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CONSUMER RATIONALITY AND THE STATUS QUO*

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Received microeconomic theory presumes rational consumers maximize utility over all commodity bundles Recent analysis, however, suggests that a consumer's status quo may limit economic rationality, "bias" consumer decisions, and induce serious errors in survey-based valuations of public and private goods. Using regression and choice-theoretic frameworks, we investigate the existence of status quo effects in the consumer valuation of a particular unpriced product—the reliability of residential electrical service Such valuations have become important in electric utility resource planning and rate making We find substantial status quo effects, which must be addressed in welfare comparisons regarding electric service reliability

INTRODUCTION AND OVERVIEW

While the received theory presumes that consumers maximize utility over *all* possible commodity bundles, recent empirical analysis suggests that a consumer's status quo may be important in limiting economic rationality. This analysis suggests, for example, that consumers attach "undue" importance to their current commodity bundle, demonstrating "apparently irrational" reluctance to switch to alternative bundles. Likewise, as consumers evaluate alternatives, they are found to asymmetrically value the losses and gains derived from changing their status quo.

The work of Kahneman and Tversky [1979][1] formalizes the importance of this status quo effect. Using the standard expected utility maximization paradigm, they demonstrate a variety of consumer decisions that appear inconsistent if the importance of the status quo is ignored. For example, they observe and postulate a "certainty effect;" that is, people "overweight" certain outcomes relative to probable outcomes. They also observe and postulate a "reflection effect;" that is, individuals evaluate marginal gains and losses asymmetrically. Based on these and other observations, they formulate "Prospect Theory" to describe decision making under

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1 And others, as summarized in Machina [1987]

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uncertainty. Their theory exploits a "value" function, rather than a utility function. This value function is centered at the status quo (the "reference point"); it is defined over deviations from the status quo; it is kinked at the status quo, being concave for gains and convex for losses; and it is steeper for losses than for gains. As a result, the value function exhibits risk-averting behavior in choices involving sure gains and risk-seeking behavior in choices involving sure losses.[2]

Contingent valuation studies used to value public goods have confirmed the presence of a status quo effect. The effect has appeared in the form of asymmetric valuations of losses and gains from the status quo. While traditional theory suggests that individuals will reveal nearly equal willingness-to-pay (*WTP*) and willingness-to-accept (*WTA*) measures of value [Willig, 1976], experimental and survey results have produced quite disparate *WTA* and *WTP* measures [Bishop and Heberlein, 1979; Brookshire and Coursey, 1987; Cummings, Brookshire, and Schulze, 1986; Knetsch and Sinden, 1984; Rowe, d'Arge, and Brookshire, 1980]. In many cases, the *WTA* measures of value have exceeded *WTP* measures by an order of magnitude of three-to-one, suggesting that individuals underperceive the value of the public good or overperceive the value of the financial loss required to pay for it.

An interesting experimental extension of these survey results is found in the work of Coursey, Hovis, and Schulze [1987]. They note that in many contingent valuation surveys for public goods, *WTA* and *WTP* measures are elicited from respondents for hypothetical, potentially unfamiliar commodities. The authors conjecture that the observed three-to-one disparity between *WTA* and *WTP* measures may therefore not reflect preferences. Rather, they hypothesize that it may be due to the essential novelty and one-time nature of the choices presented to survey respondents.

To test this hypothesis, the authors develop a *repeated* bidding experiment that allows for the respondents to learn about an unfamiliar good. They find that *initial WTA* valuations are orders of magnitude (three-to-one) greater than *WTP* measures, corroborating other experiments. However, in the series of *repeated* bidding experiments, the respondents' *WTA* measures are found to decline and converge to their *WTP* measures. Such results suggest

2. The possibility of differential risk-seeking and risk-averting behavior at different levels of wealth had been recognized previously by Friedman and Savage [1948].

that *WTA* and *WTP* measures may be approximately equal when valuing *familiar* goods and services.[3]

If such status quo effects occur, they have important implications for policy makers. For example, when contingent valuation methods are used to value public goods, the survey research must explicitly recognize the potential disparity that may arise between *WTA* and *WTP* measures. Likewise, when predictions of the market acceptance of new products or programs are required, policy makers must explicitly account for the inertia that may be engendered by a status quo effect.

The purpose of this paper is to empirically investigate the existence of a status quo effect in consumer valuations of a particular unpriced product, the reliability of residential electricity service. The notion of valuing electrical service reliability and pricing the product accordingly has recently assumed importance in utility resource planning, capacity expansion, and rate making.[4]

We base our analysis on the results of a contingent valuation survey of residential customers in the Pacific Gas and Electric Company (PG&E) service territory. In the survey each customer was asked to provide *WTA* and *WTP* measures of value for service reliability, where reliability was described by the presence or absence of service disruptions (i.e., power outages) with varying attributes (e.g., season, time-of-day, duration, and the extent of advance notice). The *WTP* measure represents the dollar amount customers would be willing to pay to avoid an additional service disruption; the *WTA* measure represents the dollar amount they would be willing to accept to incur an additional disruption. In addition to these standard contingent valuation questions, each customer was presented with a menu of six alternative rate options designed to reflect varying levels of service reliability. One option characterized the reliability experience and current service contract of the customer, i.e., his/her status quo. The other five contracts offered options with varying bill discounts and altered levels of service reliability. From this menu the customer was asked to identify his/her preferred option.

Using these data, we investigate the presence of a status quo effect in two ways. First, we estimate and compare respondents' *WTA* and *WTP* measures for several levels of service reliability.

3 Brookshire and Coursey [1987] corroborate these results

4 See Chao and Wilson [1987], Doane, Hartman, and Woo [1988a, 1988b]; Munasinghe [1979], Munasinghe and Gellerson [1979]

Second, we examine and analyze respondents choices among the reliability levels offered by the six alternative rate options, one of which is the status quo. Using a choice-theoretic framework, we quantify the determinants of these choices and calculate the compensating variations required to make customers indifferent between particular options. These analytic methods and the data are discussed in Section I. The estimated models are presented in Section II.

Section III discusses our conclusions. To summarize them, we consistently find a substantial status quo effect. The *WTA* and *WTP* estimates for our sample customers differ by an order of magnitude of four to one, larger than would be expected from any reasonable income effects. These results corroborate the growing contingent valuation literature on consumer "irrationality" and the importance of the status quo [Brookshire and Coursey, 1987; Coursey, Hovis, and Schulze, 1987; Machina, 1987; Kahneman and Tversky, 1979; Samuelson and Zeckhauser, 1986). More importantly, the status quo effect is substantiated by the analysis of customer choice among reliability-differentiated service contracts. In fact, the status quo effect implied by the choice-theoretic model is even more severe. In particular, the compensation required for reliability changes is considerably higher than the *WTA* and *WTP* measures obtained from the contingent valuation analysis.

I. The Analysis

A. Analytic Framework

Figure I presents a standard indifference curve reflecting consumer trade-offs between service reliability (measured as decreased outage hours) and all other goods and services (measured as income, net of electricity expenditures). We assume that the income effect of our marginal reliability changes is small.[5] A customer is assumed to have an initial service contract (a_1-characterized by monthly bill and number of outage hours) reflecting his/her status quo. The actual service contracts are more complicated, as described later. Along I_1, the willingness to accept (WTA_1) a marginal decrease in reliability (by one outage hour) is approximately equal to the willingness to pay (WTP_1) for a

5 For our sample, electricity expenditure represents a small portion of a household's annual budget, approximately 1.3 percent ($400/$30,000).

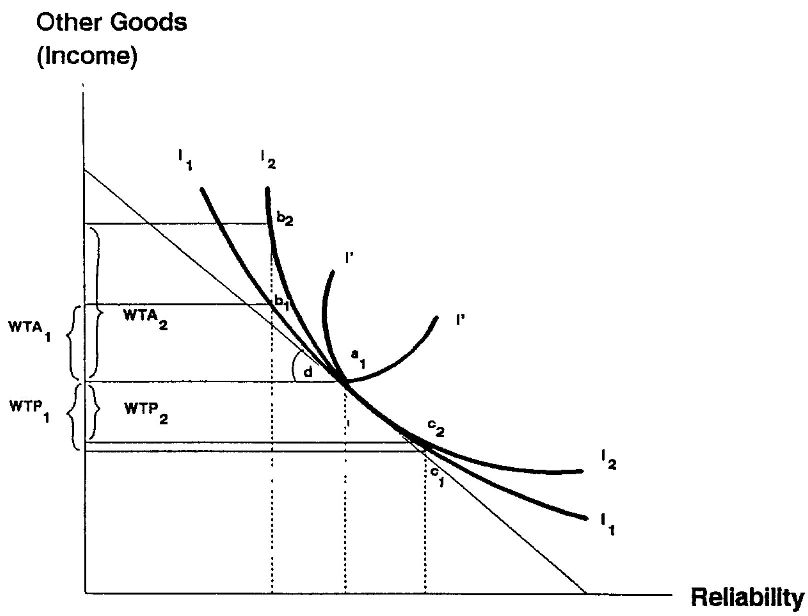

FIGURE I
Trade-offs Between Service Reliability and All Other Goods

marginal increase in reliability (by one outage hour). The slope of I_1 at a_1 is d, reflecting the relative price (or value) of reliability. If b_1 and c_1 represent alternative service contracts (alternative reliability levels and alternative monthly bills), only slight changes in the price of reliability (slope d) will be required to stimulate the customer to switch from the status quo to an alternative reliability regime (b_1 or c_1).

However, if, in the spirit of Kahneman and Tversky, the indifference curve is kinked at the status quo, I_2 obtains. In that case, the willingness to accept a one-unit decrease in reliability along I_2 (WTA_2) is substantially larger than the willingness to pay for a unit of increased reliability (WTP_2). At the same time the change in the price (value) of reliability (slope d) required to induce the customer to switch from reliability regime a_1 to either b_2 or c_2 is now much greater or much less (respectively) than along I_1.

The hypothesized kink in utility at a_1 would explain the puzzling disparity frequently observed between *WTA* and *WTP* valuations. Using a variety of analytic methods, our empirical work examines whether such a kink does indeed exist. If preferences are indeed kinked at the status quo, we should expect that *all of our methods* would consistently identify that kink.

B. Analytic Methods

A standard contingent valuation survey was used to obtain *WTA* and *WTP* measures of the value of service reliability. The survey questionnaire was mailed to a stratified random sample of 2,200 residential customers in the Pacific Gas and Electric Company (PG&E) service area. Table I presents the sample means of customer and demographic characteristics for the approximately 1,500 survey responses. The survey was stratified by geographical location to allow adequate urban-rural and climate zone variation. A high response rate (approximately 70 percent), a subsequent nonrespondent telephone survey, and a comparison of the customer demographic data with other PG&E surveys indicated that the survey data are representative. See Doane, Hartman, and Woo [1988a, 1988b].

The survey characterized the status quo (a_1) and the socioeconomic attributes of the respondents. The customers were asked to state the dollar amount they would be willing to pay (*WTP*) to avoid a service outage as well as the amount by which they must be compensated to be willing to accept (*WTA*) the outage. *WTA* and *WTP* measures were obtained for the nine outage scenarios described in Table II. Table II also summarizes the mean, median, and truncation at zero for the *WTA* and *WTP* responses. The mean is computed for customer-reported responses below the 99.5 percentile, in order to remove atypical highly influential customer responses that seem to be outliers (e.g., households that reported identical cost estimates for each of the different scenarios while not completing the rest of the survey). Our treatment of these outliers is discussed further below.

To ensure reliable *WTA* estimates, respondents were asked to identify the actions normally taken to mitigate the effect of an outage and to consider the cost of such actions when estimating their *WTA*. To facilitate this process, a list of mitigating factors was provided and included such actions as the use of candles for light, eating out, the use of a backup generator, etc. We assume that consumers would be willing to accept an amount covering these costs.

To estimate *WTP*, each respondent was asked to state the amount he or she would be willing to pay for backup generator service. This backup service was described as one that would handle all of his/her electrical needs during the outage.

TABLE I
SAMPLE MEAN OF CUSTOMER CHARACTERISTICS

Variable	N^a	Mean	Standard deviation
Income	1,281	$33,793	$14,141
Household size (persons)	1,494	2 71	1.01
Average age (years)	1,488	41 7	11 7
Number of household members 65 years or older	1,488	0.37	0 48
Average monthly electricity sales in winter (kwh)	1,501	511	262
Average monthly electricity sales in summer (kwh)	1,501	495	266
Rural	1,460	0 03	0 12
Bay area	1,501	0 71	0 32
Large city	1,460	0 32	0.33
Electric appliance owsnership			
Space heater	1,435	0 19	0 28
Water heater	1,470	0 17	0 26
Central air conditioner	1,509	0.23	0 30
Window air conditioner	1,432	0.15	0.25
Range	1,474	0.64	0 34
Security alarm	1,427	0.11	0 22
Personal computer	1,433	0.16	0 26
Video cassette recorder	1,430	0.55	0 35
Home business	1,451	0.10	0.21
Health problem	1,449	0.07	0 18
Number of household members generally at home during the day	1,445	1 29	0.81
Number of outages experienced during last twelve months	1,408	2 89	3 02

a N = Number of observations

As discussed in Schulze, d'Arge, and Brookshire [1981] and in Freeman [1982], our *WTA* and *WTP* measures may be subjected to strategic response bias. However, previous work has found such biases to be small (see Mitchell and Carson [1981], Rowe, d'Arge, and Brookshire [1980], Scherr and Babb [1975], and Smith, [1979]).

Once the *WTA* and *WTP* estimates were obtained, the custom-

TABLE II
WTA AND *WTP* MEASURES OF VALUE· CONTINGENT VALUATION SURVEY RESULTS

					Willingness to accept (*WTA*)				Willingness to pay (*WTP*)			
Scenario	Season	Time of-day	Duration	Notice	Mean	Median	% 0	Tobit	Mean	Median	% 0	Tobit
1	Winter	Evening	1 hour	none	10.75	5 00	24	10.96	2.95	1 00	43	3 13
2	Winter	Evening	4 hours	none	19 91	10 00	14	19 57	4 78	2.00	33	4 76
3	Winter	Morning	4 hours	none	12.08	3.00	37	9.22	2 99	0.14	45	3 01
4	Winter	Morning	12 hours	none	40.55	20 00	9	33 15	9.04	5 00	30	8.99
5	Summer	Afternoon	1 hour	none	3 66	0 00	61	3 63	1.64	0.00	63	1.51
6	Summer	Afternoon	4 hours	none	13.59	5.00	36	11 78	3.60	0.00	49	3.30
7	Summer	Afternoon	12 hours	none	38.03	20 00	9	37.56	8 70	5 00	32	8 52
8	Any	Any	Momentary[a]	none	1.66	0.00	69	1.44	0 16	0 00	69	0 15
9	Summer	Afternoon	1 hour	yes	2.79	0.00	64	3.01	0 98	0.00	68	1 01

a Less than five seconds

ers were stratified into two groups on the basis of their current service reliability. One group had experienced, on average, approximately three outages of two-hours' duration per year, while the second group had experienced approximately fifteen outages of four-hours' duration per year. The group with three outages accounted for approximately 90 percent of the sample.

The customers in each group were then presented with a menu of six rate options designed to reflect alternative reliability levels *as well as* their existing service reliability (i.e., status quo). The reliability contracts for the two groups of customers are presented in Table III. For each group the options were configured around the status quo reliability to represent realistic service alternatives. Each customer was asked to rank the options in order of desirability.

This part of the questionnaire was also carefully designed to avoid strategic response bias. In particular, respondents were reminded that the reliability provided by PG&E helps to determine the cost of electrical service. They were told that while PG&E cannot prevent all causes of power outages, it could spend more

TABLE III
SERVICE RELIABILITY RATE OPTIONS

A. For Households with Existing Reliability Characterized by Approximately Three Outages per Year

Option	Frequency (outages/yr)	Average duration	Change in current bill	Percent of sample choosing[a]
1	3	2 hrs	*Status quo*	60 2 percent
2	2	1 hrs	+ 5 percent	13 6 percent
3	5	2 hrs	− 5 percent	12.0 percent
4	5	4 hrs	−10 percent	4 9 percent
5	15	2 hrs	−20 percent	3 6 percent
6	15	4 hrs	−30 percent	5 7 percent

B. For Households with Existing Reliability Characterized by Approximately Fifteen Outages per Year

Option	Frequency (outages/yr)	Average duration	Change in current bill	Percent of sample choosing[a]
1	15	4 hrs	*Status quo*	58 3 percent
2	20	4 hrs	−10 percent	15 1 percent
3	15	2 hrs	+10 percent	12 7 percent
4	5	4 hrs	+20 percent	4 7 percent
5	5	2 hrs	+25 percent	3 4 percent
6	3	2 hrs	+30 percent	5 8 percent

a Percent of sample choosing the specific rate option as most preferred money to improve service, which could increase rates, or it could reduce reliability and possibly reduce rates. Therefore, information on their reliability preferences for different levels of service would be used to help plan future service. The rate options presented in Table III were listed in different orders to different respondents.

We analyze these data in two ways. First, we examine the *WTA* and *WTP* estimates for each outage scenario, focusing on sample means and distributions. We find that the average *WTA* is substantially higher than the *WTP* for each scenario, supporting the hypothesized kink at the status quo (a_1 in Figure I).

Because we also find that a substantial number of survey responses for *WTP* and *WTA* are truncated at zero (see Table II), we also perform a two-stage Tobit analysis to eliminate any truncation bias that might affect these estimates. According to the Tobit model, if the V_i (individual i's value of service reliability) are truncated in the sample at zero, then for any random individual i,

$$(1) \qquad E(V_i) = \text{prob}(V_i > 0)*E(V_i|V_i > 0) + \text{prob}(V_i = 0)*0 = \text{prob}(V_i > 0)*E(V_i|V_i > 0).$$

In the first stage of our Tobit correction, we analyze the probability that an individual's value of service reliability is positive (prob($V_i > 0$)) using a binary probit specification. In the second stage we utilize the estimated probit as the truncation-bias correction term (in the form of inverse mills ratios) in regressions ($E(V_i|V_i > 0)$) relating *WTP* and *WTA* measures to customer's demographic characteristics, his/her current reliability regime, and all attributes of the service. Because this method is fairly standard, we do not develop it here.[6]

6. For details see Doane, Hartman, and Woo [1988b]. See also Heckman [1979], Tobin [1958], and Cameron and James [1987], who have recently exploited a similar framework in analyzing truncated data generated by a "closed-end" contingent valuation of consumer willingness to pay for a recreational fishing day.

We expected that the truncation at zero would produce skewed distributions for all *WTA* and *WTP* responses, and the distributions for some outage scenarios are quite skewed For example, 69 percent of the respondents had *WTA* = 0 for a momentary outage (Scenario 8), while the mean *WTA* for the scenario was $1.66. Thus, respondents with positive *WTA* for this scenario had *WTA* measures several times the mean.

Because we carefully designed the survey instrument to reflect real valuations and because we have excluded large positive outliers, we believe that the remaining skewness is accurate In order to assess the effect of our exclusion of the large positive outliers, we tested a second Tobit formulation for the imposed truncation from above The resulting double truncation correction did not change the *WTA* and *WTP* regressions. These results are available from the authors upon request

Notice that the potential effect of these outliers is limited to the Tobit regression results reported in Table II

The "Tobit-corrected" *WTP* and *WTA* valuations corroborate the patterns found in the sample means. All *WTP* and *WTA* valuations are summarized in Table II.

As a second, more explicit test of the presence of a status quo effect, we use a probabilistic-choice model to quantify the customer preferences depicted in Figure I. We estimate the choice model using the data on customer selection of the rate options presented in Table III. Each rate option in the table offers a distinct level of service reliability characterized by the number of outages expected annually and their expected duration (denoted as Frequency (F) and Duration (D)). The associated electric bill for each rate option is denoted by Cost (C), which is measured in Table III *relative* to the status quo bill. Customers therefore have the opportunity to purchase lower reliability at reduced electricity prices (a lower bill) or greater reliability at higher prices (an increased bill). The resulting changes in the electric bill (i.e., changes in income, net of electricity charges) are assumed to summarize demand for other goods and services.

Our choice-theoretic framework follows standard lines. An individual selects his/her most preferred rate option j to maximize random utility. Representative utility is assumed to be determined by the service reliability offered with each contract, in addition to all other goods and services (measured by changes in the electric bill). In order to focus on the shape of I_2 *around* the status quo a_1 in Figure I, we "frame" representative customer utility of alternative rate option j (with attributes F_j, D_j, C_j) *relative* to the status quo (the customer's existing level of service reliability: F_0, D_0, and C_0) as

$$(2) \qquad \overline{U}_j = \overline{U}(F_j, D_j, (C_j/C_0), Z) + d_0{}^* \, ALT_0.$$

Thus, the cost effect is measured relative to the status quo monthly bill (C_0). We also include ALT_0 as an alternative-specific (or mode-specific) dummy variable denoting the status quo service option ($ALT_0 = 1$ when the alternative contract reflects the customer's current reliability regime; 0 otherwise). This mode-specific dummy allows us to test the hypothesis that there exists a status quo (SQ) effect using a simple t-test (H_0: $SQ = 0$ if $d_0 = 0$). The vector Z summarizes customer attributes.

Using (2), representative utility derived at the status quo is

$$(3a) \qquad \overline{U}_{i0} = \overline{U}_{i0}(F_0, D_0, (C_0/C_0), Z_i) + d_0{}^* \, ALT_0,$$

while the utility for any alternative reliability contract j is

$$(3b) \qquad \overline{U}_{ij} = \overline{U}_{ij}(F_j, D_j, (C_j/C_0), Z_i).$$

Because we have no strong priors on the shape of utility, we tested a full second-order approximation in F, D, C/C_0, and Z using a logit framework. As indicated by the reported estimates in Table V, we found that we could not reject the following simplified specification of utility for reliability option $j = 0, \ldots, J$:

$$(4)\quad \overline{U}_{ij} = d_1{*}F_j + d_2{*}D_j + d_3{*}(C_j/C_0) + d_4{*}(C_j/C_0){*}Z_i + d_0{*}ALT_0.$$

Using our estimates of (4), we derive the compensating variation required for changes in reliability from the status quo as follows. We seek the compensation necessary to make a customer indifferent between the status quo $\{F_0,D_0,C_0\}$ and the alternative reliability offered by rate option j $\{F_j,D_j,C_j\}$; in other words, the compensation required for $\overline{U}_{ij} = \overline{U}_{i0}$.[7] We derive that compensation as follows:

$$\begin{aligned} &d_1{*}F_j + d_2{*}D_j + d_3{*}(C_j/C_0) + d_4{*}(C_j/C_0){*}Z_i \\ &\quad = d_1{*}F_0 + d_2{*}D_0 + d_3{*}(C_0/C_0) + d_4{*}(C_0/C_0){*}Z_i + d_0{*}ALT_0. \end{aligned}$$

Hence,

$$(5)\qquad \frac{C_j - C_0}{C_0} = (-1){*}\frac{d_1{*}(F_j - F_0) + d_2{*}(D_j - D_0) - d_0{*}ALT_0}{d_3 + d_4{*}Z_i},$$

where $(C_j - C_0)/C_0$ is the proportional change in the customer's bill required to compensate him for altered service reliability $(F_j - F_0)$ and $(D_j - D_0)$. The total compensation required is therefore

$$\begin{aligned} (6)\qquad TC &= (C_j - C_0) \\ &= (-C_0){*}\{d_1{*}(F_j - F_0) + d_2{*}(D_j - D_0) \\ &\qquad - d_0{*}ALT_0\}/\{d_3 + d_4{*}Z_i\}. \end{aligned}$$

Returning to Figure I, TC measures the compensating variation required to maintain a customer's initial level of utility for reliability changes from the status quo a_1, to alternative regimes reflecting decreased reliability b_2, or increased reliability c_2. For increased reliability the implied compensation will be negative, reflecting a willingness to pay. It should be noticed that given the interactive terms (d_4), compensation measures will be heterogeneous in the population.

7. This development is equivalent to the derivation of compensating variation for quality changes in Small and Rosen [1981].

II. Empirical Results

Table II indicates that the reported *WTA* measures are uniformly three to four times larger than the *WTP* measures for all outage scenarios.[8] While the sample truncation evident in the table argues for the two-stage Tobit correction, the "corrected" Tobit measures[9] are quite similar to the sample means for all outage scenarios except 3 and 4. For all scenarios the Tobit results corroborate the three-to-four time differential between *WTA* and *WTP* measures. Both sets of results confirm the kink in household preferences in a_1 in Figure I.

Before turning to estimates of our choice model, it is interesting to note in Table III the percentage of survey respondents in each group that selected the alternative options as their most preferred choice. While there was little difference in the demographic characteristics between the two groups of households, we find that *both* groups express a strong preference for their *quite different* status quos. Approximately 60 percent of the respondents in *each* group prefer the status quo. Approximately 85 percent of the respondents in *each* group prefer the set of reliability regimes around the status quo, again in spite of the fact that the reliability levels for these sets of regimes are quite different. The average characteristics of the two respondent groups are presented in Table IV. The groups are quite similar, except for fairly minor differences in income, monthly electricity consumption (due to greater electric space heating and cooling), and rural location. As discussed below, none of these differences had a statistically significant effect upon the choice of reliability contract.

Turning to our choice model estimates, Table V reflects the preferences for the status quo. The mode-specific status quo variable (ALT_0) is consistently the most statistically significant determinant of reliability contract choice, indicating that residential customers do attach a substantial premium to their existing service level, ceteris paribus, and that they have a strong aversion toward alternative reliability options, no matter how desirable they may be based upon attributes (F and D) and cost (C). Alternative specific dummy variables for the other options proved insignificant.

8 Some of this difference may reflect a rational distinction For example, customers may believe that backup service for which they are willing to pay may not be a perfect substitute for regular service

9 The full set of Tobit regressions for *WTP* and *WTA* are described fully in Doane, Hartman, and Woo [1988b].

TABLE IV
SAMPLE MEAN OF CUSTOMER CHARACTERISTICS FOR THE TWO GROUPS OF RESPONDENTS

	Respondents experiencing approximately			
	three outages		fifteen outages	
Variable	N^a	Mean	N^a	Mean
Income	1,121	$33,301	134	$41,165
Household size (persons)	1,300	2 71	156	2.80
Average age (years)	1,299	41.7	153	39.6
Number of household members 65 years or older	1,299	0 37	153	0 27
Average monthly electricity sales in winter (kwh)	1,306	489	156	715
Average monthly electricity sales in summer (kwh)	1,306	474	156	692
Rural	1,271	0.03	157	0 09
Bay area	1,306	0 72	156	0.61
Large city	1,271	0.33	157	0 23
Electric appliance ownership.				
Space heater	1,249	0 18	152	0.29
Water heater	1,276	0 15	157	0 33
Central air conditioner	1,311	0 22	159	0.33
Window air conditioner	1,248	0 14	152	0.21
Range	1,279	0.63	157	0 76
Security alarm	1,244	0 11	151	0 19
Personal computer	1,248	0.16	152	0.17
Video cassette recorder	1,247	0.54	151	0.68
Home business	1,265	0 10	151	0.15
Health problem	1,266	0 07	149	0 09
Number of household members generally at home during the day	1,262	1.28	153	1 29
Number of outages experienced during last twelve months	1,255	2.17	133	10.9

a N = Number of observations

This predisposition for the status quo may result from familiarity and satisfaction with the current level of service; a belief that the utility will not be able to provide the actual level of service offered by the new rate options, habit, or inertia.

TABLE V
CONDITIONAL LOGIT ESTIMATION FOR SERVICE RELIABILITY CHOICE

	Model 1	Model 2
Observations	853	853
Log-likelihood	−1,118 3	−1,104.4
Log-l(slopes = 0)	−1,528 4	−1,528 4
Chi-squared	820 1	845.9
FREQUENCY	−0 47306	−0 32929
	(−5 36)	(−3 49)
DURATION	−1 19874	−0 82904
	(−5.97)	(−3 96)
COST	−25 92580	−22 41830
	(−5 97)	(−4.39)
ALT_0	1 90240	1.71610
	(23 48)	(19.96)
COST*AVGOUT		6 25528
		(4 73)

Note t-statistics for H_0 $d = 0$ are in parentheses
FREQUENCY = Number of outages per year
DURATION = Duration of outage in hours
COST = Bill discount of alternative reliability contracts relative to the status quo (equal to the monthly electricity bill of the alternative contract divided by the status quo monthly electricity bill C_j/C_0)
ALT_0 = Alternative-specific dummy variable denoting the customer's status quo service reliability ALT_0 = 1 when the alternative reliability contract is the status quo, zero otherwise
AVGOUT = Dummy variable equal to one if the household indicated its current reliability level was best characterized by three outages per year, zero otherwise (i e , household indicated its current reliability level was best characterized by fifteen outages per year)

Based on the chi-squared tests, both models have considerable explanatory power. The coefficients of FREQUENCY, DURATION, and COST are highly significant and have the correct sign. In both models the effect of DURATION is larger than that of FREQUENCY, implying that a single two-hour outage requires a greater compensation than two individual one-hour outages, all else constant.

Model 2 introduces the term COST∗AVGOUT into Model 1 in order to indicate whether the households' prior reliability experience affects required compensation. AVGOUT is a dummy variable set equal to one when a household's current reliability level was best characterized by three outages over the past year (the system average); zero otherwise (i.e., the household indicated its current reliability level was best characterized by fifteen outages over the past year). Model 2 indicates that households experiencing a larger number of outages require *lower* compensation, ceteris paribus. In both models, we were unable to reject the hypothesis that all other second-order terms were zero.

Using the parameter estimates from choice Model 2, Table VIA reports the compensating variation required for a move from a status quo of three outages of two hours each per year (Option 1) to the alternative reliability options presented in Table IIIA. Because our estimates are conditional upon the size of a household's status quo monthly electricity bill (C_0), we present compensation estimates (TC) for five monthly bill quantiles (10 percent, 25 percent, 50 percent, 75 percent, 90 percent) where the 50 percent quantile is defined as the median household.

The compensation estimates in Table VIA are derived using equation (6); they include the mode-specific status quo effect. The compensation estimates in Table VIB *net out* the mode-specific status quo variable by setting $d_0 = 0$ in equation (6). A comparison of these two sets of estimates is informative. *Netting out* the

TABLE VI

IMPLIED COMPENSATION FOR ALTERED RELIABILITY LEVELS· STATUS QUO DEFINED· AS THREE OUTAGES OF TWO-HOURS' DURATION

A Includıng Mode-Specıfic "Status quo" Effect, $ Month

From base to optıon	Attrıbutes Freq	Dur	TC by monthly bill quantıle: 10 percent	25 percent	50 percent (Medıan)	75 percent	90 percent
2	2	1	0.37	0 83	1 60	2.24	3.13
3	5	2	1.57	3 54	6 81	9.56	13.36
4	5	4	2 68	6 02	11 57	16.24	22.69
5	15	2	3 76	8 46	16 25	22 82	31.89
6	15	4	4 86	10 94	21 01	29 50	41.22

B. Nettıng out the Mode-Specıfic "Status quo" Effect, $ Month

From base to optıon	Attrıbutes Freq	Dur	TC by monthly bıll quantıle: 10 percent	25 percent	50 percent (Medıan)	75 percent	90 percent
2	2	1	−0.76	−1 73	−3.32	−4.66	−6 52
3	5	2	0.44	0 98	1 89	2.65	3 71
4	5	4	1.53	3 46	6 64	9.33	13 04
5	15	2	2 62	5.90	11 34	15 91	22.24
6	15	4	3 72	8.38	16 09	22.59	31 57

Notes Base optıon attrıbutes Freq = 3, Dur = 2
Freq = number of outages per year
Dur = average duratıon of outage ın hours
Average monthly electrıcıty bıll quantıles 10 percent = $11 15, 25 percent = $25 08, 50 percent = $48 16, 75 percent = $67 61, 90 percent = $94 48
All values are ın 1986 dollars
Negatıve compensatıon estımates ımply wıllıngness to pay

mode-specific "status quo" effect, the median household (50 percent quantile) in Table VIB would be *willing to pay* $3.32/month[10] to move from its current reliability level (three outages of two-hour duration, annually) to an *increased* reliability level (two outages of one hour, annually); this same household would require compensation of $1.89 or $16.09/month to move from its current reliability level to the *diminished* reliability of Options 3 (five outages of two hours, annually) or 6 (fifteen outages of four hours, annually) respectively.

When we include the mode-specific status quo effect (Table VIA), however, this same median household *would require a compensation* of $1.60/month to move to the *improved* reliability level offered in Option 2, *precisely* because the disutility of leaving the status quo outweighs the perceived benefit of the improved service reliability. Similarly, this same household would require compensation of $6.81 or $21.01/month to move to the diminished reliability levels of Option 3 or Option 6, respectively. For all scenarios in Table VI the compensation required for rate switching from the status quo is consistently found to be much higher than those levels required if there were no mode-specific status quo inertia. In fact, the customers must be compensated for switching reliability regimes *even when the alternative regime entails more reliable service.*[11] This suggests that the kink in utility at a_1 in Figure I is even more serious than that suggested by the disparity between *WTA* and *WTP*. Because customers must *be compensated for small increases* in reliability from the status quo, utility I' rather than I_2 is a better representation of preferences for reliability increases immediately to the right of a_1.

Furthermore, the required compensation for reliability *decreases* to the left of a_1, as suggested by the choice analysis, are higher than those suggested by the self-stated *WTA*. Evidence supporting this contention is provided in Table VII for a scenario of diminished reliability: a single one-hour outage. The sample mean *WTA* for the one-hour outage is $7.29, while the compensation implied by the choice model (including the mode-specific status quo effect) is $52.78. These estimates suggest that I' may also be a

10. We interpret a negative compensation as a willingness to pay

11 Parenthetically, Table VI also indicates a wide dispersion of implied compensation, a result corroborated in the Tobit analysis For example, households in the 90 percent monthly bill quantile require compensation approximately ten times larger than those households in the 10 percent quantile This suggests considerable customer heterogeneity

TABLE VII
A COMPARISON OF SELF-STATED *WTA* AND REQUIRED COMPENSATION (TC) FOR IDENTICAL DECREASES IN RELIABILITY ($/OUTAGE)

	Self-stated cost (*WTA*)	Total compensation including mode-specific effect
One-hour outage	7 29	52.78

Notes The one-hour outage *WTA* represents the average costs of scenarios 1 and 5 in Table II
The total compensation (equation (6)) is calculated for the median household using Model 1 in Table III The calculation assumes that the household's status quo reliability of three outages of one-hour duration per year was reduced to four outages of one-hour duration per year
All values are in 1986 dollars

better representation of consumer utility for reliability decreases to the left of a_1 in Figure I. Clearly, I' is more kinked at a_1 than I_2.

Table VIII analogously reports the estimated compensating variations required for a move from the status quo of fifteen outages of four-hours' duration to the alternative reliability regimes identified in Table IIIB. The same pattern of compensating variations found in Table VI occurs, indicating an analogous kink in utility for this quite different status quo. For example, in Table VIIIB, we find that absent the mode-specific status quo effect, the median customer must be compensated $3.54 per month for a decrease in reliability from fifteen to twenty outages per year (Option 2). When we include the mode-specific effect, the necessary compensation rises to $7.22 per month. Absent the mode-specific status quo effect, the median customer is willing to pay $3.56 per month for the *increased* reliability reflected in Option 3 (i.e., a 50 percent reduction in the average duration of each outage). However, when the mode-specific status quo effect is taken into account, this customer *must be compensated* $0.12 per month for the improved reliability, in order to overcome the status quo inertia. All customers within all bill quantiles are willing to pay for the improved reliability embodied in Options 4 through 6. However, they are willing to pay considerably less when the mode-specific status quo effect is taken into account.

III. SUMMARY AND CONCLUSIONS

Several conclusions are evident. First, our results corroborate the large disparity between *WTA* and *WTP* measures found in the literature, suggesting the hypothesized kink (along I_2) in utility at

TABLE VIII

IMPLIED COMPENSATION FOR ALTERED RELIABILITY LEVELS: STATUS QUO DEFINED AS FIFTEEN OUTAGES OF FOUR-HOURS' DURATION

A Including Mode-Specific "Status quo" Effect, $ Month

From base to option	Attributes: Freq	Attributes: Dur	TC by monthly bill quantile: 10 percent	25 percent	50 percent (median)	75 percent	90 percent
2	20	4	1.67	3.76	7 22	10.14	14.17
3	15	2	0.03	0.06	0.12	0 17	0 24
4	5	4	−0.78	−1 76	−3 39	−4 76	−6.65
5	5	2	−1 61	−3.62	−6.95	−9 76	−13.63
6	3	2	−1 94	−4.36	−8.37	−11.74	−16.41

B. Netting out the Mode-Specific "Status quo" Effect, $ Month

From base to option	Attributes: Freq	Attributes: Dur	TC by monthly bill quantile: 10 percent	25 percent	50 percent (median)	75 percent	90 percent
2	20	4	0 82	1 84	3.54	4.97	6 94
3	15	2	−0.82	−1.85	−3.56	−5.00	−6 99
4	5	4	−1.64	−3.68	−7 07	−9 93	−13 88
5	5	2	−2.46	−5.54	−10 64	−14 93	−20 87
6	3	2	−2 79	−6.28	−12.05	−16.92	−23.64

Notes Base option attributes Freq = 15, Dur = 4
Freq = number of outages per year
Dur = average duration of outage in hours
Average monthly electricity bill quantiles 10 percent = $11 15, 25 percent = $25 08, 50 percent = $48 16, 75 percent = $67 61, 90 percent = $94 48
All values are in 1986 dollars
Negative compensation estimates imply willingness to pay

the status quo. Our *WTA* measures are consistently three to four times our *WTP* measures.

Second, our analysis of the choice of reliability regime further corroborates the importance of the status quo and the hypothesized kink. Compensation levels required for reliability decreases are found to be considerably higher than was suggested by the *WTA* estimates. More importantly, customers do not seem to be willing to pay for marginal reliability increases; rather, they require *compensation* for reliability increases that involve movements from the status quo. As a result, the kink in utility implied by the choice model is substantially more severe (along I'). The fact that two fairly similar groups of households exhibit strong "kinked" preferences for quite different status quos is particularly compelling.

These results are not surprising, given other empirical literature. For example, Hausman [1979] and Hartman and Doane [1986] find consumers "irrationally" reluctant to move from the status quo. In particular, they use choice-theoretic models to analyze consumer trade-offs between capital and operating costs when deciding on the purchase of energy-efficient appliances and structures. In both cases, they find that the "implied" discount rates revealed by the consumers' choices were well above market rates of interest. This finding is consistent with the status quo effect found here.

Third, our analysis sheds some limited light on the hypothesis that more rational valuations obtain with respondent learning. The results in Table V suggest that customer experience with outages does lower the compensation required for diminished reliability, supporting the Coursey, Hovis, and Schulze [1987] experiments. If more rational valuations can be obtained through learning, it may be appropriate to ask electricity customers to select their reliability contract every year.

Finally, the usefulness of our empirical results for utility planning merits comment. The value of service reliability is used increasingly to judge the need for capacity expansion and to more efficiently price electricity services. In the process, better information about consumers' willingness to pay for reliability has been required as utilities have attempted to design reliability-differentiated services for heterogeneous customer groups.[12] We find that the *WTA*, *WTP*, and compensating variations vary significantly in the residential population. Detailed information on these heterogeneous valuations is a necessary first step for utilities interested in designing new products and services or considering adding capacity to improve the existing service quality. Furthermore, the presence of the "status quo" effect has important implications. If a utility is interested in quantifying consumers' willingness to switch to alternative service options, simple *WTP* estimates of the value of service reliability may be insufficient. In fact, such estimates may seriously *overestimate* consumers' willingness to accept alternative

12. For example, the California Public Utilities Commission explicitly recognizes the need for unbundling traditional energy services in Decision 86-012-010, December, 1986 In this decision the state utilities are allowed to negotiate rates with large natural gas users that reflect a separate rate element for their desired priority of service

reliability-differentiated service options because of the status quo effect.[13]

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13 Thıs phenomenon ıs not new The need to offer low "ıntroductory" prıces for new products to overcome status quo ınertıa ıs a recognızed busıness strategy Ignorıng status quo inertıa can be serıous The greatest marketing error ın recent decades—the substıtutıon of "new" for "old" Coca Cola—stemmed from a failure to recognıze status quo bıas See "Sayıng No to New Coke," *Newsweek,* June 24, 1985, pp 32–33.

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