THE IMPACT OF HETEROGENEOUS CONSUMER RESPONSE ON WATER CONSERVATION GOALS

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ABSTRACT

The goals of this research were to 1) identify statistically significant, observable consumer characteristics that are factors of demand for water, 2) econometrically model water demand incorporating these characteristics into the model, which allows us to segment consumer groups, and 3) design a conservation incentive program that allows individuals to choose their own best conservation alternative while, in aggregate, achieving the conservation program goals. We employed an experimental game that simulates water consumption from a potentially exhaustible source. Experiment participants included students at the University of New Mexico and members of communities in New Mexico. We found heterogeneous demand for water, including differences between student and community participants and between those who are employed and those who are retired. Consumption is a function of a variety of social and cultural factors including age, gender, ethnicity, political affiliation, religious affiliation, and risk preferences. Policy based on demand estimates that assume homogenous consumers is not efficient. By disaggregating demand, we show that a menu of price systems can achieve conservation goals with less loss of consumer welfare than can alternative policies. These systems provide each consumer an incentive to choose the one that is most beneficial given his or her unique demand, minimizing enforcement costs.

Keywords: demand estimation, conservation methods, experimental methods

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INTRODUCTION

It has long been recognized that water is one of the most critical resources in the Southwest. To assure an adequate supply of water, conservation programs (such as summer surcharges on usage) are being implemented in many locations to varying degrees of success. However, a variety of programs may be necessary in order to appeal to a wide cross-section of consumers (see for example, Gegax *et al.*1998). For such programs to be effective, it is essential to be able to forecast accurately consumer response to different programs. Accurate forecasts require accurate consumer demand models that account for differences across consumer groups. It may be cost prohibitive to alter a conservation program once it is in place. By designing the program with consumer demand models incorporated into the design, the initial programs may be more effective and efficient. Further, modeling consumer demand and response to change (e.g., institutional, pricing, or conservation measures) allows us to design more efficient conservation and pricing policies.

The goals of this research were to 1) identify statistically significant consumer characteristics that are factors of demand for water, 2) econometrically model water demand incorporating these characteristics into the model, which allows us to segment consumer groups, and 3) design a conservation incentive program that allows individuals to choose their own best conservation alternative while, in aggregate, achieving the conservation program goals. If differences across consumer groups are not recognized and incorporated into program designs, the effectiveness of conservation programs may be severely impaired by the implied assumption of homogeneity across consumer groups.

The difficulty, historically, in empirically modeling consumer demand is lack of adequate data at the level of a single consumer or a household. There are four potential sources for data: historical, survey, pilot program, or experimental. Accurate historical data, sufficiently rich to disaggregate consumer groups, are not available. While surveys and pilot programs have been popular methodologies for gauging consumer response, there are potential problems associated with each method. While surveys give some insight, the responses are purely hypothetical in that a respondent is not required to change his or her actions, nor does the respondent's answer actually result in any welfare changes to the respondent. Pilot programs are time intensive and only gauge response to a specific scenario. In this research, we employ an experimental game that is specific to water consumption from a potentially exhaustible source. Not only does the use of an experimental game allow us to alter the scenario being tested, it also reduces the potential of hypothetical response since participants are rewarded based on the choices they make during the experiment. Participants were asked to make consumption choices over a series of rounds. Vitality of the resource, current consumption, and future consumption potential were determined by the summation of choices of individual participants. These response data were combined with personal characteristic data obtained by a survey instrument, to complete the data set. These data were used to estimate water demand econometrically.

A total of 114 subjects participated in a series of six experiments. Forty-two of the participants were students at the University of New Mexico, while seventy-two of the participants were members of communities from various areas in New Mexico. Our results indicate that, indeed, there is heterogeneous demand for water. We find consumption differences between student and community participants. Furthermore, there are consumption differences between members of the community who identify themselves as part of the active workforce and those who identify themselves as retired. Specifically, we find that while consumption levels are a function of price, consumption levels are also impacted by a variety of social and cultural factors. Among these are age, gender, ethnicity, political affiliation, religious affiliation, and risk preferences. While all of these factors are not significant characteristics across all three groups (students, workforce, or retiree), they are significant in at least one of the three groups.

We begin by presenting pertinent background to the research, and then describe the theoretic basis for the research. In subsequent sections we discuss the experimental and survey instruments employed in the research, the data, and the econometric results. Given these results, we estimate disaggregated demand functions and then incorporate these functions into a non-linear pricing menu. We conclude by offering directions for future work.

BACKGROUND

The relevant background for this research spans the extant research specific to empirical estimation of water demand, experimental research that focuses on common-pool resources, as well as the research that focuses on heterogeneous demand.

EMPIRICAL WATER DEMAND

To provide adequate policy analysis and determine the potential impact of conservation programs, it is necessary to have an in-depth understanding of consumer demand for water. Many empirical studies can be found in the literature that focus on demand for water and the own price elasticity of water. Much of the early work employed aggregated, cross-sectional data and did not consider household specific data. Williams (1985) observes that "Data on average revenue price and typical monthly water bills are the usual type of price information available… prevailing practice has been to select a crude measure of price from this for a typical customer." Danielson (1979) made a case for the use of individual household data, but the norm of the studies, in large part, continued to be at a highly aggregated level.[1] The studies can be categorized in a variety of fashions, including; chronological, location of study, estimation technique, or pricing structure in effect. We present a chronological overview. It is by no means an exhaustive review of the literature, but rather is representative of the research and the results found in the extant literature.

Among the earlier research is that of Howe and Lineaweaver (1967). Utilizing a cross-sectional data set with a block rate structure, they employed a logarithmic functional form and separate demand by in-house demand and sprinkling demand. The price factor used in the analysis was a calculated marginal price. Their results indicate sprinkling demand was price elastic (-1.57), while in-house demand was price inelastic (-0.23).[2]

Increased interest in the effect of block rate structures on demand (where price depends on the quantity purchased), resulted in the consideration of different estimations. For example, see Taylor (1975), Nordin (1976), or Billings and Agathe (1980). Given the concerns, Howe (1982) re-estimated demand with the original data, but with a linear specification that accounted for intra-marginal difference in the rate structure. This necessitated separating demand by winter

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[1] This is, perhaps, a reflection of the data available, rather than the desire to aggregate.
[2] In most cases, the elasticities are estimated for the mean values of the data.

and summer use rather than indoor and outdoor use. The elasticity levels fell dramatically under this specification. For winter use, elasticity was estimated to be –0.06. For summer use, elasticities were separated by East and West and were, respectively, -0.57 and –0.43. These results suggest that while there is a difference between summer and winter responsiveness, consumers (in both cases) are relatively unresponsive to price changes. Additional studies with similar estimation techniques and results include Foster and Beattie (1981), Polzon (1984), and Jones and Morris (1984).

Williams (1985) measures responsiveness for urban water under alternative measures of price. He also explores the statistical properties of the estimated demand functions, in large part, with regard to mis-specification bias. His results suggest that marginal price estimates are more reliable than results based on average revenues. Further, he finds that while demand is price inelastic, arid Western regions are significantly more sensitive to price variations than are the more humid sections of the country.

More recent studies include Nieswiadomy and Molina (1989), Nieswiadomy (1992), Lyman (1992), Hewitt and Hanemann (1995), and Renwick and Archibald (1998), and Renwick and Green (2000). Nieswiadomy and Molina compare different econometric estimation techniques in estimating demand under both decreasing and increasing block rate structures. Using a Hausman specification test (1978) they show that the estimates obtained with an Ordinary Least Squares estimation (OLS) are biased, due to simultaneity between the average price, quantity and difference variables. They reduce the bias by estimating demand with two-stage-least-squares and with another instrumental variable approach suggested by Tezra (1986). Elasticity estimates from this study range between –0.36 and –0.86. The authors note their results are within the range of estimates found in the literature.

Nieswiadomy (1992) estimates urban water demand in the U.S. using data from 430 large U.S. utilities. He also incorporates the impact of conservation programs and education in the estimations. He tests consumer response to average prices and marginal prices. He finds the West has the greatest awareness of water scarcity and, thus, the largest elasticities. However, the elasticities are still in the inelastic range: -0.42 for the marginal price estimation, and –0.51 for the average price estimation. From this, it follows that consumers respond more to average prices than to marginal prices. Of further note is that his findings suggest education is a significant factor in reducing water usage in the West.

Lyman (1992) employs a micro-data set to estimate water demand. He allows for elasticity differences between peak (summer) and off-peak (winter) periods, household characteristics, and an adjustment mechanism for price changes. He uses a marginal cost specification and finds, among other effects, that peak demand is elastic and off-peak demand is inelastic (-2.019 versus –0.429). As would be expected, long-run elasticities had larger absolute magnitudes than their short-run counterparts. Furthermore, his results suggest a lagged specification for price is more appropriate than a current price specification. He also finds some evidence of cross-price effects between peak and off-peak periods suggesting either substitution or complementarity of water between time periods.

Hewitt and Hanemann (1995) utilize the same increasing block rate structure data that was used by Nieswiadomy and Molina (1989). However, they employ a discrete/continuous (D/C) choice model to estimate demand. They employ this model to respond to a critique of the literature that consumers do not make conscious economic decisions when they turn on the tap, and thus the price elasticity of water must be near zero. The D/C model allows for both economic and non-economic factors. The model includes not only price and income data, but also socio-demographic variables. Hewitt and Hanemann estimate elasticity between –1.57 and –1.63. These measures are substantially larger than the findings in the rest of the literature.

Renwick and Archibald (1998) focus on demand side management for water. A main hypothesis they test is that the reduction in aggregate demand attributable to a specific policy instrument is a function of the socio-economic and structural characteristics of households in a given community. They find that, indeed, reduction in demand associated with different policy instruments varies significantly with the characteristics of the households in the policy region. They observe the importance of conducting analysis of residential demand at the level of the single household. While their results indicate urban water demand is inelastic, they find price responsiveness varies by income level. Lower income households were more price responsive.

Study results are varied. What, if anything can be gleaned from them? Obviously employing the appropriate econometric estimation techniques is important. Model specification is also important. Water demand appears to be heterogeneous and has been shown to be a factor of income and of time-of-use.[3] In addition, it can be argued that the water prices employed in many

[3]Espey, *et al*. (1997) conducted a meta-analysis using the results from 24 previous journal articles. They found the price elasticities from these studies ranged from –0.02 to –3.33, with an average of –0.51. About 75% of the

of these studies may not reflect the true cost of water. Traditional pricing covers only the delivery cost and does not reflect a scarcity value of water. Therefore, these estimates may be inadequate for predicting demand in the future, when water is forecast to be even more scarce in the arid Southwest.

COMMON-POOL RESOURCE PROBLEMS

Residential water resources can be equated to a common pool resource (CPR). A CPR, defined by Ostrom *et al*. (1994), is a resource where exclusion is nontrivial, but not necessarily impossible. Individual rational resource users may ignore the external harm they impose on other users, resulting in a sub-optimal outcome from society's perspective. The individual rationality can result in non-sustainability of the resource. Thus, CPR extraction affects intra- and intergenerational distributional equity. In the case of residential water resources, this can result in both intra- and inter-generational concerns. In the case of Albuquerque, NM, current residential use from the underground aquifer has implications for the current population of Albuquerque as well as for future residents of the city.

The most familiar CPR problem in the literature is the conflict between producers' immediate own gain from exploitation and the costs that exploitation imposes on other concurrent users, as

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estimates were between –0.02 and –0.75. Espey *et al*. tested the hypothesis that the variations in results were due to the demand specification (including functional form), data characteristics, environmental characteristics, and the econometric estimation technique employed. They find elasticity estimates are influenced by evapotranspiration rates, rainfall, season, and pricing structure. The conclusion that can be drawn from their study that in addition to demographic and economic data included in other studies, more climate variables could be beneficial in future analysis. The study does not find demographic factors to be significant, but the authors conclude that such characteristics may influence water demand. However, they did not affect price elasticity for *the studies we examined* (italics added for emphasis). Many of the recent studies that find demographics to be significant are not included in the Espey *et al*. study.

well as own future exploitation.[4] Johnson and Libecap (1982) describe an individual fisherman who has a private incentive to extract more fish than would be socially optimal, reducing his own future catch as well as that of his fellow fishermen. Offsetting this is the incentive for firms to under-extract to maintain higher output prices and thus profits. Experiments have tested the willingness of participants to reduce investment in CPR-exploiting industries. For example, in Mason and Phillips (1997), some participants established voluntary rules that generated sustainable yields. Multiple-period theoretical models and experiments capture behavior when benefits and costs of extraction affect current and future welfare (e.g., Karp 1992, Mason and Polasky 1997, Herr *et al*. 1997, and Gardner *et al*. 1997).

For many environmental resources, however, the activities that threaten the CPR are not the productive practices of a small industry group facing a common time horizon, but the consumption practices of an unorganized and varying population, such as the case of water consumption. Many water resources problems might be avoided if changes in individual consumption patterns occur. For this to happen, understanding those patterns is vital. Chermak and Krause (forthcoming) explore this type of problem and the impact of heterogeneity on the consumption of a common-pool, generic resource. They employ a multiple-round, overlapping generations experiment to ascertain the impact of heterogeneous response on the consumption of the resource. They found heterogeneity in the response of their subjects, all of whom were University of New Mexico undergraduates. The heterogeneity, however, could not in all cases guard against the impacts of over-consumption by a sub-set of the subjects. They found the heterogeneity in consumption was statistically correlated to several observable factors, such as political affiliation. They also found information impacted consumption choices. They

[4] For more background on CPR problems see, for example, Ostrom *et al*. (1994).

found that subjects who knew exactly to which generation they belonged tended to adapt more to prior-round draws, and relied less on a pre-determined strategy.

HETEROGENEOUS DEMAND

Consumer theory shows demand is a function of, among other things, income, tastes and preferences, and expectations. While income is readily observable, consumer tastes and preferences are generally not. It may be especially difficult to observe an individual's preferences when the good involved is an environmental good (such as water when scarcity is explicit), the consumption of which may result in externalities for current or future generations. An individual's tastes and preferences combined with his or her expectations of the future may result in a specific consumption strategy. For example, one strategy would be to consume a quantity perceived as my "fair share." While strategies are not directly observable (especially ex ante), readily observable characteristics may be correlated to observed patterns of use that suggest use of specific strategies. We identify observable characteristics from the extent literature that may be correlated to consumption choices. The significance of these characteristics in consumption choices is then tested econometrically. There is a growing literature concerned with the correlation between observable characteristics and behavior. We draw on this literature in choosing the social, economic, and cultural variables that we test; specifically, age, religion, culture, and gender.

The importance of age in decision-making is analyzed in the literature. For example, Rogers (1994) explores the importance of human time preference. Relatively high discounting of the future among young adults enhances reproductive success, and so is evolutionarily stable. Given this, we would expect to see young adults consuming more in the current time period (rather than saving for the future) relative to older individuals.

Religion and economics were discussed by Smith (1776) when he argued that clergy, just like secular individuals, are motivated by self-interest. More recent economic studies of religion (e.g., Iannaccone, 1998, or Stark *et al*., 1996) argue that religious activities involve a large amount of risk since the promised rewards may never materialize. Religious affiliation, then, may be correlated with risk preferences. In addition, religious affiliation may be correlated with preferences for environmental goods. Lowry (1998) found religious affiliation is correlated with demand for membership in environmental groups. Specifically, he found demand for environmental groups is inversely related to membership in many mainstream Christian religions.

There is support in the extant literature that cultural differences may affect economic outcomes. Roth *et al.* (1991) conducted an ultimatum game and a one-period market game in Israel, Japan, the U.S., and Yugoslavia. They found that while behavior in all of the market sessions converged to the equilibrium, behavior in the bargaining sessions did not converge. Furthermore, there were distinct differences in outcomes across the subject pools. The data support the hypothesis that the subject pool differences were related to different expectations as to what constitutes a fair offer. They tentatively concluded that the differences in bargaining behavior were attributable to cultural differences.

The results are mixed in the fairly large experimental literature concerning economic decisions and gender. Brown-Kruse and Hummels (1993) find more cooperation in all-male groups, while Nowell and Tinkler (1993) and Eckel and Grossman (1996) find more cooperation in all-female groups. Andreoni and Vesterlund (1999) find conditions under which men are more cooperative and under which women are more cooperative in the same experimental investigation. Furthermore, there is evidence that gender differences, if any, are sensitive to experimental protocol variations. Mason *et al.* (1991) find that initial differences disappear with repetition. Finally, gender differences in attitudes towards risk (see Jianakoplos and Bernasek, 1998, and Eckel *et al*., 1997) may confound identification of gender effects in other behaviors.

THEORETIC CONSIDERATIONS

Consider the i^{th} consumer who consumes water from a finite stock. The future stock of water depends not only on the beginning stock, but also on the aggregate consumption of the good in the current time period. The consumer's utility is derived from consumption of water and (potentially) from the conservation.[5] The consumer's maximization problem is then defined by a dynamic game:

$$\max_{q(t),\mathbf{x}(\mathbf{t})} \int_{t_1}^{t_2} [U_i(q_i(t), \mathbf{x}_i(t), R(t); \mathbf{B}_i)]dt$$

$$s.t. \quad \mathbf{p}(t)\mathbf{x}_i(t) + p(t)\,q(t) \le y_i$$

$$\dot{R} = f\left(\sum_{i=1}^{N} q_i, a\left(\sum_{i=1}^{N} q_i\right)\right), R(0) = \overline{R}, R(t) \ge 0,$$

[5] Utility derived from conservation arises from two sources. If conservation today results in greater own consumption possibilities in the future, then conservation could be strategic. However, if conservation were solely to benefit others, the conservation effort would be altruistic in nature.

where: (dropping the time notion, t, for simplicity) q is the quantity of water consumed, **x** is a bundle of all other goods, while p is the price of water and **p** is a vector of prices for the vector **x.** R is the stock of available water, $\mathbf{B}_i$ is a vector of the personal characteristics of the i^{th} consumer, and y is the i^{th} consumer's available budget. The resource stock constrains utility over the life of the consumer (from t_1 to t_2). Furthermore, R is affected by the aggregate consumption, $\sum_{j=1}^{J} q_j$ (where $i \in J$ and $j = 1, ..., J$), of all consumers and the growth or depletion of R, which is itself a function of aggregate past consumption, $a(\sum_{j=1}^{J} q_j)$.

We assume utility is concave in consumption for player i. That is;

$$\frac{\partial U_i}{\partial q_i} > 0, \qquad \frac{\partial^2 U_i}{\partial q_i^2} < 0.$$

Utility may be increasing or decreasing in stock. That is;

$$\frac{\partial U_k}{\partial R} > 0 \quad \text{for } k = 1,2,....,m \quad m < N,$$
$$\frac{\partial U_k}{\partial R} < 0 \quad \text{for } k = m+1,....,N \quad \text{, and}$$
$$\frac{\partial^2 U_k}{\partial R^2} < 0.$$

This implies the "m" type player may gain utility from increasing stock, either from expected own future consumption (strategic consumption), or from future consumption by others (altruism). At this level of generality, strategic consumption and altruism are not separated. The "m +1" type player does not derive increased current utility from an increase in stock available in the next time period.

A consumer's demand for q at any time t can be estimated as:

$$q_i = f(p, \mathbf{p}, m_i, R; \mathbf{B}_i).$$

We assume a normal good, thus q_p<0 and q_y>0. The sign of the partial derivative with respect to other goods depends on if they are gross complements, substitutes or unrelated. That is, $q_{P_z} \overset{>}{\underset{<}{-}} 0$, where z refers to the specific good. The sign on the partial with respect to stock, q_R, depends on whether utility or disutility is derived from an increase in the remaining stock. The consumption strategy can be positively, inversely or not related to the quantity demanded, $q_S \overset{>}{\underset{<}{-}} 0$. The final consideration is the effect of personal characteristics on demand. That is,

$$q_{\mathbf{B}_n} = \frac{\partial f}{\partial \mathbf{B}_n} \overset{>}{\underset{<}{-}} 0 \quad (n = 1, \ldots, N),$$

where n is a specific characteristic in the vector. The estimation of disaggregate demand functions requires personal characteristics to be included in the model. To obtain a data set sufficiently rich in detail on individual characteristics, we employed an experimental protocol and survey design. The data set allows us to statistically test the significance of individual characteristics and disaggregate demand, for our sample, into individual demand groups.

EXPERIMENTAL PROTOCOL

A difficulty in estimating disaggregate demand functions is the lack of adequately detailed data. To collect a detailed data set, we employed an experimental design, supplemented by a survey to collect demographic information, and a risk game to ascertain participants risk preferences. Combining these data mechanisms allowed us to obtain a data set that is rich in demographic detail and one that includes responses that are not hypothetical in nature since a subject's payoff depends on the choices made during the game.

The experimental design simulated consumption of a water resource from a depletable common pool over a trial lasting T rounds. The water resource growth (or depletion) is described by:

$$Q(t)\begin{cases} < R(t), \text{ then } R(t+1) = R(0) + a\,(R(t) - \underline{R} - Q(t)), \\ \geq R(t), \text{ then } R(t+1) = 0. \end{cases}$$

Where $Q(t) = \sum_{i=1}^{N} q_i(t)$, and $Q(t)$ is the aggregate consumption of water in time t and $q_i(t)$ is player i's water consumption in t. $\underline{R}$ is the minimum level of the water resource that must be preserved in order to maintain at least a stock equal to the beginning stock, $R(0)$. This allows the stock to grow, maintain, decline, or deplete, depending on the cumulative extraction of the active players. If cumulative consumption, $Q(t)$, is less than $(R(t) - \underline{R})$, the stock at t+1 increases; if $Q(t) = (R(t) - \underline{R})$ the stock is maintained at $R(0)$; if $(R(t) - \underline{R}) < Q(t) < R(t)$, the stock in t+1 declines. If $Q(t) \geq R(t)$, the stock is depleted and the game ends.[6]

While some aspects of water consumption may be modeled like any other privately consumed commodity, we were particularly interested in water consumption under conditions of explicit scarcity. We were also interested in investigating individual consumption decisions in an environment in which those decisions affected the group stock. The growth (or decay) of the stock was an important feature of the experiment design. The monetary payoff to participation was strongly influenced by the effects of individual consumption on the group's stock, and all

[6] This design is appropriate for either an underground aquifer or for surface water with storage capabilities. In the case of Albuquerque, while the current water source is from the aquifer, this will change in the near future when the City completes plans to begin drawing on their San Juan-Chama water rights.

participants were aware of this aspect of the experiment design. Thus, the consumption decisions observed in these experiments may be more analogous to consumption decisions that affect a large change in water use (for example, changing a yard from lawn to native plants) rather than small water-use decisions (for example, shortening showering time). These results can also be interpreted as being analogous to water decisions when it is well known that water is scarce, such as periods of water rationing during dry summers.

The number of players drawing from the pool varied across rounds, and each player could draw in only a subset of consecutive rounds. This aspect of the experiment was designed to capture the real-world situation in which populations vary with time or with individuals moving in and out of the population. All active players' consumption choices contributed to the total exploitation of the water resource.

Each experimental set consisted of five rounds, T=5, and each group consisted of three players. Each of these players was active in three consecutive rounds, which were unique to the player. Therefore, Player 1 (P1) was active in rounds 1, 2, and 3; Player 2 (P2) was active in rounds 2, 3, and 4; and Player 3 (P3) was active in rounds 3, 4, and 5. Participants knew that each set consisted of five rounds. The number of sets was not pre-announced. Participants were told their person-type prior to the beginning of play for each set. They also knew they were randomly assigned to groups of three and that the groups were randomly reconstituted at the start of each new trial. They did not know the identity of the other two players in their group.[7]

[7] An example of the experimental protocol is included in Appendix A.

The initial endowment at the beginning of each set was ten units. That is $R(0)=10$. If the supply of the resource, after withdrawal by active members, remained above the pre-announced critical level of two units $(\underline{R}=2)$, the stock "reproduced" and another round was played. The growth (or decay) factor, a, was set equal to three in five of the experiments and was set equal to four in one experiment.[8]

The primary task for each participant in the experiments was to choose a consumption (or withdrawal) level, given the available information. Participants knew their earnings from the experiments would be a positive multiple of resource successfully drawn in two randomly selected trials.

A total of six experiments were conducted. Experiments One, Two, and Three employed undergraduate college students from the University of New Mexico (UNM) as participants. Experiments Four, Five, and Six employed community members from several areas of New Mexico as participants. The three experiments with student participants were conducted on three separate days, while the community participant experiments were conducted on three separate evenings. All experimental sessions took place in rooms located in the Economics Department at the University of New Mexico Main Campus. Experiments One, Two, and Three employed 15, 9, and 18 subjects, respectively. Experiments Four, Five, and Six each employed 24 subjects. No participants participated in more than one experiment. Community participation was obtained by response to an advertisement in the Albuquerque Journal Business Section and the student participants were recruited from various UNM classes.

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[8] The growth factor was employed to ascertain an implied price of water where $P_t = a/N_{t+1}$, where N is the number of active players. In t=5, the price of water was assumed equal to one (1), since there was no round 6.

Given the opportunity costs of community participants and student participants are, in most cases, very different, the payoffs for the student and community participants were vastly different. Community participants were guaranteed a minimum payment of $25.00 to cover the time and effort required to travel to campus and participate in the experiment. To attract a larger subject pool, participants were told that they could earn up to $100, depending on their play of the game. Student participants were guaranteed a minimum payoff of $5.00. The maximum student payment was $50. The average payment to community participants was approximately $63.40. The average student payment was approximately $19.40. The only time participants were paid the minimum payment was when the number of participants was not an even multiple of three. In these cases, participants who volunteered to not play were paid the minimum.

In addition to providing experimental data, each participant completed a survey that asked for information concerning age, ethnicity, economic status, political and religious affiliation, schooling, and living arrangements.[9] Lastly, each subject participated in a probability game, which allowed us to classify subjects according to relative risk preference.[10]

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[9] A sample of the survey form is included in Appendix B.

[10] The participants were asked to make a series of nine choices between Alternative A and Alternative B. They were informed that they would be paid on only one of the choices. The choice would be determined by the random draw of a bingo ball. The potential pay-off for each individual choice depended on which of ten bingo balls was chosen. Alternative A always paid $2.50, regardless of the ball chosen. Alternative B paid $5.00 if one of a specified number of balls was chosen, and paid $0.00 if any other ball was chosen. The probability of one of the $5.00 pay-off bingo balls being drawn was 10% in Choice One and increased by 10% for each choice thereafter.

DATA

The data gathered from the experiments and the surveys are included in the following tables and are reported by type. First the survey and risk preference data are presented, followed by the experimental game data.

SURVEY DATA

Table 1 presents the quantitative demographic data. The table presents summary statistics for the entire subject pool. It also presents the data broken out for the student and community sub-groups.

TABLE 1: PERSONAL CHARACTERISTICS

CHARACTERISTIC	MEAN	S.D.	MIN.	MAX	N[11]
AGE (years)	41.86	20.65	17.33	83.70	111
Students	20.42	1.98	17.33	26.30	39
Community	53.48	16.41	21.60	83.70	72
BUDGET ($/month)	1407.10	1043.36	0.00	5000.00	105
Student	590.81	460.72	0.00	2100.00	37
Community	1851.24	1003.76	100.00	5000.00	68
SCHOOLING (years)	14.38	2.33	9.00	25.00	114
Students	13.64	0.94	12.50	16.00	42
Community	14.818	2.76	9.00	25.00	72

The average age of participants was almost 42 years. The youngest participant was slightly over 17 years of age, while the most mature participant was almost 84 years old. Based on an ANOVA test, there is (as might be expected) a statistical difference between the ages of the student and the community participants. Monthly budgets varied from $0.00 to $5000.00, with an average of $1407.10. Again, as would be expected there is a statistical difference between the

[11] While a total of 114 subjects participated in the experiments, some participants elected to not divulge some information. In these cases the total sample size was less than 114.

average budget of the student and the community participant. The average number of years of schooling for a participant was 14.8. The minimum years of school were nine, the maximum 25. These were not statistically different across groups.

Personal characteristics that are included in the econometric analysis include ethnic background, political affiliation, religious affiliation, and risk preferences. These data are summarized in the following tables. As with Table 1, statistics are presented for the entire sample as well as for the student and community sub-samples. In the following tables, a category of "Did Not Report" is included where appropriate. Table 2 presents participants racial backgrounds. These statistics can be compared to those for Bernalillo County, New Mexico. The US Census Bureau (1998) reports approximately 52% of county residents are White, 38% Hispanic, and 3.7% Black. The remaining 6% of the population is dispersed between several ethnic groups.[12]

TABLE 2: ETHNIC BACKGROUND

RACIAL BACKGROUND	PERCENTAGE	N
WHITE	56%	64
Student	52%	22
Community	58%	42
HISPANIC	27%	31
Student	21%	9
Community	31%	22
BLACK	2%	2
Student	0%	0
Community	3%	2
OTHER	9%	11
Student	14%	6
Community	7%	5
DID NOT REPORT RACE	5%	6
Student	12%	5
Community	1%	1

[12] The ethnic backgrounds include American Indian, Eskimo, or Aleut, Asian and Pacific Islander.

Table 3 presents the political data. When considering the total sample, 26% of participants classified themselves as Democrats, while 25% classified themselves as Republicans. The breakdown between the sub-categories is very consistent with 17% of the students identifying themselves as a Democrat and 17% as a Republican. The community participants classified themselves as 32% Democrat and 31% Republican. There is little or no statistical difference between the percentages of student or community participants for the Independent, Green, or No Affiliation categories. Also, 13% of the total sample listed their party affiliation as Independent. However, 33% of the student participants did not give an affiliation, while only 10% of the community participants did not.

TABLE 3: POLITICAL AFFILIATION

AFFILIATION	Percentage	N
DEMOCRAT	26%	30
Student	17%	7
Community	32%	23
REBUBLICAN	25%	29
Students	17%	7
Community	31%	22
INDEPENDENT	13%	15
Students	14%	6
Community	13%	9
GREEN	4%	4
Students	5%	2
Community	3%	2
NO AFFILIATION	13%	15
Students	14%	6
Community	13%	9
DID NOT REPORT AFFILIATION	18%	21
Students	33%	14
Community	10%	7

Table 4 presents religious affiliations. The results are self-explanatory. Catholic, Protestant, and Non-Denominational Christian affiliations account for over 65% of responses. It should be noted that the last three lines in the table report the percentage of participants who attend religious services.

TABLE 4: RELIGIOUS AFFILIATION

AFFILIATION	Percentage	N
CATHOLIC	22%	25
Students	19%	8
Community	24%	17
PROTESTANT	25%	28
Students	19%	8
Community	28%	20
NON-DENOMINATIONAL CHRISTIAN	18%	21
Students	21%	9
Community	17%	12
OTHER	14%	16
Students	12%	5
Community	15%	11
NO AFFILIATION	9%	10
Students	10%	4
Community	8%	6
DID NOTE REPORT AFFILIATION	12%	14
Students	19%	8
Community	8%	6
ATTEND SERVICES	66%	75
Students	60%	25
Community	69%	50

The final Table in this section, Table 5, presents participants' risk preferences, as determined by a probability game. Participants were classified into one of four risk groups; neutral, averse, seeking, or idiosyncratic. While the first three categories follow the classical definitions for risk, the fourth category describes those participants who did not exhibit any of the classic preferences.[13] While 38% of participants are classified as risk neutral, 30% are classified as risk averse. The community group had a substantially larger percentage of risk seekers, than did the

[13] That is, they appeared to either randomly or systematically alternate back and forth between the sure low-value pay-off and the more risky high-value pay-off with no obvious reaction to the changes in the expected value of the high value pay-off.

student group. Finally, a larger percentage of the student group was classified as having idiosyncratic risk preferences than was the community group. These differences may be attributable to the fact that younger participants have had less experience with financial risk-taking. There is some empirical evidence that preferences towards risk change systematically with age. For example, in experiments that entailed financial risk-taking, Harbaugh and others (2000) found that older participants were more likely to make decisions that were consistent with the Expected Value of a gamble than were younger participants. This is consistent with our finding that older participants' choices were less idiosyncratic than were younger participants' choices.

TABLE 5: RISK PREFERENCES

RISK PREFERENCE	PERCENTAGE	N
AVERSE	30%	34
Student	30%	13
Community	31%	21
NEUTRAL	38%	43
Student	38%	16
Community	38%	27
SEEKING	18%	21
Student	10%	4
Community	24%	17
IDIOSYNCRATIC	14%	16
Student	21%	9
Community	10%	7

Finally, 47% (54 of 114) of the participants were male. Within the student group 50% were male, while 46% of the community participants were male. These are the personal characteristics considered in the econometric estimation of a disaggregated demand function. In addition to these variables, data from the experimental game is necessary. These data are discussed in the following section.

EXPERIMENTAL DATA

Table 6 reports the round by round draw statistics for individual draws, the average starting resource level and the percentage of the resource that was drawn. As would be expected, the percentage of the resource drawn is largest in rounds 1 and 5, when there is only one active player. The percentages drawn are approximately 41% and 53%, respectively. If a participant were following a strategy of equal portions for active players, one would expect the active players in these two rounds to take 100% of the available resource (that is, the resource available above the safe minimum standard). Rounds 2, 3, and 4, have two, three, and two active players, respectively. Again, following the equal proportions strategy, we would expect draws of 50%, 33% and, again, 50%. In all three rounds the average individual draw was less than 30%. This might lead one to believe that, on average, individuals were very conservative in their water decisions. However, as can be seen from the standard deviations of the percentages and the maximum percentages drawn, it is apparent that not all participants were conservative and, in fact, there were very different consumption paths for different participants. This result suggests heterogeneity in consumption among participants.

TABLE 6: DESCRIPTIVE INDIVIDUAL STATISTICS

	MEAN	s.d.	MIN.	MAX.	N
ROUND 1					
Draw	4.1087	2.1507	0.0000	8.0000	92
Starting Resource Level	10.0000	0.0000	10.0000	10.0000	92
Percentage Drawn	0.4109	0.2151	0.0000	0.8000	92
ROUND 2					
Draw	5.7514	3.5822	0.0000	25.0000	181
Starting Resource Level	22.1878	6.5446	10.0000	34.0000	181
Percentage Drawn	0.2720	0.1545	0.0000	1.0000	181
ROUND 3					
Draw	7.8327	7.1465	0.0000	55.0000	269
Starting Resource Level	38.6245	20.3671	6.0000	94.0000	269
Percentage Drawn	0.2250	0.1527	0.0000	0.9032	269
ROUND 4					
Draw	11.4371	11.5881	0.0000	60.0000	167
Starting Resource Level	57.0060	54.3828	-59.0000	322.0000	167
Percentage Drawn	0.2579	0.1842	0.0000	1.0000	167
ROUND 5					
Draw	46.1566	67.4411	0.0000	300.0000	83
Starting Resource Level	111.1325	155.4818	0.0000	1202.0000	83
Percentage Drawn	0.5281	0.4168	0.0000	2.0000	83

Given the heterogeneous response among individuals, the logical question is whether the heterogeneity guards against over-consumption. To answer this, we turn to group statistics. Table 7 presents descriptive statistics for group draws, starting resource levels, and percentage of the resource consumed by group. While the average values are fairly conservative, the striking result is, again, the large variation as indicated by the standard deviations (s.d.) and ranges. The maximum percentages drawn in rounds 2, 3, 4, and 5 are all 100% or greater. This means that in each of these rounds, there were groups that over-consumed the resource and thus, depleted it prior to the end of the rounds.

TABLE 7: GROUP STATISTICS

ROUND 1	Mean	s.d.	Min	Max	N
Draw	4.04	2.17	0	8	91
Starting Resource Level	10	0	0	10	91
Percentage Drawn	0.404	0.217	0	0.8	91
ROUND 2					
Draw	11.35	5.01	3	39	91
Starting Resource Level	22.43	6.81	6	34	91
Percentage Drawn	0.546	0.29	0.107	2.16	91
ROUND 3					
Draw	23.42	12.34	4	72	89
Starting Resource Level	40.18	20.68	6	94	89
Percentage Drawn	0.65	0.25	0.144	1.67	89
ROUND 4					
Draw	27.31	24.73	4	160	83
Starting Resource Level	62.59	55.58	7	322	83
Percentage Drawn	0.55	0.32	0.05	1	83
ROUND 5					
Draw	56.36	85.32	0	432	81
Starting Resource Level	122.93	161.05	2	1202	81
Percentage Drawn	0.544	0.407	0	2	81

We find that of the 91 total sets, 14 of those sets (15%) depleted their water resource prior to the end of the rounds. The statistics are slightly different between the student and community groups. Eight of the 43 student sets (17%) depleted their resource prior to the end of the rounds, while six of the 48 community participant sets (12.5%) depleted their water resource. This suggests differences between these groups. Tables 8 and 9 present group statistics for the student and community groups. Visual inspection suggests variations across these groups over rounds with community groups, in general, drawing smaller percentages than the student group.

TABLE 8: STUDENT GROUP STATISTICS

ROUND 1					
Draw	3.89	2.27	0	8	47
Starting Resource Level	10	0	0	10	47
Percentage Drawn	0.389	0.227	0	0.8	47
ROUND 2					
Draw	10.64	5.23	3	29	47
Starting Resource Level	22.26	6.76	10	34	47
Percentage Drawn	0.498	0.202	0.107	1	47
ROUND 3					
Draw	21.83	11.09	5	72	46
Starting Resource Level	39.74	19.02	7	79	46
Percentage Drawn	0.61	0.23	0.23	1.3	46
ROUND 4					
Draw	27.93	25.92	4	160	44
Starting Resource Level	61.07	46.9	7	175	44
Percentage Drawn	0.55	0.31	0.05	1.57	44
ROUND 5					
Draw	63.67	97.24	1	432	42
Starting Resource Level	108.79	107.5	10	433	42
Percentage Drawn	0.58	0.38	0.01	1	42

TABLE 9: COMMUNITY GROUP STATISTICS

ROUND1	MEAN	s.d.	MIN.	MAX.	N
Draw	4.2	2.08	0	8	44
Starting Resource Level	10	0	10	10	44
Percentage Drawn	0.42	0.21	0	0.8	44
ROUND 2					
Draw	12.11	4.7	6	25	44
Starting Resource Level	22.61	6.94	6	34	44
Percentage Drawn	0.6	0.36	0.18	2.16	44
ROUND 3					
Draw	25.12	13.47	4	57	43
Starting Resource Level	40.65	22.54	6	94	43
Percentage Drawn	0.68	0.27	0.14	1.67	43
ROUND 4					
Draw	26.62	23.63	4	117	39
Starting Resource Level	64.31	64.59	10	322	39
Percentage Drawn	0.56	0.33	0.07	2	39
ROUND 5					
Draw	48.49	70.71	0	325	39
Starting Resource Level	138.15	204.16	2	1202	39
Percentage Drawn	0.5	0.43	0	2	39

These data are incorporated into our econometric estimations. The following section presents the econometrically estimated water demand function.

ECONOMETRICALLY ESTIMATED DEMAND

Consumer *i*'s demand for *q* at any time *t* is $q_i = f(p, \mathbf{p}, m_i; \mathbf{B}_i)$, where *p* is the price of water, **p** is a vector of prices of other goods, m_i is consumer *i*'s budget, and $\mathbf{B}_i$ is a vector of observable characteristics, both economic and personal. The economic characteristics that we test include cumulative draw from previous rounds of the trial and monthly budget. The personal characteristics tested are drawn, in large part, from the extant literature concerning gender, age, cultural, political, and religious factors.

Using binary variables, we control for informational differences between the participant groups. We consider three groups: student participants, workforce participants, and retired participants. We allow for differences among sets and person type with the use of dummy variables. We also include a binary variable to identify individuals who, in an earlier set, belonged to a group that fully depleted its water resource prior to the terminal time. We employ a linear fixed effects model. The functional specification is:

$$q_{it} = \sum_{x=1}^{X} \left((b_x + \sum_{g=1}^{G} b_{gx} G_g) X_{ix} \right) + \sum_{d=1}^{D} \left((a_d + \sum_{g=1}^{G} a_{dg} G_g) D_{id} \right)$$
$$+ \sum_{p=2}^{P} \left((a_p + \sum_{g=1}^{G} a_{pg} G_g) P_p \right) + \sum_{s=2}^{S} a_s S + (a + \sum_{g=1}^{G} a_{dg} G_g) + e$$

The first set of terms on the right-hand side, $\sum_{x=1}^{X}\left((b_x+\sum_{g=1}^{G} b_{gx}G_g)X_{ix}\right)$, represents the coefficients and the quantitative variables, $\sum_{x=1}^{X} b_x X_{ix}$, and the slope interaction terms for the groups (G=workforce, retired), $\sum_{x=1}^{X}\left(\sum_{g=1}^{G} b_{xg}G_g)X_{ix}\right)$. The X quantitative variables include

- Price (in monetary units per unit of water),
- Cumulative Individual Draw (units of water),
- Budget ($ per month),
- Age (in years),
- Education (total years)

In all cases, intercept and interaction terms for group type are designated by "G." The second set of right-hand side terms, $\sum_{d=1}^{D}\left((a_d+\sum_{g=1}^{G} a_{dg}G_g)D_{id}\right)$, represents the coefficients for the individual observable binary characteristics and the shifters for the G, where D_{id} are the set of observable characteristics including:[14]

- Died in a Previous Set,
- Gender,
- Cultural Identity (Caucasian, Hispanic, Other, Did Not Report Race),[15]
- Political Affiliation (Democratic, Republican, Independent, Other, No Affiliation, or Did Not Report Affiliation),
- Attendance at Religious Services,
- Religious Affiliation, if any (Catholic, Protestant, Non-Denominational Christian, Other Affiliation, No Religious Affiliation, Did Not Report Affiliation), and
- Risk Preferences (Risk Neutral, Risk Averse, Risk Seeking, Idiosyncratic Risk).

[14] In all cases, where appropriate, we include a test for "no response" since this in itself may be a significant characteristic.

[15] Due to the small number of Black participants, we include them in the "Other" category rather than as a separate group.

$\sum_{p=2}^{P}\left((a_p + \sum_{g=1}^{G} a_{pg} G_g) P_p\right)$ is the summation of the intercept and interaction terms associated with the Person-type, where p = 2 (alive in rounds 2,3, and 4) or 3 (alive in rounds 3, 4, and 5) and are the intercept shifters associated with group type. $\sum_{s=2}^{S} a_s S$ is the summation of set intercept terms (s=2,3,4). Finally, $(a + \sum_{g=1}^{G} a_{dg} G_g)$ are the constant terms for the student group, (a) and the workforce and retired group intercept shifters, $(\sum_{g=1}^{G} a_{dg} G_g)$ (where G=1, 2 and 1=workforce and 2= retired). Binary variables for Person-type and for set are included to allow for differences. In the case of Person-type, differences could be attributed to the differences in the number of competing participants for the water as well as for differences in stock levels. Set differences are included to allow for learning across sets. In addition to these factors, we allow for differences by including intercept and interaction terms for workforce participants and retirees.

The intercept for the base case, a, is defined an individual who is a student, has not been a member of a group that previously exhausted its water resource, is a White male, identifies himself as Catholic, does not attend religious services, is a member of the Democratic party, and is risk neutral. The customary error term, å, is assumed normally distributed with a zero mean. The results are reported in Table 10.[16] For ease of comparison, the results are divided into three categories across the table. Columns two through four present the base-case. Columns five through seven present the slope and interaction terms for the workforce sub-group, while columns eight through ten present the slope and interaction terms for the retired sub-group.

[16]The regression was estimated using full feasible generalized least squares (see, e.g., Greene 2000). First order autocorrelation was indicated by the Durbin Watson statistic; an iterative Prais-Winsten algorithm was used in the correction.

TABLE 10: ECONOMETRIC RESULTS

	BASE-CASE TERMS			INTERCEPT AND INTERACTION TERMS					
				WORKFORCE			RETIRED		
PARAMETER	ESTIMATE	s.e.	PROB.	ESTIMATE	s.e.	PROB.	ESTIMATE	s.e.	PROB.
PRICE	-2.7155	0.6695	0.0001	1.9332	0.8098	0.0170	0.7807	0.7319	0.2861
CUMMULATIVE DRAW	0.8853	0.0154	0.0000	-0.4849	0.0268	0.0000	-0.4179	0.0268	0.0000
DIE IN PREVIOUS ROUND	-0.5569	1.9790	0.7784	-2.4352	3.6560	0.5054	12.1230	4.2828	0.0046
AGE	0.5070	0.5119	0.3220	-0.6317	0.5163	0.2212	-1.4754	0.5448	0.0068
GENDER	-1.0719	1.4530	0.4607	0.3177	2.0337	0.8759	0.7587	1.8137	0.6757
HISPANIC	-1.3276	1.7421	0.4460	-3.9703	2.7798	0.1532	6.6279	3.4683	0.0560
OTHER RACE	0.6931	2.2444	0.7575	-5.4800	3.7081	0.1395	-5.4186	6.3503	0.3935
DID NOT REPORT RACE	-1.2721	2.7694	0.6460				23.7810	11.3930	0.0369
REPUBLICAN	-2.3099	2.3579	0.3273	0.4833	3.0245	0.8730	12.8840	3.9529	0.0011
INDEPENDENT	-0.9500	2.4754	0.7011	9.3805	3.7358	0.0120	5.1822	6.0504	0.3917
GREEN	0.1711	3.2530	0.9580				11.7580	6.7003	0.0793
NO POLITICAL AFFILIATION	-1.1285	2.0768	0.5869	0.3998	3.7946	0.9161	-0.1669	5.0981	0.9739
DID NOT REPORT AFFILIATION	0.2216	2.3990	0.9264	4.6677	4.0866	0.2534	-4.3794	4.9786	0.3791
ATTEND	2.0630	1.5753	0.1903	3.6862	2.6022	0.1566	5.7661	3.3518	0.0854
PROTESTANT	1.0496	2.0776	0.6134	4.6778	3.5203	0.1839	-3.1664	3.9113	0.4182
NON-DENOMINATIONAL	0.0466	2.0981	0.9823	1.6975	3.0666	0.5799	-5.2311	4.1258	0.2048
OTHER RELIGIOUS AFFILIATION	2.7490	2.6795	0.3049	-0.0986	4.2564	0.9815	-0.0633	4.4097	0.9886
NO RELIGIOUS AFFILIATION	1.8129	2.6920	0.5007	-6.0968	4.4474	0.1704			
DID NOT REPORT RELIGIOUS AFFILIATION	0.0113	2.5047	0.9964	-4.3507	4.3619	0.3186	4.1997	7.4320	0.5720
YEARS OF SCHOOL	-0.4914	1.0794	0.6489	0.2574	1.1359	0.8208	-0.4512	1.1752	0.7010
RISK AVERSE	2.0399	1.5562	0.1899	-8.1296	2.5446	0.0014	2.0489	3.7221	0.5820
RISK SEEKING	-0.4226	1.9966	0.8324	-1.0256	3.3103	0.7567	-10.1500	4.6340	0.0285
IDIOSYNCRATIC RISK	0.1654	2.1353	0.9383	-9.0360	4.1094	0.0279	10.6030	4.5470	0.0197
PERSON TYPE 2	0.8024	1.2741	0.5289	1.7872	2.1975	0.4161	2.8784	2.7216	0.2902
PERSON TYPE 3	1.2234	1.3203	0.3541	8.3638	2.2267	0.0002	8.7821	2.4365	0.0003
SET 2	1.6041	0.8577	0.0614						
SET 3	0.3667	1.2746	0.7736						
SET 4	1.1975	1.5025	0.4254						
CONSTANT	-4.9274	10.3500	0.6340	16.0290	12.4350	0.1974	78.3180	19.6310	0.0001
RHO	-0.0780	0.0354	0.0278						

The parameter estimate for price is statistically significant in the base-case and has the appropriate sign for a normal good. The estimate for the workforce sub-group is significantly different from that of the base. The sum of the base parameter estimate and the workforce parameter estimate is negative, although of a smaller absolute magnitude than the base-case. The interaction term for the retired group is not statistically different from zero. Therefore, there is no difference in the parameter estimate for the base-group or the retired group.

The cumulative individual draw parameter estimate is significant, as are the interaction terms for both the workforce and retired groups. The sign for the base is positive. The signs on both the interaction terms are negative. However, the sum of the estimate and the interaction term do not reverse the sign. The parameter estimate for age for the retired group is statistically significant and negative. That is for those in the retired group, the older the participant, the less he or she consumes, all else equal. This finding is somewhat consistent with Rogers (1994). There are no statistical gender effects. This is not surprising given the lack of consensus in the literature on gender effects.

Within the group of variables for cultural identity, we find that several are significant for either or both the workforce or the retired group, although none are significant in the base-case. Within the student group, we find no statistical differences in demand for participants who identified themselves as Caucasian, Hispanic, Other Race, or those who did not report their race. In the Workforce group, we find those who identify themselves as either Hispanic or as an Other Race individual would have a demand function with a smaller intercept term than that of the

Caucasian counterpart, all else equal. Finding cultural differences in demand is consistent with Chermak and Krause (forthcoming) and Roth *et al*. (1991).

The results also do not indicate differences in the student group associated with their political or religious affiliation. Again, there are statistically significant differences in the workforce and the retired groups. Specifically, in the workforce group, those who identify themselves as an Independent would consume more than their Democratic counterpart. In the retired group those who identified themselves as either a Republican or a Green party member would consume more than their Democratic counterpart.[17] Within the religious affiliations, those in the workforce group who identified themselves as a member of a Protestant religious group would consumer more than their Catholic counterparts, while those in the retired group who identified themselves as non-denominational Christian would consume less than their Catholic counterparts, all else equal. These results are not inconsistent with Chermak and Krause (forthcoming). We find that those participants who identify themselves as attending religious services consume more than those participants who do not (again, all else equal). This is true regardless of group type. However, those in the workforce and the retired groups consume more than their student counterparts.

Risk preferences influenced demand. The parameter estimate on the variable identifying a risk averse participant is significant and positive, indicating someone who is a member of this group would consume more than their risk neutral counterpart. However, the parameter estimate identifying a risk averse member of the workforce group indicates he or she would consume less.

[17] This result appears counter-intuitive, given the goals of the Green party. Due to the relatively small number of Green respondents, the factor may be capturing something other than the "Green" affiliation.

While this result may seem inconsistent intuitively, it may be due to an age and experience difference. While risk averse students react by trying to consume immediately (perhaps in order to get their share), risk averse workforce members reduce their consumption in order to minimize the probability of depletion of the resource. We also find the parameter estimates for the factor that identifies workforce members with idiosyncratic risk preferences is significant and negative. Thus, these participants would consume less than their risk neutral counterparts, all else equal. Within the retired group, we find the parameter estimate for those identified as risk seeking to be significant and negative. Again, this may not seem intuitive. However, it may be that members of this group choose a risky strategy of not consuming the resource in order to have a larger quantity available in future periods.[18] Within the retired group, the parameter estimate for those with idiosyncratic risk preferences is also significant and positive.

We also find some indication of differences when a participant is person-type three. This may be due to their unique position as the only individuals who consumed by themselves in the last round. Not only did this free them from considering others' consumption choices, it also, in some cases, allowed them to consume from a resource that was substantially larger than it was in previous rounds. The combination of no interdependency and the relatively abundant nature of the water resource allowed the individual to consume at higher levels than we saw otherwise.

Finally, all else equal, the intercept terms for both the workforce and the retired groups, as indicated by the significant and positive parameter estimates, suggest these groups consume more than the base.

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[18] For a discussion on consumption strategies, see, for example, Chermak and Krause (forthcoming).

These results suggest that there are differences in consumption levels across groups. While we cannot observe the preferences of these groups, we can distinguish the groups by observable characteristics that are statistically significant. Observable characteristics that influence demand include cultural identity, political and religious affiliation, risk preferences, and age. Furthermore, we find significant differences across participants who are at different stages in their lives. Demand of those in the workforce or those who are retired differs from that of students. Given this, the results of these experiments suggest a disaggregated water demand.

DISAGGREGATED DEMANDS

The econometric results in Table 10 can be used to estimate water demand functions for different groups of consumers. For ease of example, consider three consumer types:

- Consumer 1: a 43-year-old White male in the workforce with 12 years of education, who is an Independent, attends Protestant services, and is risk neutral,
- Consumer 2: a 65-year-old Hispanic male with 16 years of education, who is retired, is a Republican, attends Catholic services, and is risk seeking, and
- Consumer 3: a 30-year-old female student with 13 years of education, is neither White nor Hispanic, identifies herself politically as a Green, has no religious affiliation, and has idiosyncratic risk preferences.

Employing the econometric estimates from the previous section, we find the following demand functions for our three consumers.[19]

$$q_1 = 36.76 - 2.93p \quad \text{(Consumer 1).}$$
$$q_2 = 33.60 - 2.09p \quad \text{(Consumer 2), and}$$
$$q_3 = 48.35 - 0.85p \quad \text{(Consumer 3),}$$

[19] For all consumers we assume some experience, thus we assign them Set 2 attributes. Further, we consider that the water resource they consume is also being consumed by others and so we assign them to Person-type 2. We assume no previous shortages, so they "Did Not Die in a Previous Set." Any other characteristics, not specifically mentioned are assumed to be equal to the mean value.

where q is the quantity demanded, p is the per-unit price, and the subscript refers to the consumer type.

As can be seen from the functions, the consumer types exhibit very different demand functions. Not only do the three consume different quantities at a given price, but the own price elasticity, or responsiveness is unique to the consumer type. Elasticity is measured as;

$$h_i = \frac{\partial q_i}{\partial p} \times \frac{p}{q_i},$$

and can be interpreted as the percentage change in the quantity demanded, given a 1% change in the price of the good. Table 11 reports estimated elasticity measures for the consumer groups at various price levels. Several facts are apparent. First, consumers react differently to price changes. While in all but one case, the demand across the consumer types is inelastic (the percentage change in the quantity demanded is less than the percentage change in the price), there are variations across the three. Also, when faced with a very high price, the student consumer's demand is elastic. This result should be viewed with a note of caution, since the price is outside the range of the data.

TABLE 11: Consumer Response to Price Changes

CONSUMER	p_i^1	q_i^1	h_i^1	p_i^2	q_i^2	h_i^2	p_i^3	q_i^3	h_i^3
1	1.00	33.83	-0.086	2.00	30.90	-0.190	6.50	17.73	-1.073
2	1.00	31.52	-0.066	2.00	29.43	-0.142	6.50	20.04	-0.677
3	1.00	47.41	-0.018	2.00	46.47	-0.036	6.50	42.85	-0.128

The difficulty for the regulator, of course, in using disaggregated demand information to promote conservation, is to recognize the information that he or she has as well as the information that he or she does not have. This is necessary in order to provide appropriate incentives to consumers in order to achieve targeted conservation goals, while minimizing the impact on consumers. In the following section we employ the three estimated demand functions to construct a non-linear pricing instrument that achieves that goal. The result is compared to traditional one-price results and is also compared to the perfect information case as well as to the imperfect information case.

CONSERVATION AND NON-LINEAR PRICING

Consider the regulator tasked with pricing a water resource while maximizing social welfare, which we equate to the sum of consumer and producer surplus (*CS* and *PS*, respectively). Her objective is:

$$\max_{p_i} CS = \sum_{i=1}^{I} U_i(q_i) + p_i Q - C(Q)$$

where $Q = \sum_{i=1}^{I} q_i$. Let I=3, where the three consumers are described by the demand functions from the previous section. While the regulator knows the distribution of demand, she does not know which consumer is which. Furthermore, the regulator knows costs are equal to:

$$C(Q) = 3 + 0.95Q\ .$$

Traditional pricing for water may be made on either an average or marginal cost basis. To cover costs, we assume average cost pricing for the traditional model. Given this, Table 12 reports the consumption levels for the three consumers, as well as *CS*.[20] The optimal price with a single price and no tariff is $0.9766 per unit of water.[21] Consumer 3 receives the majority of the *CS*,

[20] The numerical examples presented in this section were developed with an Excel spreadsheet, employing the "Solver" routine to maximize the welfare objective.

[21] In all cases we have maintained the assumption that unit commodity charges must be equal to or greater than the marginal cost, *MC*.

which would be expected given his demand function. Profits to the water utility are $0.00, and so social welfare is equal to consumer surplus.

TABLE 12: TRADITIONAL SINGLE PRICING

CONSUMER	PRICE ($/unit)	QUANTITY (units)	*CS* ($)
Consumer #1: $q_1 = 36.76 - 2.93p$	$0.9766	33.90	$196.10
Consumer #2: $q_2 = 33.60 - 2.09p$	$0.9766	31.56	$238.27
Consumer #3: $q_3 = 48.35 - 0.85p$	$0.9766	47.52	$1328.32
Totals		112.98	$1762.68
Consumer Surplus + Producer Surplus			*$1762.68*

A second pricing scheme is a two-part tariff with a fixed charge plus a commodity charge. With perfect information a regulator would be able to distinguish the three consumers and assign the optimal fixed and commodity charge. Table 13 reports the perfect information results. Again, profits are equal to total costs and so social welfare is equal to consumer surplus. The changes are subtle, but there are slight shifts in the consumption levels of the consumers and there is a very small increase in consumer surplus.

TABLE 13: PERFECT INFORMATION PRICING

CONSUMER	FIXED CHARGE ($)	COMMODITY CHARGE ($/unit)	QUANTITY (units)	*CS* ($)
Consumer #1	$0.00	$0.9766	33. 09	$196.10
Consumer #2	$0.84	$0.9500	31.61	$238.27
Consumer #3	$1.26	$0.9500	47.54	$1328.32
Totals	$1.68		113.05	$1762.69
Consumer Surplus + Producer Surplus				*$1762.69*

The difficulty with the pricing scheme presented in Table 13 is that it may provide an incentive for consumer types to misrepresent their own consumer-type. With the menu presented above, it is advantageous for both Consumers 1 and 3 to present themselves as Consumer 2 types. If consumers are successful in portraying themselves as type 2 consumers, the results in Table 14 will hold.[22] In this case all three consumers identify themselves as a type 2 consumer. They all pay a $0.84 fixed charge and a $0.9500 per unit commodity charge. For Consumer 1, this results in an increase in both consumption level and consumer surplus. It is in her best interest to choose the fixed charge in order to have access to the lower commodity charge. In the case of Consumer 3, it is obvious that he would find it in his best interest to pay a lower fixed charge when there is no difference in the commodity charge. Consumer 1 increases her surplus by $0.06, while Consumer 3 increases his by $0.42. While these increases in themselves may not seem particularly impressive, another aspect of the scenario is that the water utility now loses $0.49.

TABLE 14: TWO-PART TARIFFS UNDER IMPERFECT INFORMATION

CONSUMER	FIXED CHARGE ($)	COMMODITY CHARGE ($/unit)	QUANTITY (units)	*CS* ($)
Consumer #1	$0.84	$0.9500	33.98	$196.16
Consumer #2	$0.84	$0.9500	31.61	$238.27
Consumer #3	$0.84	$0.9500	47.54	$1328.74
Totals	$2.36		113.19	$1763.18
Consumer Surplus + Producer Surplus				*$1762.69*

The inefficiency arises because the regulator assumes perfect knowledge, and in fact there are asymmetries of information. To correct for inefficiencies in the market, either an enforcement mechanism is necessary to ensure that consumers reveal their true consumption type, or a pricing mechanism that offers consumers the incentive to reveal truthfully their consumer types is necessary. The incentive inherent in the prices and tariffs must satisfy

$$U_i^*(q(p_i, tariff_i) \geq U_i(q(p_j, tariff_j)$$

[22] To make sure that consumers reveal themselves truthfully, the regulator would have to monitor consumer declarations. The transaction costs of such an arrangement could prove to be quite high.

where p_j and $tariff_j$ are the prices and tariffs charged types other than i.

This requires that fixed and commodity charge combinations be designed such that it is never better for a Consumer 1 type to reveal himself as another type. Table 15 presents the results for a two-part tariff with incentive compatibility constraint.[23] As can be seen, the fixed charge for consumers 2 and 3 both increase, while the commodity charge decreases for all three. The profits for the water utility are again zero, and so social welfare is equal to consumer surplus.

TABLE 15: TWO-PART WITH INCENTIVE COMPATABILITY CONSTRAINT

CONSUMER	FIXED CHARGE ($)	COMMODITY CHARGE ($/unit)	QUANTITY (units)	*CS* ($)
Consumer #1	$0.00	$0.9766	33.89	$196.10
Consumer #2	$0.00	$0.9766	31.56	$238.27
Consumer #3	$1.26	$0.9500	47.54	$1328.32
Totals	$1.26		113.00	$1762.69
Consumer Surplus + Producer Surplus				*$1762.69*

The incentive compatibility of the pricing menu can be most easily seen by considering consumer surplus levels if consumers reveal themselves to be something other than what they are. The results are presented in Table 16. The diagonal numbers are the consumer surplus values for truthful revelation. In all cases, they are the largest numbers in each row. Rational consumers with a utility maximization objective will always reveal themselves truthfully. The simplicity of this pricing mechanism lies in the regulator's knowledge that her information is incomplete. Thus, the mechanism is based only on the information she has, rather than on an assumption of perfect information.

[23] For more on incentive compatibility and non-linear pricing see, for example, Laffont and Tirole (1993) or Patrick (2000).

TABLE 16: INCENTIVE COMPATABILITY CONSTRAINT WITHOUT CONSERVATION

Consumer's True Type	Consumer Represents Self as:		
	1	2	3
1	$196.10	$196.10	$195.74
2	$232.08	$238.27	$231.81
3	$1271.54	$1271.54	$1328.32

While the above numerical example provides insight into the mechanism, the results are not particularly dramatic except for the insight of slight changes in individual consumer choices and the loss incurred by the provider. However, it should be recognized that, in this example, we are in very inelastic portions of the demand curve for each consumer.[24] These conditions can, perhaps, be best equated to pre-conservation times in many Southwest communities. Given the current objectives of many municipalities, the problem can be modified to include a conservation goal.

Again, consider our three consumers with the same cost function. Suppose that in this case water consumption must be reduced by 10%, from 113 units to 102 units. We again impose the criteria that individual consumer groups must pay a commodity charge at least equal to the marginal cost of delivery. Table 17 presents the outcomes for a single commodity charge with no fixed charge, a two-part price under perfect information, a two-part price with asymmetric information, and a two-part price under imperfect information with an incentive compatibility constraint. The information in this table is of great interest. We see that the single price mechanism requires a substantial increase in price in order to achieve the desired conservation level. This mechanism actually reduces use below the target level, but at a high cost to consumers, as there is a large

[24] For consumers 1, 2, and 3, their average price elasticities for the incentive compatible solution are -0.08, -0.06, and –0.04, respectively.

transfer of consumer surplus to producer surplus. Total consumer surplus is $1473, while total social welfare is $1752.

TABLE 17: CONSERVATION PRICING MECHANISMS

CONSUMER	FIXED CHARGE	COMMODITY CHARGE	QUANTITY	CS_i
SINGLE PRICE				
1	n.a.	$2.85	28.42	$ 137.82
2	n.a.	$2.85	27.65	$ 182.91
3	n.a.	$2.85	45.93	$1240.94
Total			102.00	$1473.20
Consumer Surplus + Producer Surplus				*$1752.13*
TWO-PART (Perfect Information)				
1	$ 0.00	$4.74	22.84	$ 89.04
2	$ 105.07	$0.95	31.62	$ 239.11
3	$174.53	$0.95	47.54	$1329.58
Total	$279.60		102.00	$1657.74
Consumer Surplus + Producer Surplus				*$2021.13*
TWO-PART (Asymmetric Information)				
1	$105.07	$0.95	33.98	$ 197.00
2	$105.07	$0.95	31.62	$ 239.11
3	$105.07	$0.95	47.54	$1329.51
Total	$197.68		106.04	$1765.62
Consumer Surplus + Producer Surplus				*$1978.16*
TWO-PART (Incentive Compatible)				
1	$ 0.00	$3.46	26.62	$120.94
2	$ 19.42	$2.76	27.83	$185.37
3	$115.30	$0.95	47.54	$1329.58
Total	$134.72		102.00	$1635.89
Consumer Surplus + Producer Surplus				*$1984.66*

The perfect information two-part pricing tariff results in the desired conservation goal and the transfer from consumers to producers is substantially less than in the single price mechanism. This solution, as would be expected, results in the highest social welfare levels. However, to achieve these levels of welfare, perfect information is required. Unless the regulator knows each consumer's true type, the pricing schedule as is offers the incentive to some consumer types to not truthfully reveal their type.

Again, Consumers 1 and 3 find that it is best to represent themselves as Consumer 2 types. This results in substantially higher consumption levels for Consumer 1, and an increase in CS. Consumer 3 is, again, simply trading a high fixed charge for a lower fixed charge. These misrepresentations also result in not meeting the conservation goal of 10% reduction. In fact, only a 6% reduction is realized. Consumer surplus is greater than under the perfect information case, which is to be expected since more water is consumed (and the conservation goal is not met). However, even with the increased CS, the overall welfare is lower than the perfect information case due to added costs incurred by the supplier.

The incentive compatible mechanism offers very divergent pricing choices. Consumer 1 pays an extremely high commodity charge, while Consumer 2 pays a lower commodity charge but incurs a fixed charge of $19.42. Consumer 3 pays a very high flat rate, with a commodity charge that just covers marginal cost. This results in the conservation goal being met, while maintaining a high level of welfare. It also does not offer the incentive to misrepresent, as can be seen in Table 18.

TABLE 18: INCENTIVE COMPATABILITY CONSTRAINT UNDER CONSERVATION

Consumer's True Type	Consumer Represents Self As:		
	1	2	3
1	$120.94	$ 120.94	$ 81.70
2	$148.00	$ 185.37	$117.78
3	$1089.78	$1070.36	$1329.58

The results from the conservation example show the power of combining disaggregate demand functions with an efficient conservation mechanism in order to achieve a conservation goal while maintaining as high a level of social welfare as possible. The changes in consumption levels from the "no conservation" example to the conservation example come about through the increased prices. These prices move the consumer from the inelastic to a more elastic portion of his or her demand curve.[25] The use of the non-linear pricing mechanism with an incentive compatibility constraint improves the efficiency of the mechanism.

CONCLUSIONS

Many policies intended to ameliorate water shortages in the arid Southwest attempt to induce consumers to reduce their use of water. Publicity and education campaigns implore consumers to use water wisely. Higher prices are advocated to encourage conservation. The relative effectiveness of each policy depends on consumer response to that policy. Therefore, it is imperative that we understand consumer demand for water.

Water demand varies across consumers. Some of that variation is correlated with observable characteristics. We used a series of experiments to investigate consumer heterogeneity, and found consumption differences based on student and employment status and on a variety of social and cultural factors. Among these are age, gender, ethnicity, political affiliation, religious affiliation, and risk preferences. Given the diversity of the Southwest's population, these insights can help predict demand for water among current and future residents.

Some of the variation in water demand cannot be predicted based on observable characteristics. Policy based on demand estimates that assume homogenous consumers is not efficient. Regulators cannot be assumed to know each consumer's unique demand for water. By disaggregating demand by type, we show that a menu of price systems can achieve conservation

[25] The average price elasticities for the Consumers 1, 2, and 3 are -0.38, -1.66, and -2.07, respectively.

goals with less loss of consumer welfare than can alternative policies. Furthermore, these systems can be designed so that each consumer has an incentive to choose the one that is most beneficial given his or her unique demand. Thus enforcement costs are minimized. Similar analyses can be carried out to determine the impact of other conservation mechanisms, such as offering rebates for xeriscaping.

Extensions to this research include additional experiments to determine the impact of observable characteristics over a wider range of prices. This is particularly relevant, considering the results of the conservation example. In addition, incorporating conservation devices into our analysis will aid in the design of alternative conservation mechanisms.

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APPENDIX A
Community Participant Experiment Protocol[26]

Welcome to this economics experiment and thank you for participating. By taking part in this experiment you will earn some money. How much you earn will depend on your decisions and on the decisions of other participants. Please do not communicate with other participants during this experiment. Because it is important that we control this aspect of the experimental environment, we will strictly enforce this rule. If we observe any communications, those involved will forfeit their earnings. In addition, because this experiment requires groups of three, two other participants may also lose their earnings.

We will not record your names or reveal your identity or the decisions that you make to anyone else, nor will we tell you how any other particular participant responded. Please do not write your name on your response sheet.

You are in a randomly determined group of three subjects. No member of your group will know the identities of any other group members. Your group will remain together for one complete set. Each set consists of five rounds. After you have played five rounds (a complete set) your group will change and you will be in a new group of three for another set of five rounds.

You will record a decision for each round on your response sheet and fold the sheet in half. An experiment worker will collect the sheets, enter some information, and then return them to you for the next round. Your earnings for each set will be recorded on your response sheet at the end of each fifth round.

Between some of the rounds we will ask you to complete some other portions of this experiment. We will give you instructions for those tasks when you are asked to do them.

Everyone who participates in this experiment will receive a minimum $25 participation payment whatever the outcome of the experiment. The maximum possible that you will be paid is $100. We will pay you your calculated pay off from two randomly chosen sets. These two sets will be determined after the last round of the last set has been played by drawing two balls from the bingo cage. Therefore, during the experiment you will not know which sets will determine your monetary payoff.

This experiment is about the use of water. In this experiment, if your group uses up all of its water, no one in the group will be able to get any more. If your group's water supply reaches a critically low level, your ability to get water will decline. If your group's water supply increases, you will be able to consume more water. Your payment for this experiment is determined by how much water you consume.

The experiment works as follows:

At the beginning of each set your group has ten units of water. Your payment for this experiment is based on the amount of water that you take from your group's Water Supply. Each member's

[26] The Student Participant Experiment Protocol is very similar. It is available from the authors on request.

water use counts in only three consecutive rounds. In each group and in each set, Person 1's water use counts in rounds one, two and three, Person 2's water use counts in rounds two, three and four and Person 3's water use counts in rounds three, four and five. Please look at the chart to see the rounds in which you can take water from your group's supply. (O*verhead of Figure 1*) We will tell you whether you are Person 1, 2, or 3 before you are asked to make your decision. You will not be the same Person Number in every set. In order to protect your anonymity, we will distribute and collect data sheets from every person in every round whether or not they were active in that round. For the rounds in which you are inactive, please enter a zero as your amount.

You decide how much of your group's water you want to use in each round. Your group's water supply becomes threatened at two units. If your group's supply remains above this threatened level, your group will start with ten in the next round. If more than two units of the Water Supply are left, those extra units will be multiplied by three, and that amount will be added to your base amount of ten. So, in the next round your group would start with more than ten units. If your group's Water Supply falls below two, then your group will start the next round with ten minus three times your group's over-use. If your group uses up all of its water, then everyone will receive a payoff of zero for that round and all of the rest of the rounds in that set. To protect your privacy, if your group uses up its Water Supply before the end of a set, you must continue to fill out a response sheet with zeroes for the remaining rounds. So, the amount you can withdraw depends on how much other group members withdrew in the earlier rounds.

If your group has any Water Supply left over after the fifth round of a set that is chosen for payment, the money equivalent will be paid to the Middle Rio Grande Water Assembly, a water conservation organization operating in the Middle Rio Grande watershed.

Here is an example of what might happen. (*Overhead 2, units determined by draw*.)

Suppose the first person wrote down __ units. Since he is the only person consuming water in this round, the supply at the end of Round 1 is: 10 minus ___ or ____.
Now we calculate how much water your group has for Round 2.
We multiply the excess water (the amount left that is above the critical level) by 3 and add it to the base supply of 10. Remember that 2 is the critical level. ___ is greater than this critical level by ___. In Round 2, this group will start with 10 + ____ = ___ units of water.
In Round 2, Water Supply is reduced by the amount used by Person 1 plus the amount used by Person 2. We subtract that total from ____, then calculate how much water will be available in Round 3.

Do you have any questions?

Refer back to the instructions and these Key Points at any time during the experiment.

Key Points:

The sets that will determine your payoff will be chosen randomly at the end of the experiment. Your payoff for this experiment will be a multiple of the number of units of water you consumed during each of your active rounds in the sets drawn. A unit does not equal one dollar.

In each set, you will only be able to withdraw during three of the five rounds.

If, during any round, your group's water supply is completely exhausted, all members of the group will receive zero units for that and all subsequent rounds of the set.

Set 1			Set 2		
	Group Starting Water Supply	Your Water Use		Group Starting Water Supply	Your Water Use
Round 1	10		Round 1	10	
Round 2			Round 2		
Round 3			Round 3		
Round 4			Round 4		
Round 5			Round 5		
You are Person # ____; Your total units :			You are Person # ___; Your total units:		

Set 3			Set 4		
	Group Starting Water Supply	Your Water Use		Group Starting Water Supply	Your Water Use
Round 1	10		Round 1	10	
Round 2			Round 2		
Round 3			Round 3		
Round 4			Round 4		
Round 5			Round 5		
You are Person # ____; Your total units:			You are Person # ___; Your total units:		

Set 5			Set 6		
	Group Starting Water Supply	Your Water Use		Group Starting Water Supply	Your Water Use
Round 1	10		Round 1	10	
Round 2			Round 2		
Round 3			Round 3		
Round 4			Round 4		
Round 5			Round 5		
You are Person # _____; Your total units:			You are Person # _____; Your total units:		

APPENDIX B
Student Participant Survey[27]

ID_______

Participant Survey

Thank you for participating in this experiment and answering this survey. All information you provide is strictly confidential. Your name will never appear in any experimental records. Please answer all of the following questions. **Please do not write your name on this sheet!**

1. What is your age? Years: ______ Months:_______

2. Sex? Male: ______ Female: _______

3. Racial or ethnic background? ________________________

4. Where do you live? On-Campus:____ Off-Campus with Parent(s): ____ Off-Campus:____

5. State from which you graduated High School? ____________________________

6. Highest level of Parental Education? Years:___________

7. Estimate your personal monthly budget (including rent and living expenses)? ____________________

8. Does this support anyone but you? Yes:______ No:_______

9. If you answered yes to #8, how many people (including yourself) does it support? ________

10. What is your political affiliation? ____

11. Do you attend religious services? Yes:________ No:_________

12. What do you consider to be your religious affiliation, if any? ________________________________

13. How many years of college have you completed? ______________

14. What is your classification?

Freshman: ______ Sophomore: ________ Junior: ________ Senior: ______ Other: ________

15. What is your estimated GPA? _______________

16. What is your major? ____

17. How many college economics courses have you completed? __________

[27] The Community Participant Survey is very similar. Some questions, which are obviously not relevant, are not included. A copy of the survey instrument is available from the authors on request.

18. Have you ever participated in any other economics experiments? Yes:______ No:______

19. If you answered yes to 18:

a) Were you paid for any of the experiments? Yes: _____ No: _______

b) How many experiments were paid experiments: ___________

c) How many months has it been since you last participated in a paid experiment? _______months