject the price otherwise. If (1) holds with equality, then it can be solved for the minimum price $P_{i,min}$ at which she would accept drinking the water and becomes the WTA_i for drinking contaminated water in the private good situation. Note that this preference structure assumes that participants may not wish to consume cockroach contaminated water for two reasons, 1) their own participative risk beliefs captured in r_i and 2) any possible feelings of disgust captured by *C*.

In the public good situation that employs voting groups of three participants (n=3), social preferences may enter the decision on WTA. To avoid the problem of infinite reflective altruism we assume that the measure of social outcomes is a function $S_i(P_{1,min}, P_{2,min}, P_{3,min}, P^G)$ of the individual private WTA values for individuals 1, 2, and 3, as well as of the price the group faces for the public good, P^G. A moment's reflection on the experiments described below is worthwhile at this point. We initially obtain private good values for avoiding drinking cockroach-contaminated water using the RPVM. Participants are then placed into a number of different voting groups of n=3 and informed of the private values of all members in their group. Thus, participant 1 who might have a private value of $P_{1,min}$=\$0 might be in a group with $P_{2,min}$=\$30,

and $P_{3,min}$=\$0. Participant 1 might be very concerned that by voting to accept any compensation drawn above \$0, say P^G =\$5, that she is imposing a loss on participant 2 of \$25 (\$5 - \$30) by forcing him to drink cockroach contaminated water, since a majority of two positive votes and one negative vote apply at that price. University Human Subject protocols necessitate that participant 2 could withdraw, but then the participant would forgo the compensation of \$25 and earnings from other parts of the experiment. However, such a decision would in all cases imply an even larger loss for participant 2. Thus, a variety of other regarding behaviors can be captured by our formulation as we show below. In particular, a participant in the public good part of the experiment will vote yes if

$$(2) \qquad r_i U^{,i,0}(0, W+P^G, S_i(P_{1,min}, P_{2,min}, P_{3,min}, P^G)) + (1-r_i)U^{i,1}(0, W+P^G, S_i(P_{1,min}, P_{2,min}, P_{3,min}, P^G)) \geq U^{i,1}(1,W,0)$$

and the public good compensation or lowest price at which participant 1 will vote "yes", $P^G_{i,min}=WTA_i^G$, can be obtained by solving for P^G when (2) holds with equality. Note that if social preferences are present, $P^G_{i,min} \neq P_{i,min}$.

The alternative measures of social preferences that we test follow the approach of Engelmann and Strobel (2004). They test alternative measures of other regarding preferences. First, Charness and Rabin (2002) suggest that ORB is best measured by efficiency concerns and equity concerns reflected in maximin preferences. Engelmann and Strobel capture these preferences with two variables labeled *Eff* and *MM*. Where *i* denotes the individual and *k* members of the voting group, *k*=1, 2, 3, then, where $x_k=P^G-P_{k,min}$.

$$Eff_i = \sum_k x_k$$

$$MM_i = \min\{x_k\}$$

As an alternative measure of equity, Fehr and Schmidt (1999) suggest that participants dislike any payoff difference across participants. Two variables described in Engelmann and Strobel (2004) capture this are:

$$FS\alpha_i = -\frac{1}{2}\sum_{k \neq i} \max\{x_k - x_i, 0\}$$

and

$$FS\beta_i = -\frac{1}{2}\sum_{k \neq i} \max\{x_i - x_k, 0\} .$$

Unfortunately, these variables cannot be included as separate variables without creating collinearity problems (See Engelmann and Strobel, 2004, and Messer et al., 2005). However they can be summed in a variable labeled *FSSTRICT*.

A third theory of equity preferences is that of Bolton and Ockenfels (2000) who suggest that participants prefer average payoffs to be close as possible to their own. Engelmann and Strobel (2004) capture this, by

$$ERC_i = -\left| x_i - \frac{1}{3}\sum_k x_k \right|$$

In testing these alternative measures for social preferences, $S_i(P_{1,min}, P_{2,min}, P_{3,min}, P^G)$, we first include all of them and then explore the efficiency variable, *Eff*, with the three alternative equity measures.

After the participants submitted their private offers, instructions for a third part of the experiment were distributed and questions were answered privately. In the third part, the participants were split into five different groups, one for each of the remaining decisions.

1. Participants were informed that they were now in groups of three and they were asked to submit their public WTA for the CW without any other information about their group members.

For each of the remaining four decisions, the participants were asked to submit their public WTA offer for the CW. Before they submitted their public WTA offer, the computer screen confidentially displayed the *private* WTA offers for WTA from each member of their group, including their own. For the subject, the four decisions varied by how similar and how symmetric the WTA values were from the other members in their group:

2. Groups were formed based on having the *most* similar and most symmetric WTA values as possible (i.e., values of \$6, \$7, and \$8).
3. Groups were formed based on having the *least* similar yet most symmetric WTA values possible (i.e., values of \$0, \$15, and \$30)
4. Groups were formed based on having the most *asymmetric* WTA values possible where two of the values were as *low* as possible and one of the values was as high as possible (i.e., values of \$0, \$0, \$30).

5. Groups were formed based on having the most asymmetric WTA values possible where two of the values were as *high* as possible and one of the values was as low as possible (i.e., values of $0, $30, $30).

The information for the next decision appeared on the computer screen only after the offers of the previous round had been submitted to guarantee the decisions were made independently. Again, these questions were displayed in different orders in different sessions.

4. Experiment Results.

Student Experiments. The results of the sessions involving students suggest that participants are indeed concerned about the introduction of the sterilized cockroach into their water. The mean WTA and WTP rise significantly to $7.28 and $4.59 for CW, respectively (Table 1 and 2). Thus, for some participants, stigma exists since there is no scientific evidence that risk increased with the dipping of the sterilized cockroach. However, the results also appear to differ dramatically from some of the psychology literature, where in hypothetical questions, up to 90.5% of the participants said they would not drink liquids after a sterilized cockroach was dipped in them (Hejmadi, Rozin, and Siegal 2004). In contrast, in our experiments, 60.9% of the participants submitted a WTA or WTP value of *zero*. Additionally, clean-up did appear to have been partially effective as the mean WTA and WTP for FW are $3.33 and $2.17, respectively, which is higher than the mean WTA and WTP for SW, but significantly lower than for CW. Table 3 provides a break-down of the descriptive statistics across different groups.

Examining the cumulative distributions, the majority of the offers and bids for all three private water treatments are between $0 and $5 (Figures 1 and 2). For both the SW and the FW, the distributions are skewed towards zero, with no WTA offers between $25 and $30 and only

one for WTP bids. In contrast with the CW, 12% and 11% of the participants submitted WTA offers and WTP bids in the highest range of $25-$30, respectively, thereby indicating a strong desire to shun the CW water by some participants.[2]

In obtaining WTA and WTP, the offers and bids were truncated at $0 and $30. Thus, we use a two-limit tobit model to explain values. Since each participant submitted six offers or bids using the RPVM, we use a random effects model with the dependent variable being each bid or offer. We use dummy variables to indicate whether the bid or offer is from the CW, FW, or SW treatments, with the SW variable omitted. We also use dummy variables to indicate if the treatment is a WTA or WTP treatment, WTP coded as a one; a private or public treatment, private coded as a one; the gender of the participant, females coded as a one; if the person is majoring in at least one science major, non-science majors coded as a one; and whether the participant was a freshman, freshmen coded as a one. We also include interaction terms between gender, major, and school year.

This yields the following model for person i:

$$(3) \quad Value_{ij} = \alpha + \beta_1 * CW_{ij} + \beta_2 * FW_{ij} + \beta_3 * WTP_{ij} + \beta_4 * Private_{ij} + \beta_5 * Female_{ij} + \beta_6 * Non\text{-}Science_{ij} + \beta_7 * Freshman_{ij} + \beta_8 * Freshman * Non\text{-}Science_{ij} * + \beta_9 * Freshman * Female_{ij} + \beta_{10} * Female * Non\_Science_{ij} + \mu_i + \varepsilon_{ij},$$

where $\mu_i \sim N(0, \sigma_\mu^2)$ and $\varepsilon_{ij} \sim N(0, \sigma^2)$. The estimation results are given in Table 4. Bids and offers are significantly greater for both CW and FW in comparison to the SW, where the

[2] One individual who offered $30 for the CW stated in the follow-up questionnaire that their offer would have been $1,000 if they had been allowed to do so. Interestingly, this individual offered $0 for the SW, and after the filtering process, offered $0 for the FW, further suggesting that the stigma exists for some people and can be removed by some type of mitigation efforts.

coefficient on CW is greater than the coefficient on FW, indicating that stigma is shown to exist in the laboratory setting and can be partially reduced. The coefficient on WTP was significantly negative at the 1% level, giving evidence that the endowment effect exists with respect to stigma (Kahneman and Tversky, 1979); however, interestingly, stigma does not appear to exhibit the typical doubling of WTA. The differences in WTA versus WTP can be seen in Figures 3 and 4, where the average WTA offer is always higher than the average WTP bid in both the public and private cases. Recall, subjects participated in either the WTA or WTP design, not both.

The coefficient on females is positive and significant; this suggests that women are more likely to be affected by stigma than men. A significant amount of the earlier psychological work in contagion and disgust focused on whether the behavior of stigma was learned or was naturally inherent in human beings. Examining the coefficient on non-science majors, it is found to be positive and significant, giving support to the hypothesis here that those who work with scientific equipment may find the water that has the sterilized cockroach dipped in it to be more acceptable due to conditioning. Examining age and life circumstance differences, as has been done in the previous research mentioned above, the coefficient on freshman is positive and significant, showing that first year undergraduates tend to be more susceptible to stigma. All of the interaction terms are negative, with only freshman*female being non-significant, implying that these reduce the positive effects found on the other coefficients.

Finally, when comparing the values in the private versus the public setting, the average offer and bid in the public scenarios is *lower* than the average offer in the private good scenarios, though the difference is not significant at the $\alpha < 0.10$ level. Figures 5 and 6 show that for both WTA and WTP the average offer and bid was lower in the public case compared to the private case for each modification of the water. This lowering of the values appears to be consistent with

the behavior observed by Messer et al. (2004) where the worst-off participants (those who most want to avoid drinking the CW) may lower their WTA in a risky public setting so as not to impose financial costs on others. In the CW treatment, those with the highest WTA in the private setting (as measured by having a WTA ≥ $15), submitted offers that on average were $5.95 lower for the public case (t-stat of 2.02). Therefore, the results suggest that the high private WTA individuals may exhibit some form of ORB stemming from the belief that the compensation that they need in order to drink the water may be higher than the compensation of others in their group, resulting in them lowering their offers in a public setting. Like Johannesson et al. (1996), where similar effects were observed, the research was done without perfect information, therefore, participants could only conjecture whether or not they were truly the worst-off participants.

To summarize, stigma was found to exist when monetary payoffs are involved. Stigma appears to be at least partially removed when the water underwent additional treatment. Additionally, females, non-science majors, and freshman experience greater levels of stigma. Finally, in public settings where costs and losses can be coercively imposed upon others, there appears to be evidence of some type of ORB.

Staff Experiments. The mean WTA from staff for the SW, CW, and FW in a private setting are $3.41, $7.55, and $5.15, respectively (Table 5), showing that the new participant population shows the same ordering of offers as the student population (Figure 7). Even more interesting may be the fact that the staff population's means are almost identical to those of the students. Table 6 shows the difference in the mean WTA offer between groups for the SW, CW, and FW is $1.59, $0.27, and $1.82, respectively. The difference in the means for the CW using a

t-test with unequal variances is not significant at the 0.10 level, indicating that the amount of stigma appears to be constant across different aggregated population segments.

In the follow-up questionnaire, we could not ask the staff about their major and year in school since this would be nugatory. However, we were able to collect data on whether the participants had ever used an autoclave and if they frequently go camping. The amount of stigma that affects individuals appears to change across different segmented portions of the population (Table 7). Females have an average CW offer of $9.03 compared to the average offer for the males of $2.04. This is consistent with our previous findings. Instead of using science majors, we looked at whether the participant had ever used an autoclave before. The average CW offer for those who had used an autoclave is $5.84 versus $7.75 for those who have never used an autoclave. This result is commensurate with the science major findings in the student population. Finally, those who frequently go camping have an average CW offer of $3.83 compared to the average offer of $8.59 for those who do not. A similar affect is found with the CW offer as those that go camping lowered the average FW offer to $2.83 compared to $5.58 for the non-campers.

In obtaining the WTA offers, again, the allowable offers were truncated at $0 and $30 and each individual submitted four offers, so we continue to use a random effects two-limit tobit model. The dependent variable in our estimation is the value offered. The independent variables are the private offer for CW, denoted as self, Efficiency, Maximin, FSSTRICT, and ERC as described above. This yields the following model for person *i*:

$$(4) \quad Value_{ij} = \alpha + \beta_1 * Self_j + \beta_2 * Efficiency_{ij} + \beta_3 * Maximin_{ij} + \beta_4 * FSSTRICTe_{ij} + \beta_5 * ERC_{ij} + \mu_i + \varepsilon_{ij},$$

where $\mu_i \sim N(0, \sigma_\mu^2)$ and $\varepsilon_{ij} \sim N(0, \sigma^2)$. We also estimate the coefficients on the individual measures of ORB in a regression with efficiency and self, but omit the other measures to get an idea of how each measure performs independently of the others.

Since some of the participants did not change their offers in the public voting rounds, we present the coefficients for the full population and for the individuals who changed their offer at least once. This yields a closer examination of the other regarding behavior of the population as a whole and for the portion of the population that actually exhibits the other regarding behavior. A possible conjecture is that some of the people who did not change their offers, may have actually been demonstrating other regarding behavior in a paternalistic fashion. Since the majority of the individuals who did not change their offer, offered \$0.00 for their private CW, a possible explanation is that these people perceived If these individuals thought that drinking the water would cause the other positive offer members of their group no harm, then offering a lower value would only serve to help them by allowing for the possibility of earn more money.

The estimation results are found in Tables 8 and 9. Table 8 shows the ORB for those who changed their offers at least once. In the full model, self is found to be positive and significant at the 1% level for both the full population and for those who change their offers. This shows that if a person has a positive offer in the private rounds, they would still have a positive offer in the public rounds. Efficiency is also positive and significant at the 1% level. Thus, individuals have preferences to seeing that aggregate welfare is maximized in the drinking of the stigmatized water. These results are further confirmed by the individual ORB measure regressions. In each regression the coefficient on efficiency is positive and significant at the 1% level, excluding the full sample maximin regression where has a p-value of 0.013.

Maximin is negative in both populations for the full model and significant at the 5% level only in the model with only those who changed their public WTA. In the individual regressions, the coefficients are both positive, but not significant. This is evidence that maximin only applies directly to the sample that has only those who changed their public WTAs, and only when combined with other measures. The negative and significant sign is in the opposite direction than we would expect since participants should submit an offer that is higher with respect to the worst off person in the group, or the person with the highest stigma, in order to help them. However, since maximin is significant in this one case, this sign should not be worrisome.

FSSTRICT is positive and significant at the 1% level for both full model specifications. The sign on the coefficient is what the theory would predict. Given that an individual does not like differences in payoffs to exist, they must be compensated more to accept these payoffs. The sign remains the same in both of the measure regressions and is significant at the 1% level for those who exhibit ORB.

ERC is negative in both of the full models and significant at the 5% level in the total population sample. However, for both measure regressions the coefficient on ERC is positive, and in the changers sample, it is significant at the 1% level. This positive sign is what we would expect since ERC states that individuals do not like differences between themselves and the average payoff, so any difference would need to be compensated by receiving a higher payoff, yielding a higher offer.

The levels of significance change and the signs change on several of our coefficients between the full model and the individual measure regressions. This may be due to the fact that the correlation coefficients are high, especially between ERC and FSSTRICT which has a correlation of 0.9903 (Table 11). With larger correlation coefficients between the measures, it

becomes more difficult to disentangle the effects from each other. Thus, looking at the individual measure regressions becomes increasingly important. In examining the individuals who changed offers between the private and public rounds, we can see there is strong evidence supporting self, efficiency, ERC, and FSSTRICT with all being significant and of the correct sign.

To summarize, stigma was found to exist in the Cornell staff population. The amount of stigma present was slightly greater than that found in the student population; however, this difference was not significant. These results from the staff population continue to support the idea that stigma can be partially eliminated and the amount of stigma present changes as different segments of the population are examined.

5. Conclusion

It has been argued that stigma represents an over-reaction to risk. The policy challenge is one of finding ethically and politically acceptable ways to mitigate stigma when costly and unfortunate events occur. Given the increasing list of potentially stigmatizing events, research can provide industry and government with more tools and a better understanding of both stigma and strategies for mitigation. What is important to realize is that even after it has been determined that there is no more threat, the stigmatization can persist. Having a fundamental understanding of what helps reduce stigmatization can be useful in reducing public overreaction.

We have found in an experimental setting that stigma does indeed exist when monetary incentives are introduced. Individuals avoid drinking water they were previously drinking in order to avoid an unknown risk. Additionally, those who participate in this avoidance behavior can be categorized into certain groups: females, non-science majors, and freshman.

Additionally, this stigma can be mitigated by additional information and treatments of purification.

When examining the reaction of people in a voting setting to the realization that some people are made worse off by the stigmatized object, evidence of social preferences were observed. Individuals took into account both their own values for the water and the efficiency of the group in a positive and significant way. Participants also required more compensation for differences between their value and the value of other people in their group and for differences between their value and the average value of the group, supporting the theories of equity theories. Little evidence was found supporting the idea of maximizing the welfare of the worst off.

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Table 1: Private WTA Means – Students

Treatment	Mean WTA	Difference from SW	Difference from CW
SW	$1.82	---	---
CW	$7.28	$5.46***	---
FW	$3.33	$1.51**	-$3.95***

Notes: N = 42
Paired T-tests (one-tailed)
*** < 0.01 significance; ** < 0.05 significance; * <0.10 significance

Table 2: Private WTP Means – Students

Treatment	Mean WTP	Difference from SW	Difference from CW
SW	$1.42	---	---
CW	$4.59	$3.17***	---
FW	$2.17	$0.74	-$2.43***

Notes: N = 45
Paired T-tests (one-tailed)
*** < 0.01 significance; ** < 0.05 significance; * <0.10 significance

Table 3: Means Across Groups, WTA and WTP – Students

	Group	N	Private SW	Public SW	Private CW	Public CW	Private FW	Public FW
WTA								
	Everyone	42	$1.82	$7.28	$3.33	$1.49	$6.32	$2.94
	Males	22	$0.98	$4.17	$1.77	$0.98	$3.96	$1.84
	Females	20	$2.75	$10.70	$5.05	$2.05	$8.93	$4.15
	Science Majors	17	$0.06	$3.81	$1.26	$0.18	$3.59	$1.94
	Non-Science Majors	25	$3.02	$9.64	$4.74	$2.38	$8.18	$3.62
	Non-Freshmen	28	$1.39	$6.61	$3.29	$1.57	$5.48	$2.75
	Freshmen	14	$2.68	$8.63	$3.42	$1.32	$8.00	$3.32
WTP								
	Everyone	45	$1.42	$4.59	$2.17	$1.07	$3.49	$1.81
	Males	19	$1.58	$0.53	$0.79	$1.58	$0.26	$0.42
	Females	26	$1.31	$7.56	$3.17	$0.69	$5.84	$2.83
	Science Majors	8	$3.75	$7.00	$4.50	$3.75	$6.37	$3.62
	Non-Science Majors	37	$0.92	$4.07	$1.66	$0.49	$2.86	$1.42
	Non-Freshmen	22	$1.14	$3.99	$0.68	$0.45	$2.58	$0.48
	Freshmen	23	$1.70	$5.17	$3.59	$1.65	$4.35	$3.09

Table 4: Two-Limit Random Effects Tobit Results, Dependent Variable-Value WTA/WTP

CW	11.735***
	(1.344)
FW	4.881***
	(1.409)
WTP	-5.773***
	(1.400)
Private	1.346
	(1.035)
Female	15.805***
	(3.617)
Non-Science Majors	9.535***
	(3.621)
Freshman	12.915***
	(3.532)
*Freshman * Non-Science Majors*	-9.606***
	(3.149)
*Freshman * Female*	-3.578
	(2.773)
*Female * Non-Science Majors*	-6.264*
	(3.507)
Constant	-18.856***
	(3.873)

Notes: Observations = 261
Standard errors in parentheses
***<0.01 significance; ** <0.05 significance; * <0.10 significance

Table 5: Private WTA Means - Staff

Treatment	Mean WTA	Difference from SW	Difference from CW
SW	$3.41		
CW	$7.55	$4.14***	
FW	$5.15	$1.74***	-$2.40***

Notes: N = 71
Paired T-tests (one-tailed)
*** < 0.01 significance; ** < 0.05 significance; * <0.10 significance

Table 6: Private WTA Means – Students and Staff

Treatment	Mean WTA Staff	Mean WTA Students	Difference Between Groups
SW	$3.41	$1.82	$1.59*
CW	$7.55	$7.28	$0.27
FW	$5.15	$3.33	$1.82*

Notes: N = 42 for students, N = 71 for staff
T-tests (assuming unequal variances);
*** < 0.01 significance; ** < 0.05 significance; * <0.10 significance

Table 7: Means Across Groups, Staff

Group	N	Private SW	Private CW	Private FW
Everyone	71	$3.41	$7.55	$5.15
Males	15	$1.00	$2.04	$1.37
Females	56	$4.05	$9.03	$6.16
Have Never Used an Autoclave	51	$3.65	$7.75	$5.54
Have Used an Autoclave	19	$1.37	$5.84	$2.79
Do Not Go Camping Frequently	50	$3.82	$8.59	$5.58
Go Camping Frequently	20	$1.05	$3.83	$2.83

Table 8: Two-Limit Random Effects Tobit Results, Dependent Variable-Value Offered by Participants who Changed their Private Offer at Least Once

		Efficiency Plus Alternative Equity Measures		
	Full Model	Charness & Rabin	Fehr & Schmidt	ERC – Bolton & Ockenfels
Self (Private CW Offer)	.7460***	.6669***	.6315***	.64052***
	(.0977)	(.0962)	(.0884)	(.0893)
Efficiency	.5067***	.1256**	.2232***	.2222***
	(.1262)	(.0536)	(.0445)	(.0451)
Maximin	-.7144**	.1833		
	(.2863)	(.1117)		
FSSTRICT	1.7057***		.2792***	
	(.5836)		(.0986)	
ERC	-1.6860*			.5038***
	(.9623)			(.1961)
Constant	-2.5361	-1.9411	-2.7147*	-2.3723
	(1.5803)	(1.6285)	(1.5996)	(1.5723)

Notes: Observations = 140
Standard errors in parentheses
*** < 0.01 significance; ** < 0.05 significance; * <0.10 significance

Table 9: Two-Limit Random Effects Tobit Results, Dependent Variable-Value Offered by the Full Sample

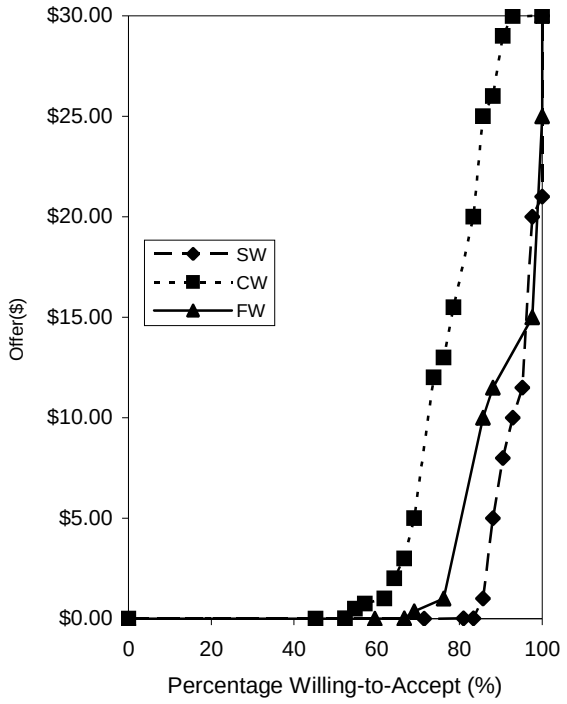
		Efficiency Plus Alternative Equity Measures		
	Full Model	Charness & Rabin	Fehr & Schmidt	ERC – Bolton & Ockenfels
Self (Private CW Offer)	1.1006***	1.0660***	1.0552***	1.0664***
	(.0753)	(.0729)	(.0675)	(.0681)
Efficiency	.1898***	.1079**	.1228***	.1224***
	(.0662)	(.0433)	(.0324)	(.0328)
Maximin	-.2119	.0354		
	(.1599)	(.0805)		
FSSTRICT	1.0582***		.0678	
	(.4063)		(.0702)	
ERC	-1.6898**			.0803
	(.7237)			(.1401)
Constant	-5.3881***	-5.4144***	-5.6325***	-5.4336***
	(1.1329)	(1.1413)	(1.1056)	(1.0937)

Notes: Observations = 284
Standard errors in parentheses
*** < 0.01 significance; ** < 0.05 significance; * <0.10 significance

Table 10: Correlation Matrix of the Dependent Variables

	Self	*Efficiency*	*Maximin*	*FSSTRICT*	*ERC*
Self	1.0000				
Efficiency	0.1439	1.0000			
Maximin	0.5226	0.6885	1.0000		
FSSTRICT	0.4746	0.2036	0.7710	1.0000	
ERC	0.4678	0.1867	0.7492	0.9903	1.0000

Figures 1 and 2: Private WTA Offers and WTP Bids



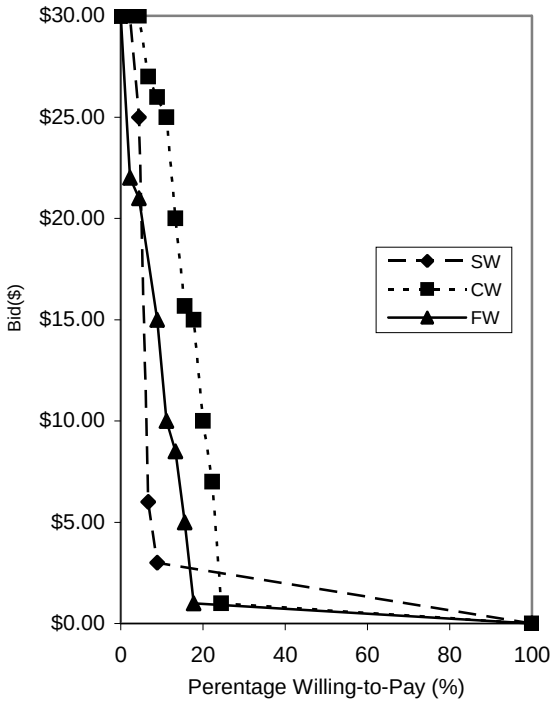


Figure 3: Average Private WTA and WTP

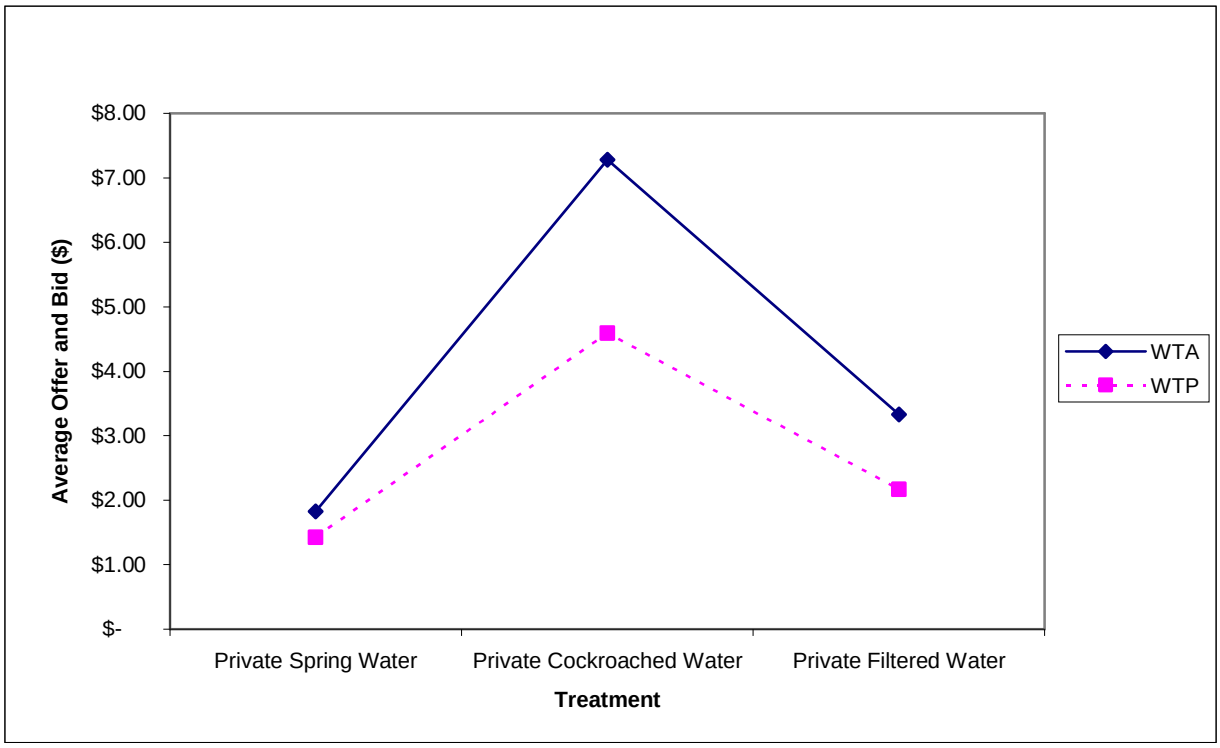


Figure 4: Average Public WTA and WTP

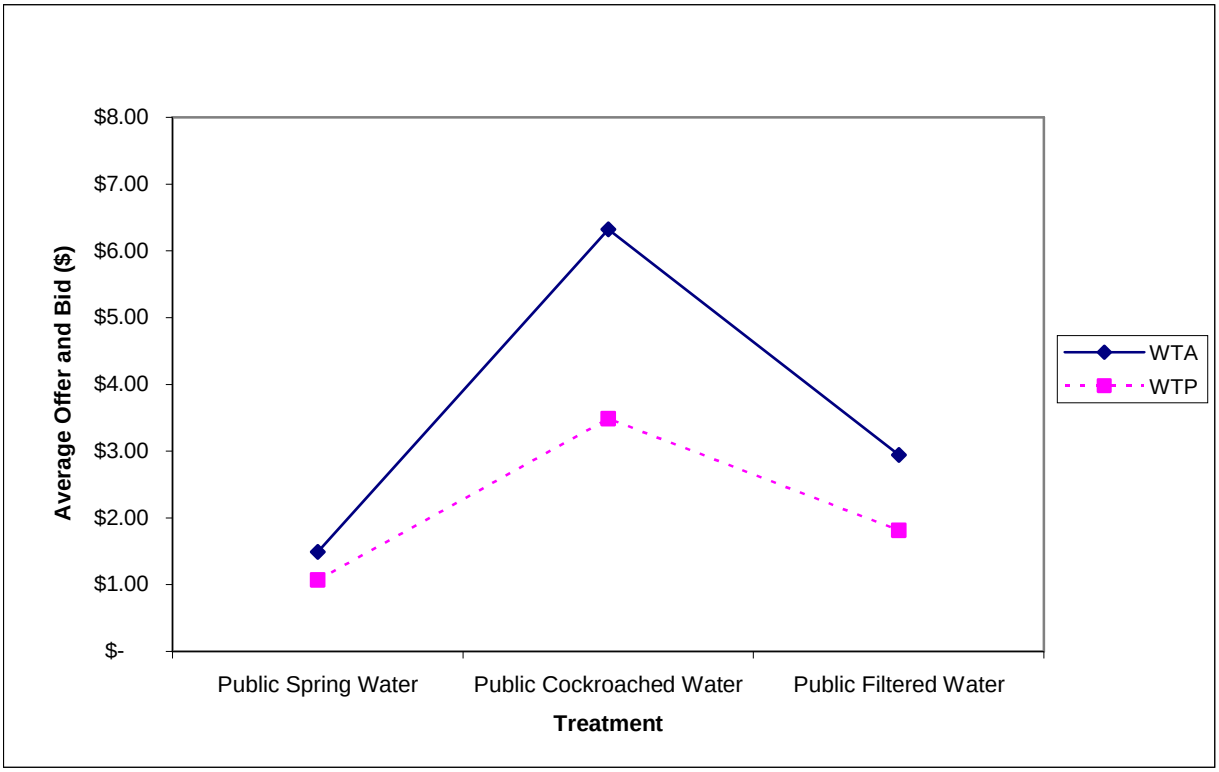


Figure 5: Average WTA

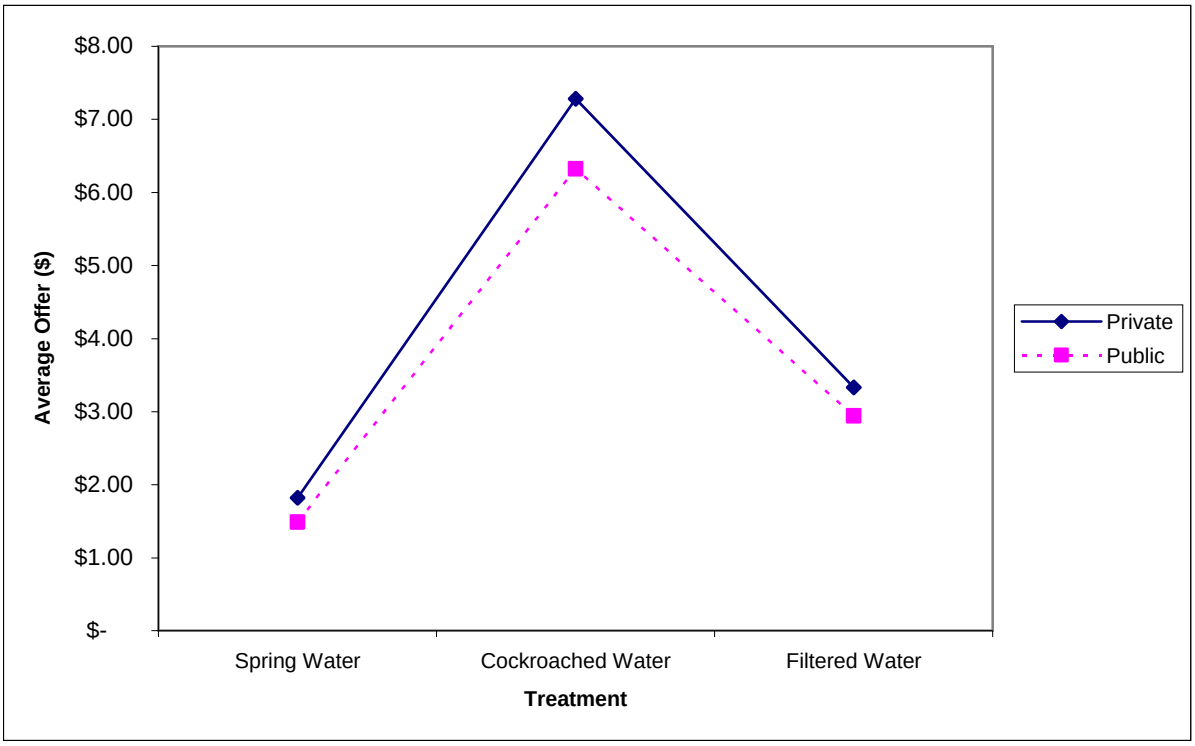


Figure 6: Average WTP

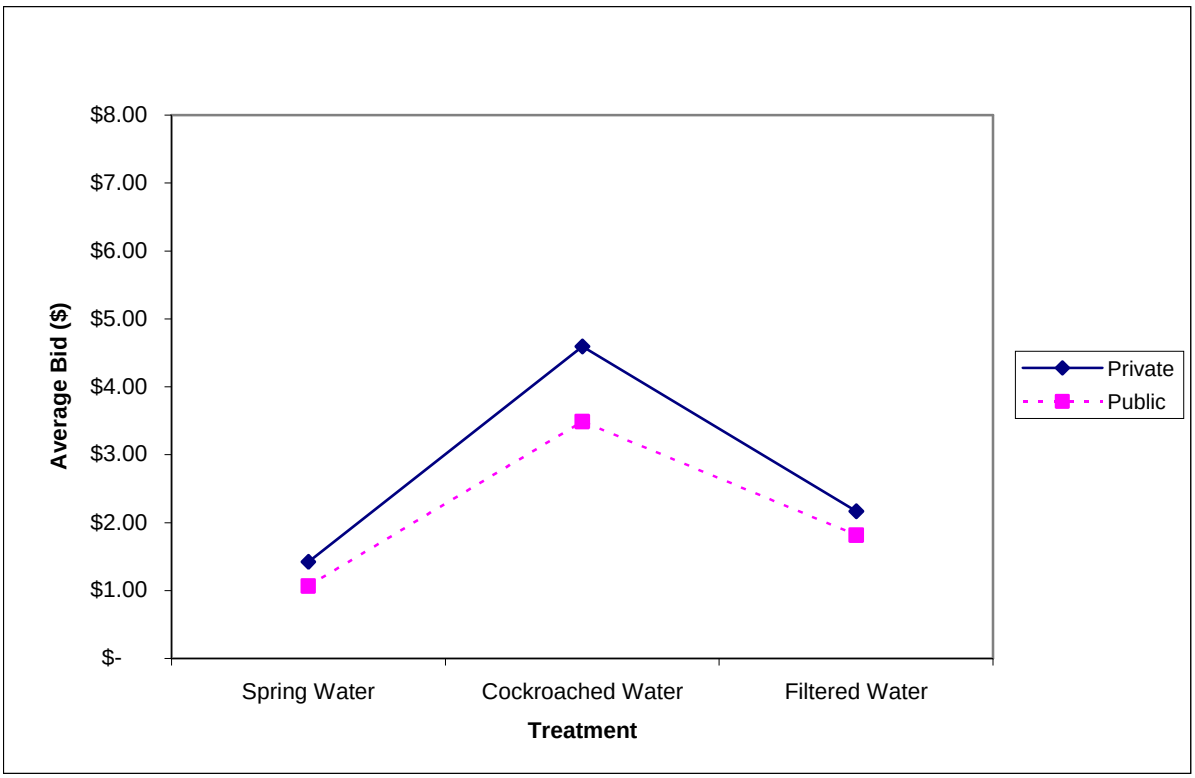


Figure 7: Average Private WTA and WTP from Students and Staff