

**Simplifying Difficult Calculations:  
Consumer Choice of Two-Part Tariffs**

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### **Simplifying Difficult Calculations: Consumer Choice of Two-Part Tariffs**

We investigate how consumers choose two-part tariffs. Although it is typically assumed that consumers calculate a cost, this holds true only for certain usage. When facing uncertain usage, people instead rely on simple comparisons of the overage rate, usage allowance, and flat fee attributes. This causes systematic biases in tariff choice beyond what actual cost justifies, such as excessively large usage allowances. An online calculator improved choice of the lower cost option from 65% to 80%, yet this further increased to 91% if people also had to consider a range of usage levels. Tariff biases are apparently due to information processing shortcomings, that these two decision aids address, rather than intrinsic preferences.

Firms often use nonlinear pricing plans, where the mapping from quantity purchased to total price is not a linear function. An example is a two-part tariff<sup>1</sup> which consists of a flat fee plus a per unit charge for usage beyond an allowance. We see increasing use of two-part tariffs in consumer settings such as cell phones, car rentals, car leases, broadband services, utilities, and time shares. This makes it important to understand how consumers choose two-part tariffs. Our research answers this call by detailing the decision processes consumers use, and perhaps more importantly, being the first to document decision aids that can help them make lower cost tariff choices.

Traditional economic analyses assume that consumers choose a nonlinear pricing plan based solely on an expected cost they calculate (e.g., Dolan 1987; Miravete 2003). More recent work has challenged this view by finding that consumers prefer pricing plans that offer unlimited usage for a flat rate, even if it costs less to pay on a per unit basis (Lambrecht and Skiera 2006; Train, McFadden, and Ben-Akiva 1987). The notion is that people have inherent preferences for aspects of a pricing plan, such as a flat rate. However, these preferences aside, an underlying assumption is that people still calculate and rely on an estimated cost. A possible exception is work by Nunes (2000) showing that consumers choose between flat rate and pay per use plans based largely on which plan is cheaper over a larger portion of their range of usage. Even with this cognitive shortcut, people must still calculate the usage level at which the plans cost the same. We question the assumption that consumers calculate an expected cost (or a breakeven usage level) when choosing among

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<sup>1</sup> A pure two-part tariff does not include any usage allowance with the flat fee. However, we use the term to refer to the more general class of pricing plans that include some units at no cost as part of the flat fee. This has also been referred to as a three-part tariff (Lambrecht, Seim, and Skiera 2007).

two-part tariffs. We propose that people rely instead on simpler heuristics requiring less intensive calculations.

People have trouble calculating the cost of a two-part tariff for two reasons. First, the calculation requires three mathematical operations (subtraction, multiplication, addition). For example, try estimating the cost of the following plan for 530 units of usage: \$28 for 350 units and \$0.22 for each additional unit. Second, averaging this cost calculation over all possible usage levels requires calculus-based integration. Continuing the previous example, now try estimating the expected cost if the usage varies uniformly from 300 to 700 units. The calculation becomes much harder. We confirmed this intuition with a pilot group of 172 college students (average SAT score > 1400) who estimated the average cost of six different two-part tariffs with likely overage fees. Their estimates had an average unsigned error of less than 4% for certain usage, yet over 29% for uncertain usage uniformly distributed.

Decision makers may ease this difficulty by avoiding a calculation and instead individually comparing each attribute of the two-part tariffs to form an overall cost assessment (i.e., a weighted attribute model). The attributes here would be the overage rate, the dollar amount of the flat fee, and the number of units in the usage allowance. Consumers would then weight each comparison outcome to form an overall evaluation. We find evidence that consumers rely on such heuristics to choose a two-part tariff.

Our findings make several contributions to the pricing literature. They identify the cognitive shortcuts people use when choosing a two-part tariff, much like past work has done for the choice between flat rate and pay-per-use pricing (Nunes 2000). We show that these shortcuts help explain why, beyond differences in total cost, people overprefer two-part tariffs with larger usage allowances (Lambrecht and Skiera 2006). These shortcuts also

explain why people similarly overprefer plans with lower overage rates and lower flat fees, effects not well documented in the literature. Finally, and perhaps most importantly, understanding the choice process can help researchers and marketers develop effective decisions aids. Our final study shows that simply giving people a calculator is not enough. Participants with a calculator chose the lower cost plan even more if they were also asked to consider their preferences across a range of usage levels. This study of decision aids addresses two general shortcomings in tariff research – that we know little about much tools will help consumers, and that apparent biases are rarely parsed into information processing shortcomings versus true underlying preferences.

This work differs from past approaches to tariff choice in important ways. First, we examine choices where every option is a two-part tariff. Related past work has largely focused on how people choose between flat rate and pay-per-use formats (Lambrecht and Skiera 2006; Miravete 2003; Nunes 2000; Train et al. 1987). By limiting ourselves to just two-part tariffs, we isolate preference for a particular format (such as flat rate) from preference for particular attributes of a two-part tariff. Second, past field studies have often had little variation in all of the attributes. For example, every firm and every plan in the data from a recent field study had exactly the same overage rate (Lambrecht and Skiera 2006). We use laboratory studies to systematically vary each of the attributes to complement these findings from the field. Third, to measure usage expectations, past work has either gathered estimates of the minimum, average, and maximum usage (Lambrecht et al. 2007; Nunes 2000), or inferred expected usage from choice (Iyengar, Jedidi, and Kohli 2008; Miravete 2003; Train et al. 1987). Our studies instead provide consumers full information about their

usage. This eliminates usage misestimation as a factor, and lets us focus on our primary topic of how people choose among two-part tariffs.

### **PAST WORK ON TARIFF CHOICE**

Much early work on tariff choice centered on minimizing the expected cost (Dolan 1987; Oi 1971; Train et al. 1987). These choice models typically assumed that a consumer's expected usage equals the point where the marginal price for another unit exceeds the marginal utility expected from that unit. Based on this expected usage level, consumers calculate the total cost to find the option providing the most utility. A core assumption in these approaches is that choosing requires that consumers calculate and rely on the expected cost when maximizing value. Further, even if consumers happen to misestimate the cost, the feedback provided by the bill helps them learn which plan is less expensive (Miravete 2003).

Prior work has also explored when consumers deviate from cost-based choice, most notably the "flat rate bias". The general finding is that consumers prefer paying a flat fee for unlimited usage versus paying per unit, even when it is somewhat more expensive (Lambrecht and Skiera 2006; Nunes 2000; Train et al. 1987). A number of accounts have been given to explain the preference for the flat rate pricing format. Consumers may like to have insurance against increased costs during periods of high usage (Train et al. 1987). Field data has also found that the flat rate preference is greater for consumers who want a certain total price and for those who find paying per unit diminishes their enjoyment (Lambrecht and Skiera 2006). These explanations both suggest that consumers choose a pricing plan for reasons other than just cost. Alternatively, in a more cognitive account, Nunes (2000) showed that people mistreat their usage as uniformly distributed and favor the pricing plan with the

lower cost over a larger portion of the range of usage (i.e., they compare the breakeven point to the usage range). Although this “ratio rule” may be less applicable when both options are two-part tariffs<sup>2</sup>, it still shows that people choose flat rate plans more than the total cost would justify.

In sum, the common view in the literature is that people choose a two-part tariff based largely on the expected cost, adjusted for other preferences like that for a flat rate format. This dual consideration is nicely captured by Lambrecht and Skiera (2006) when they write "the results indicate that though consumers choose their tariff on the basis of the expected billing rate, in general, they prefer flat rates because of tariff-specific characteristics" (p.221). This view assumes that people still calculate an expected cost that reflects the range of usage levels. However, there is little evidence that people spontaneously perform such a calculation. We propose that people often do not explicitly estimate the cost because of the inherent difficulty in this calculation, and that they instead adopt other cognitive shortcuts.

### **DIFFICULTY OF COST ESTIMATES**

The fact that people struggle with basic mathematical computation has been well established in the developmental psychology and marketing literatures (Gallistel and Gelman 1992; Viswanathan, Rosa, and Harris 2005). When trying to find the product with the lowest per unit price, many consumers cannot perform the calculations (Gatewood and Perloff 1973; Mitchell, Lennard, and McGoldrick 2003), or even describe the necessary calculations (Capon and Kuhn 1982). Consumers similarly find it difficult to evaluate multiple price discounts (e.g., 25% off a product already reduced 50%), tending to add rather than multiply the discounts (Chen and Rao 2007). Finally, consumers even have trouble accurately

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<sup>2</sup> For example, there could be multiple usages levels (or breakeven points) where the total costs are equal.

recalling the price of a product when a surcharge such as shipping and handling has been partitioned out (Morwitz, Greenleaf, and Johnson 1998). Across these findings, it seems that consumers have difficulty evaluating prices when they require further computation.

Two-part tariffs inherently require that consumers make a calculation to find the total cost, but the difficulty of this calculation will depend on the usage level. When there is little in overage fees (i.e., usage is below or near the usage allowance), consumers can reasonably estimate the cost by starting with the flat fee that is given and possibly adjusting slightly upwards. However, if the overage fees are sizable (i.e., usage is well above the usage allowance), then the flat fee becomes less informative about the total cost and a calculation is needed. The formula for the total cost equals the flat fee plus overage fees calculated as the overage rate times the excess of usage over the usage allowance. We expect consumers will find this calculation for certain usage challenging, yet perhaps still manageable for some.

Although the aforementioned calculation is non-trivial, it becomes much more difficult in typical usage situations. First, when choosing among numerous alternatives, consumers must remember the estimated cost of one pricing plan while performing the calculations necessary to estimate the price of other plans. Second, when there is uncertainty about usage, the formula for determining the expected cost becomes quite complex and requires integration from calculus.<sup>3</sup> Consumers generally cope with difficult cognitive tasks by finding a cognitive shortcut or avoiding the task altogether (Bettman, Luce, and Payne 1998; Viswanathan et al. 2005). Here, in the case of a two-part tariff, this means consumers will often not attempt to calculate the expected cost when uncertain about their usage. This

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<sup>3</sup> For example, in the fairly simple case of uniform usage across a range, the expected cost equals  $(\text{FlatFee} * (\text{UsageAllowance} - \text{MinUsage})) / (\text{MaxUsage} - \text{MinUsage}) + (\text{FlatFee} * (\text{MaxUsage} - \text{UsageAllowance}) + 0.5 * \text{OverageRate} * (\text{MaxUsage}^2 - \text{UsageAllowance}^2) - \text{OverageRate} * \text{UsageAllowance} * (\text{MaxUsage} - \text{UsageAllowance})) / (\text{MaxUsage} - \text{MinUsage})$ .

prediction may seem intuitive in some ways, yet past work has often described the decision processes people use as being anchored in an expected cost calculation (Dolan 1987; Lambrecht and Skiera 2006; Miravete 2003). We posit that the validity of this view will depend on usage uncertainty, or put more formally:

**H<sub>1</sub>:** Consumers are less likely to calculate and base their tariff choice on an estimated cost when they are uncertain about their usage.

### **SIMPLER CHOICE HEURISTICS**

If consumers do not calculate an estimated cost, what heuristics could they use to choose among two-part tariffs? Prior research suggests consumers frequently rely on a single dimension (Viswanathan et al. 2005), a few simple rules combined in an additive fashion (Capon and Kuhn 1982; Chen and Rao 2007), or the extent of “wins and losses” over the decision attributes (Alba and Marmorstein 1987; Russo and Doshier 1983; Weber, Goldstein, and Barlas 1995). These approaches all involve consumers making comparisons on individual attributes, and then integrating these comparisons into a single evaluation.

When deciding which attributes to compare, consumers tend to use alignable and evaluable ones. Alignability occurs when there is a correspondence between two attributes of different options (Markman and Medin 1995; Zhang and Markman 2001), such as sharing semantic meaning or a unit of measure. Evaluability means it is easy to judge if an attribute value is good or bad (Hsee 1996), typically by comparing it to an available alternative. We expect consumers to focus on the three alignable and evaluable attributes that define a two-part tariff: (1) the dollar amount of the flat fee; (2) the usage allowance included with the flat fee; and (3) the overage rate per unit for additional usage.

Consumers can compare pricing plans on these attributes, without regard to the usage level, using a simple set of rules. Specifically, these rules should favor smaller flat fees, larger usage allowances, and lower overage rates. We propose that people often rely on the outcomes of these attribute comparisons to judge which two-part tariff has a lower cost. Because consumers are less likely to estimate the cost for uncertain usage, we expect them to rely on these attribute comparisons primarily when usage is uncertain.

**H<sub>2a</sub>:** When usage is certain, tariff choice reflects consumer estimates of the cost more than simple attribute comparisons.

**H<sub>2b</sub>:** When usage is uncertain, tariff choice reflects the simple attribute comparisons more than either an estimated (or actual) cost.

Although people may use these attribute comparisons, this does not mean people will not still have other intrinsic preferences. For example, people may like plans with very large usage allowances because they provide a guaranteed maximum price, avoid overage fees that detract from enjoyment during consumption, or reduce search effort (Lambrecht and Skiera 2006). However, we suggest that some of these apparent “intrinsic preferences” may actually be attributable to the cognitive processes people use rather than an intentional choice. In particular, we predict that the use of simple attribute comparisons leads people to overprefer plans with favorable attribute comparisons, beyond what is justified by the difference in total cost.

**H<sub>3</sub>:** When usage is uncertain, the three attribute comparisons still account for tariff choice even after adjusting for total cost.

We propose that consumers generally weight some attribute comparisons more than others. In particular, one robust finding is that people exhibit loss aversion whereby avoiding

a given loss is preferred more than acquiring a gain of equal size (Kahneman and Tversky 1979; Thaler 1980). If consumers see overage charges as a “loss”, and they are overly concerned with avoiding losses, then they will favor plans offering a larger usage allowance and a lower overage rate at the expense of a higher flat fee. Here, a higher flat fee is the accepted cost of insurance to limit exposure to potentially unlimited overage fees. Therefore, we predict consumers will give more weight to the attribute comparisons involving the usage allowance and overage rate versus the flat fee because the first two attributes protect against overage fee losses. More formally, we predict the following:

**H<sub>4</sub>:** When usage is uncertain, consumers give more weight to comparisons on the overage rate and usage allowance than the flat fee.

Two empirical studies support our predictions and find evidence for the proposed process of simple attribute comparisons. The first study finds that in the simpler case of certain usage, people chose largely in accordance with the total cost. In contrast, when uncertain about their usage, people instead relied more on simple comparisons of the three attributes. The use of these cognitive shortcuts led people, after adjusting for differences in total cost, to over prefer plans with lower overage rates, lower flat fees, and higher usage allowances. These preferences did not appear when usage was certain. The second study explores how to help people overcome these tendencies and choose more in line with total cost. We find that an online calculator helps people choose the lower cost plan more often even when usage is uncertain. However, we find that choices are further improved in the economic sense by also encouraging people to use this calculator at low, medium, and high levels of usage. It appears that consumers need help with both the simple mathematical

operations at a single usage level (i.e., the calculator), as well as the integration of cost differences across the range of usage (i.e., evaluate at multiple points).

## STUDY 1

### Method

We gathered choices and cost estimates for two-part tariff plans from 168 undergraduates participating in exchange for \$5 of compensation. Participants were told that they would be taking various days trips for which they would need to choose a rental car. They were then given an explanation and examples of how to calculate the total cost of two-part tariffs like those used in rental car pricing. Participants next chose one of two pricing options for each of 32 trips. They were given the pricing for each option (e.g., \$27 covers first 120 miles, \$0.14 for each additional mile), as well as the length of each trip in miles.

The details for the tariffs in each choice were constructed by randomly selecting from the pricing plans shown in Appendix 1. These 24 pricing plans were created to reflect a range of total cost levels (\$55, \$62), quantity discounts or premiums (rate per unit: decreasing, equal, increasing), and usage allowances relative to the expected usage (150 less, 50 less, 50 more, 150 more). We removed any pairings that consisted of identical plans, that differed on only the overage rate, or that had the same usage allowance that exceeded the expected usage level (such that no overage for either plan). This left 240 of the 288 possible pricing plan pairs, of which each participant viewed 32 random pairs.

The length of each trip was explicitly given to eliminate any bias in usage estimation. Although each trip was expected to be 250 miles, this was not evident to participants because the stimuli underwent a random “currency conversion”. Specifically, a conversion rate for

each trip was randomly chosen from a uniform distribution between 1 and 2. Mileage measures were divided by this conversion rate, and prices were multiplied by this conversion rate. The resulting usage allowance, flat fee, and overage rate were rounded to the nearest tens unit, dollar, and penny respectively. In essence, this currency conversion simply changes the absolute numbers shown for the stimuli without changing either the nature of the choice, the relative difference between the plans on each attribute, or the total cost of each plan.

To test our predictions, uncertainty in the trip length was manipulated between subjects. Half of the participants were given an exact length of each trip that was always 250 miles (pre-conversion). The other half of the participants were told the length of the trip was equally likely to fall anywhere between 175 and 325 miles (pre-conversion). We choose a uniform distribution of usage because it is one of the simplest distributions to understand.

After the final choice, participants were asked two questions about their choice process. First, to see if people spontaneously mention estimating a cost, participants were asked to describe how they made their choices. Second, to see if some attribute comparisons were weighted more than others, participants rated the importance of the following when choosing a plan: “A small daily rate (before any charges based on actual driving)”; “A daily rate that includes a large number of miles”; and “A low rate for driving any miles beyond the included miles”. These questions were designed to capture the importance of the flat fee, the usage allowance, and the overage rate respectively. Participants indicated the importance of each attribute using a seven-point scale (1 = “Not Important” and 7 = “Very Important”).

Finally, we also asked participants to estimate the total cost of the 24 plans in Appendix 1 based on their expected usage. As with the choices, the random “currency conversion” was employed to hide the fact that the trips were all the same length of 250

miles. The uncertainty of the usage for this estimation task matched the condition used for the choices. These explicit estimates will let us assess how well cost estimates can account for the choices made.

## Results

*Plan Choice.* Before performing any analysis, we removed the data for choices where people had an extremely large error in the cost estimate to reduce the influence of outliers (top 5% of deviation from actual cost when averaged for the two plans). The remaining 5,107 choices were analyzed using a repeated-measure binary logit choice model. The model included the estimated total cost, the flat fee, the overage rate, and the usage allowance. We also included the actual total expected cost (by integrating the total cost across all usage levels) to allow testing for biased choice in the economic sense. We coded these variables (and those in all models) as percentage differences using the larger of the two values as the dominator to facilitate comparisons of the resulting coefficients. The model also included a class variable for usage uncertainty, and its interactions with the other five factors in the model.

The results indicated main effects for the actual cost ( $\chi^2(1) = 91.16, p < .0001$ ), the usage allowance ( $\chi^2(1) = 17.09, p < .0001$ ), and the overage rate ( $\chi^2(1) = 21.89, p < .0001$ ). There were no main effects for the estimated cost ( $\chi^2(1) = 0.95, p > .32$ ), or the flat fee ( $\chi^2(1) = 0.48, p > .48$ ). However, the main effects were qualified by an interaction with uncertainty for the actual cost ( $\chi^2(1) = 21.51, p < .0001$ ), the flat fee ( $\chi^2(1) = 4.34, p < .04$ ), the usage allowance ( $\chi^2(1) = 9.82, p < .01$ ), and the overage rate ( $\chi^2(1) = 18.59, p < .0001$ ), but not the estimated cost ( $\chi^2(1) = 1.15, p > .28$ ). Participants relied more on the attribute comparisons, and less on the actual cost, when usage was uncertain versus certain (see model 1 in Table 1).

For uncertain usage, even after adjusting for differences in estimated and actual total cost, participants preferred more favorable simple comparisons on the attributes in support of H<sub>3</sub>. None of the effects of favorable comparisons were present for certain usage, presumably because participants could better estimate the cost.

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Insert Table 1 here

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We used the AIC statistic to assess how well other models also fit the choice data. We first compared models with just the estimated cost, just the actual cost, or just the three attribute comparisons (models 2, 3, and 4 in Table 1). Actual cost outperformed estimated cost (i.e., a lower AIC) whether usage was certain ( $AIC = 2,871$  vs.  $3,292$ ) or uncertain ( $AIC = 3,286$  vs.  $3,481$ ). We attribute this to the fact that participants may have used heuristics other than a specific cost calculation that are still somewhat diagnostic and correlate with actual cost. More importantly, the three attributes model performed the best for uncertain usage ( $AIC = 3,258$ ) even though it performed the worst for certain usage ( $AIC = 3,402$ ). Thus, as predicted in H<sub>2a</sub> and H<sub>2b</sub>, participants relied on attribute comparisons more than the total cost for uncertain usage, and vice versa for certain usage.

*Use of Attribute Comparisons.* We next analyzed participants' descriptions of their decision process. A person was coded to have made a calculation if they used any word that implied a mathematical operation (e.g., calculate, compute, estimate, math, add, or multiply). The descriptions were also coded for any mention of a comparison between the flat fees, the usage allowances, or the overage rates. As predicted in H<sub>1</sub>, uncertain usage led to fewer participants making a calculation ( $M = 41\%$  vs.  $74\%$ ,  $\chi^2(1) = 18.34$ ,  $p < .0001$ ). The participants not making a calculation were instead more likely to mention comparisons of the

flat fee ( $M = 16\%$  vs.  $3\%$ ,  $\chi^2(1) = 9.34$ ,  $p < .01$ ), the usage allowance ( $M = 48\%$  vs.  $16\%$ ,  $\chi^2(1) = 20.12$ ,  $p < .0001$ ), and the overage rate ( $M = 22\%$  vs.  $10\%$ ,  $\chi^2(1) = 5.42$ ,  $p < .02$ ).

This is direct evidence that participants often rely on attribute comparisons in place of more difficult cost estimates.

We further focused on the decision process by looking at participants' ratings of attribute importance. First, we analyzed the importance ratings using a 2 (usage: certain or uncertain) x 3 (attribute rated: flat fee; usage allowance; overage rate) repeated-measures ANOVA with the factors being between-subjects and within-subjects respectively. As predicted in H<sub>4</sub>, there was a main effect of the attribute ( $F(2, 163) = 35.74$ ,  $p < .0001$ ) as participants rated the flat fee ( $M = 3.9$ ) to be less important than the usage allowance ( $M = 4.8$ ;  $t(164) = 45.07$ ,  $p < .0001$ ) and the overage rate ( $M = 5.0$ ;  $t(164) = 67.60$ ,  $p < .0001$ ). There were no other significant factors (all  $p > .05$ ), though the importance ratings tended to be somewhat higher when usage was uncertain ( $F(2, 163) = 2.96$ ,  $p < .09$ ) presumably because these participants had just used these comparisons more when making their choices. Second, we analyzed if the importance ratings could explain how much people relied on the attribute comparisons for choice. We reran the initial choice model (model 1) after adding the three importance ratings and the interaction of each rating with the associated attribute comparison. As expected, importance rating interactions were found for the flat fee ( $\chi^2(1) = 17.91$ ,  $p < .0001$ ), the usage allowance ( $\chi^2(1) = 17.49$ ,  $p < .0001$ ), and the overage rate ( $\chi^2(1) = 4.41$ ,  $p < .04$ ). Attribute comparisons influenced choice more for participants who deemed comparisons on that attribute to be more important<sup>4</sup>.

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<sup>4</sup> A separate analysis that replaced the attribute importance rating with the process description coding for whether a particular attribute was compared found similar results.

*Use of Ratio Rule.* Although the previous findings support our proposed process, we also tested whether choices could be explained by the ratio rule proposed by Nunes (2000). We started by finding the breakeven usage level at which the total cost between the two plans was equal<sup>5</sup>. We then calculated the ratio rule as (maximum usage minus the breakeven point) divided by (breakeven point minus the minimum usage). Because this formula requires a range of usage, we obviously had to limit this analysis to just participants in the uncertain usage condition. Finally, before analyzing the data, we also removed records with extremely large values for the ratio rule (the largest 5%) since this value is theoretically unlimited and could skew the results.

We then reran the last choice model with the importance ratings after adding a term for the ratio rule. We also included an additional factor for the minimum amount of overage expected across the two plans, and its interaction with the ratio rule and the three attribute comparisons. We expect that when one of the plans is not likely to have any overage, then this choice is similar to having a flat rate option like those used by Nunes (2000), and people are more apt to rely on the ratio rule. However, when both plans might have overage, then the ratio rule will be harder to apply, and the attribute comparisons will be relied upon more. The model supports this process. There was a main effect of the ratio rule ( $\beta = 0.37$ ,  $\chi^2(1) = 10.21$ ,  $p < .0001$ ), but the effect of the ratio rule diminished as the minimum overage increased ( $\beta = -1.06$ ,  $\chi^2(1) = 7.26$ ,  $p < .0001$ ). In contrast, increases in the minimum overage increased the coefficients for the usage allowance ( $\beta = 8.99$ ,  $\chi^2(1) = 15.09$ ,  $p < .0001$ ) and the overage rate ( $\beta = -9.33$ ,  $\chi^2(1) = 9.48$ ,  $p < .0001$ ), but not the flat fee ( $\beta = -0.94$ ,  $\chi^2(1) = 0.14$ ,  $p > .71$ ). The lack of a finding for the flat fee may be because this is the only attribute that

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<sup>5</sup> We used the smallest breakeven level in cases where there was more than one breakeven usage level.

does not help reduce overage fees. Regardless, the overall pattern suggests that participants employed the ratio rule only if one of the options had little chance of incurring overage, but relied largely on the attribute comparisons when both choices likely had overage.

## Discussion

The current findings make it clear that people do not rely solely on an estimated cost when choosing between two-part tariffs. People apparently find this calculation too difficult when there is a lot of expected overage or uncertainty about their usage. Of course, in most settings, consumers do have uncertainty about usage. This means that the typical view in the literature that people calculate a cost and adjust for other plan preferences is not what people are actually doing in most choices. In place of a cost calculation, people instead rely on other simpler heuristics such as comparisons of the three attributes. Unfortunately, the use of these heuristics leads to systematic shifts in preference that do not minimize the expected cost. It seems that the cognitive process people adopt to deal with a difficult problem leads them to prefer a plan comparing favorably on things other than total cost. Thus, while people may choose a higher cost tariff for conscious reasons (like avoiding overage charges that detract from enjoyment), these biases also seem to result from an inadequate decision process. The next study will provide decision aids to help distinguish these two possibilities.

The simplifying heuristics people use depends on the context. When usage is certain, although people often estimate the total cost, the best model of choice was still the actual cost. We would posit that a common approach may be to estimate just the difference in cost rather than the cost of each plan, as joint evaluations are often easier than separate evaluations (Hsee 1996). When usage is uncertain, people instead rely on simple

comparisons of the attributes more than any cost calculation. This subsequently causes people to prefer two-part tariffs with smaller flat fees, larger usage allowances, and lower overage rates more than is justified by actual differences in cost. We find some support that people also choose on the basis of the ratio rule (Nunes 2000) in the special case of at least one of the plans being very unlikely to have overage. It seems how people choose a tariff depends on the difficulty of the calculations, and that no single generalization about the process can be made. That being said, many (most) real-world settings will involve uncertain usage and multiple plans with the potential for overage, suggesting that simple attribute comparisons will be a very common way consumers choose a tariff in practice.

We also found some process evidence that people rely on attribute comparisons for choice. First, when asked to describe the process they used, people spontaneously mentioned these attribute comparisons. This was true especially when they were uncertain about their usage. Second, the biasing effect of each attribute comparison was greater as people believed that a favorable outcome on that attribute was more important. People chose as if they compared each attribute and then assigned it a relative importance weighting. The usage allowance and overage rate attributes were generally viewed as more important than the flat fee. We attribute this to people's desire to limit their exposure to overage charges and out of pocket losses.

## **STUDY 2**

The previous study established that people show biases in tariff choice partially because they employ an inadequate decision method. This suggests that helping consumers choose better will require changing the process. In the previous study, participants chose the

lowest cost plan only 70% of the time even though random guessing would give 50%. This improved to only 73% when considering just the people who said they made a calculation. Thus, when left to their own devices, people seem to have trouble choosing the two-part tariff with the lowest cost even if they try to estimate the cost.

We propose that two things make calculations difficult: performing the mathematical operations and incorporating uncertainty. As such, we expect an online calculator will help only with the former, and considering a range of usage possibilities is necessary for the latter. This means that having a calculator will lead people to choose the lower cost plan more often, but the effect of a calculator would be even further enhanced if the plans are also evaluated across the range of usage. We formalize these predictions below.

**H<sub>5</sub>:** Providing consumers a total cost calculator increases their choice of the plan with the lowest actual cost.

**H<sub>6</sub>:** For consumers using a total cost calculator, encouraging them to consider a range of usage levels further increases choice of the lowest cost plan.

This study examines the effectiveness of these decision aids (calculator and considering a range of usage) in isolation and in combination. This not only tests our predictions, but also identifies ways to help consumers improve their decision making from the standpoint of minimizing the expected cost. Providing decision aids also helps us understand the extent to which tariff biases reflect an inability to identify the lower cost plan versus intrinsic preferences.

Method

Three hundred and thirteen undergraduates completed this study for undergraduate course credit. The design replicated the previous study with four important changes. First, we included only uncertain usage because this is the hardest for people to calculate and the most common situation in practice. Second, we provided some participants decision aids to see if this helped them pick the lower cost plan. These included an online calculator that reported the total cost of each plan for any input usage level, and forcing people to first choose the plan they prefer at each of the minimum, average, and maximum usage levels. Participants received these decision aids according to a 2 (online calculator: absent; present) x 2 (choices across range: absent; present) between-subjects design. Third, we changed the process questions to further explore why people prefer a favorable comparison on a particular attribute. Previous work has identified the insurance, taxi-meter, and convenience effects as drivers of the flat rate bias (Lambrecht and Skiera 2006). To see if these considerations underlie the reliance on particular attribute comparisons, we had people rate their agreement (1 = “Strongly Disagree” and 7 = “Strongly Agree”) with statements assessing the importance of these three effects (see Appendix 2). Fourth, we did not gather any estimates of the cost as this variable did not account for much of choice and a calculator would eliminate the need for estimation. These changes achieve several objectives: replicating our results, gauging if decision aids lead to lower cost choices, and providing further insight into the process.

## Results

*Lower Cost Choice.* We first analyzed whether the decision aids helped people choose the lower cost plan. A repeated-measures binary logit model on choice of the lower cost plan

included factors for the presence of the two decision aids and their interaction. There were main effects for the online calculator ( $\chi^2(1) = 128.21, p < .0001$ ) and requiring choices across the range ( $\chi^2(1) = 20.96, p < .0001$ ), as well as an interaction ( $\chi^2(1) = 21.45, p < .0001$ ).

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Insert Figure 1 here

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Planned contrasts revealed the nature of the effects as shown in Figure 1. When left to their own devices, participants chose the lower cost plan just 65% of the time. Providing only an online calculator helped participants choose the lower cost plan 80% of the time, a significant increase from the case without decision aids ( $\chi^2(1) = 39.31, p < .0001$ ). In contrast, only requiring choices across the range led participants to still choose the lower cost plan just 65% of the time, the same rate as without any decision aids ( $\chi^2(1) = 0.01, p > .94$ ). However, requiring choices across the range did help if participants also had the online calculator as they chose the lower cost plan 91% of the time, a significant increase from the case with just the online calculator ( $\chi^2(1) = 27.38, p < .0001$ ). In isolation, an online calculator led to lower cost choices while considering a range of usage levels did not. However, the decision aids had a synergistic relationship as a calculator helped more when people also considered a range of usage levels. This pattern of results confirms H<sub>5</sub> and H<sub>6</sub>.

*Plan Choice.* We next tested the influence of attribute comparisons using a repeated-measures binary logit model on the plan chosen, as in the previous study. The model included differences for the actual cost and the three attribute comparisons. The model also included two between-subjects factors for the presence of the online calculator and choices across the range, as well as their interactions with the other factors in the model. The analysis found a main effect of the actual cost ( $\chi^2(1) = 223.90, p < .0001$ ) that was qualified by

interactions with having an online calculator ( $\chi^2(1) = 95.58, p < .0001$ ), making choices across the range ( $\chi^2(1) = 18.50, p < .0001$ ), and having both of these decision aids ( $\chi^2(1) = 24.32, p < .0001$ ).

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Insert Table 2 here

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The estimated coefficients in Table 2 show that people's reliance on the actual cost largely mirrored the results for choice of the lower cost plan. Having just an online calculator led people to choose on the basis of cost more than without decision aids ( $\chi^2(1) = 17.66, p < .0001$ ), while just making choices across the range did not ( $\chi^2(1) = 0.97, p > .32$ ). However, making choices across the range further increased reliance on cost when a calculator was already available ( $\chi^2(1) = 22.46, p < .0001$ ).

The analysis also found support for reliance on the attribute comparisons as predicted in H<sub>3</sub>. There were main effects for the overage rate ( $\chi^2(1) = 15.62, p < .0001$ ) and the usage allowance ( $\chi^2(1) = 40.35, p < .0001$ ). There was not a statistically significant effect for the flat fee ( $\chi^2(1) = 0.39, p > .53$ ). Although we expected the flat fee comparison to influence choice as in the previous study, the lack of this one finding is not entirely surprising. We predicted in H<sub>4</sub> that the flat fee comparison would be the least important because it does little to protect against overage fees.

There were also not any interactions between the presence of the decision aids and the three attribute comparisons (all  $p > .10$ ). This suggests that even though the decision aids increased reliance on the actual cost, the attribute comparisons still seem to influence choice. Although the coefficients for the attribute comparisons do not decrease to zero when decision aids were provided, the coefficient for the actual cost does increase by nearly a factor of four. Given the formula for the marginal mean in a logit choice model, this indicates that the

influence of an attribute comparison did go down for a given difference in cost as it contributed relatively less to the overall utility. Put another way, when given the two decision aids, a small change in actual cost tended to dominate any favorable attribute comparisons. However, when the actual cost was nearly the same, the attribute comparisons seemed to function as a tiebreaker (especially the usage allowance).

*Reasons for Attribute Preference.* Our final analysis explored if the attribute comparison effects were linked to the insurance, taxi-meter, and convenience effects proposed in past work (Lambrecht and Skiera 2006). We created an index for each factor in Appendix 2 (Cronbach's alphas were .50, .71, and .83 respectively). These three indices were added to the choice model, as well as the interactions of each index with the other factors in the model.

The results indicated the presence of interactions. A desire for insurance increased reliance on both the overage rate ( $\chi^2(1) = 4.17, p < .05$ ) and the usage allowance comparisons ( $\chi^2(1) = 5.22, p < .03$ ). Consistent with our story, participants wanted favorable comparisons on these two attributes as protection against overage fees. This suggests that the insurance effect found in past work (Lambrecht and Skiera 2006) is driving how much people weight the attribute comparisons, which subsequently leads to choice behaviors like the flat rate bias. However, the effect of the decision aids on choice indicates that this insurance effect is driven by an information processing shortcoming as well as any intrinsic preference. The analysis did not find any other significant interactions (all  $p > .05$ ).

## Discussion

We again found evidence that people prefer two-part tariffs with favorable comparisons on the usage allowance and overage rate, beyond what is justified by their effects on total cost. Process measures further showed that reliance on these two comparisons was greatest for people wanting insurance against overage fees. It appears that people wanted larger usage allowances and lower overage rates to protect them against the losses created by potentially high levels of usage. Although people often could not completely eliminate overage fees in our choices, they could reduce their exposure to the potentially unlimited overage fees by ensuring favorable comparisons on these two attributes.

Unlike the previous study, we found little evidence that people relied on the flat fee comparison. We attribute this to the fact that people believe the flat fee is the least important because it provides little protection against overage fees. Interestingly, the flat fee might be the most important attribute because that financial commitment cannot be recovered when usage is low. However, people think it best to view a higher flat fee as insurance against overage charges. This suggests that consumers might improve their decision making by focusing more on the unrecoverable cost of the flat fee to counter the natural allure of a larger usage allowance.

Our decision aids indeed helped people choose lower cost plans. Not surprisingly, an online calculator improved people's choice of the lower cost plan from 65% to 80%. It seems that when people can easily find the total cost of each plan, they choose much more in line with cost rather than some other tariff preferences. This provides evidence that a portion of the tariff preferences we see, such as the flat rate bias (Lambrecht and Skiera 2006; Train et al. 1987), is attributable to the cognitive shortcuts adopted to deal with the difficulty of the necessary calculations. However, even with the calculator, people still chose the higher cost

plan 20% of the time. We attribute this to two reasons: (a) people likely still rely on heuristics for plans with similar cost (Lambrecht and Skiera 2006); and (b) people are not sure what usage levels to plug into the calculator. In support of the latter explanation, choice of the lower cost plan improved to 91% when people were also forced to think about what they would choose at a low, medium, and high level of usage. We propose that people naturally think about times of heavy usage and the potential overage fees, but neglect the foregone gain of choosing a plan with a smaller flat fee when usage is low. Although the decision aids increased choice of the lower cost plan, the preferences for favorable attribute comparisons still tended to linger. We suggest that the comparisons are hard to ignore as cues and may have still served as a sort of “tiebreaker”.

## GENERAL DISCUSSION

Past research on nonlinear pricing has typically assumed that consumers perform some total cost calculation to make a choice. We find, however, that consumers often do not spontaneously perform such calculations. Two studies demonstrate that consumers instead rely on simple comparisons of the three attributes that define a two-part tariff. In effect, consumers allow their preferences to be influenced by a set of simple comparisons such as “Which plan has the lower overage rate?” Although these cues generally point to the lower cost plan, they also lead people to prefer two-part tariffs with a smaller flat fee, a larger usage allowance, and a lower overage rate more than the cost justifies. This is because people deal with each individual cue one-at-a-time and ignore the fact that actual costs demand a more complicated treatment that requires combining the individual cues in not only an additive but also a multiplicative fashion.

We find that these comparisons influence choice primarily when expected usage is uncertain, and people especially rely on the comparisons of the usage allowance and overage rate. We attribute this pattern of findings to: (a) the increased difficulty of performing calculations when usage is uncertain; (b) the ease in comparing the attributes independent of usage; and (c) beliefs about the greater importance of attributes that limit the extent of out-of-pocket fees. We also find that providing decision aids causes people to choose the lower cost plan more often. In particular, an online calculator helps one manage the mathematical operations, and considering how preference changes across a range of usage levels incorporates usage uncertainty. These decision aids together helped people pick the lower cost plan 91% of the time, close to the maximum possible of 100%.

We have outlined a general process for choosing among two-part tariffs. This process provides an additional account for some well-established phenomena such as the flat-rate bias (Lambrecht and Skiera 2006; Nunes 2000; Train et al. 1987). It also explains similar, yet previously unidentified, effects that we find for the overage rate and the flat fee. We have also highlighted the role of cognitive processes and beliefs in tariff choice. In the simplified case of certain usage, or when they have decision aids to help them, people choose largely in accordance with the actual cost. This suggests that some of the tariff biases that we see are partially caused by the use of simplifying heuristics rather than solely an inherent preference. However, when facing the more typical situation of uncertain usage without a decision aid, people over rely on simple comparisons of the attributes. They generally believe it is more important to get a lower overage rate and larger usage allowance to limit additional out-of-pocket costs, even if it means also having the sunk cost of a higher flat fee.

It is worth noting several potential boundary conditions for our findings. First, participants may have exerted less effort on these tasks because their decisions in the lab had no actual economic consequences. Even so, people took a reasonable amount of time to make each choice across the two studies (median time of 21 seconds). Future research could explore whether increased effort reduces these biases, and in particular, the types of choices for which it helps. Second, our studies examined only the initial choice. When repeatedly making choices, consumers may learn over time that a different choice would cost less (Miravete 2003). Future research should understand the types of feedback that facilitate this learning (e.g., large overage fees in the past). Third, the usage allowance ranged from 40% to 160% of expected usage in our stimuli. At some point, providing a much larger usage allowance provides no value since usage will never exceed it. Fourth, we explicitly provided participants their expected usage. In many real-world situations, where usage patterns are likely more complicated than a uniform distribution, consumers may know little about their usage pattern. We speculate that people will exhibit a greater aversion to overage fees and rely even more on attribute comparisons in these settings due to the great amount of usage uncertainty. In the extreme case, people may even completely avoid two-part tariff pricing formats if they cannot reasonably estimate their usage and its cost. Future research should explore how people generate expectations about their usage and apply it to a two-part tariff choice.

Future work could also explore when people will not rely on these attribute comparisons. We find that they do not matter when people are certain about their usage. Previous work by Iyengar et al. (2008) suggests other conditions where attribute comparisons may be relied upon less. The setting in that work included three choices which may have

made the comparison cues less clear since there are two different comparisons for each attribute. It also had additional attributes (like brand) that were not alignable and may have been hard to integrate with the results of the three attribute comparisons. It also used more extreme differences in attributes (e.g., usage allowance varied by a factor of 20), suggesting a potential boundary condition of our process model. Future work should tease out whether these factors cause people to rely less on attribute comparisons, and if so, what decision process they use instead. It is likely not a calculated cost estimate given our findings. Similarly, different settings are likely to influence the weights people assign to each attribute comparison (e.g., perhaps less weight on overage rate in category where overage fees are commonly incurred).

Future work should also explore the optimality of pricing in the market given our results. For example, we do not completely endorse the pricing plans typically offered in the cellular telephone market. It is the case that the observed preference for larger usage allowances anticipates the fact that consumers generally purchase cellular plans that far exceed their average usage (U.S. Wireless Customer Satisfaction Study 2008). However, counter to most cellular plans that have quite high overage rates, our results suggest lower overage rates might increase market share even if the overage rate is unlikely to apply. We speculate that firms may use their current pricing because they believe that consumers choose larger plans only when overage rates impose a severe penalty for additional usage – a belief our results do not empirically support.

This work demonstrates that researchers cannot assume that people evaluate the complex price of a two-part tariff in an accurate and unbiased fashion, or that they even try to calculate a cost. Rather, people use heuristics to simplify the task. We have shown that these

heuristics lead consumers to make suboptimal choices with regard to cost, but we cannot make conclusions as to whether consumers still maximize their satisfaction. For example, consumers may be ultimately better off choosing plans with larger usage allowances because it lets them enjoy their consumption free of thoughts about the cost or worries about overage charges (Lambrecht and Skiera 2006). Here, the reliance on attribute comparisons to avoid difficult cost calculations could coincidentally result in a more satisfying outcome. Consumer satisfaction with a two-part tariff choice involves a complex interplay between choice and subsequent usage and enjoyment. We have provided some insight into the decision process used by consumers for choice. Future work will need to explore how consumers can make better choices and how firms can provide better options.

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**Table 1**  
**Choice Model Fit and Regression Coefficients in Study 1**

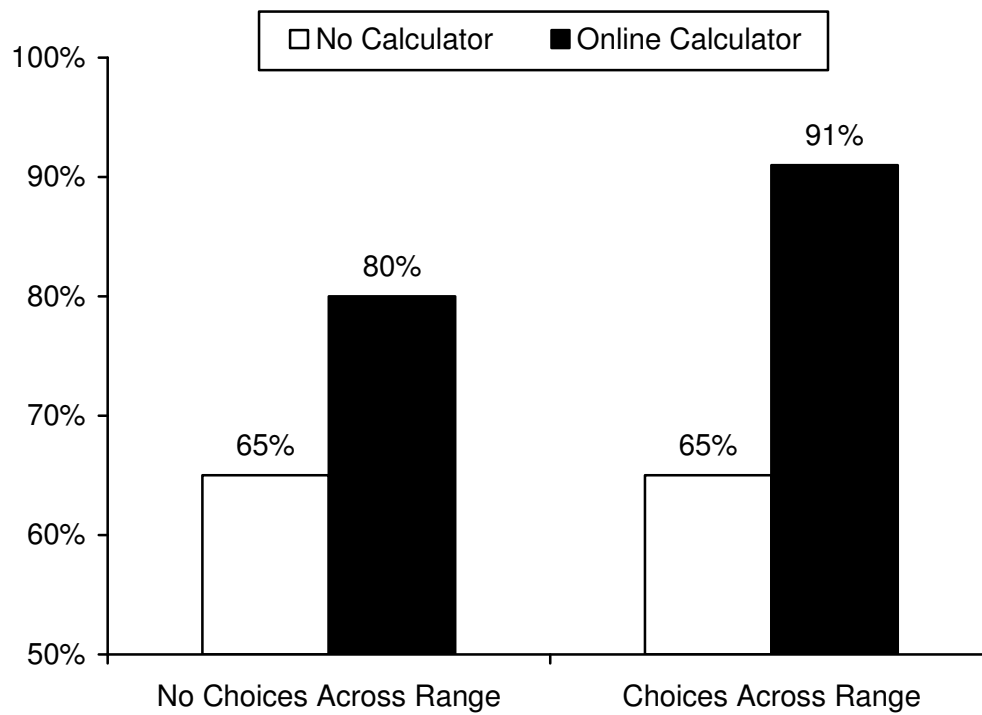
	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>
Model Fit (AIC)	2,851 3,088	3,292 3,481	2,871 3,286	3,402 3,258
Estimated Cost	+ 0.02 <sup>NS</sup> - 0.77 <sup>*</sup>	- 5.39 <sup>***</sup> - 2.47 <sup>***</sup>		
Actual Cost	-14.42 <sup>***</sup> - 6.88 <sup>***</sup>		-14.09 <sup>***</sup> - 8.30 <sup>***</sup>	
Flat Fee	+ 0.32 <sup>NS</sup> - 0.65 <sup>*</sup>			- 2.03 <sup>***</sup> - 2.20 <sup>***</sup>
Usage Allowance	+ 0.21 <sup>NS</sup> + 1.50 <sup>***</sup>			+ 1.88 <sup>***</sup> + 2.58 <sup>***</sup>
Overage Rate	- 0.03 <sup>NS</sup> - 0.87 <sup>***</sup>			- 0.72 <sup>***</sup> - 1.37 <sup>***</sup>

NOTE. — 1<sup>st</sup> row has coefficients when usage is given as just the expected usage  
2<sup>nd</sup> row has coefficients when usage is given as a uniform distribution  
NS = non-significant ; \* = p < .05 ; \*\* = p < .01 ; \*\*\* = p < .001

**Table 2**  
**Choice Model Regression Coefficients in Study 2**

	No Calculator		Online Calculator	
	No Choices Across Range	Choices Across Range	No Choices Across Range	Choices Across Range
Actual Cost	- 6.30 ***	- 5.27 ***	- 12.32 ***	- 24.99 ***
Flat Fee	+ 0.69 <sup>NS</sup>	+ 0.22 <sup>NS</sup>	- 0.55 <sup>NS</sup>	+ 0.18 <sup>NS</sup>
Usage Allowance	+ 1.03 ***	+ 0.97 **	+ 1.15 **	+ 1.29 ***
Overage Rate	- 0.49 **	- 0.55 ***	- 0.29 <sup>NS</sup>	- 0.16 <sup>NS</sup>

NOTE. — NS = non-significant ; \* =  $p < .05$  ; \*\* =  $p < .01$  ; \*\*\* =  $p < .001$

**Figure 1****Choice of Lower Cost Plan by Condition in Study 2**

**Appendix 1**  
**Pricing Plan Stimuli**

<b>Cost for 250 Units</b>	<b>Rate Direction</b>	<b>Usage Versus Allowance</b>	<b>Flat Fee</b>	<b>Usage Allowance</b>	<b>Overage Rate</b>
\$55	Decreasing	Well Above	\$31	100	\$0.16
\$55	Decreasing	Just Above	\$51	200	\$0.08
\$55	Decreasing	Just Below	\$55	300	\$0.14
\$55	Decreasing	Well Below	\$55	400	\$0.11
\$55	Equal	Well Above	\$22	100	\$0.22
\$55	Equal	Just Above	\$44	200	\$0.22
\$55	Equal	Just Below	\$55	300	\$0.22
\$55	Equal	Well Below	\$55	400	\$0.22
\$55	Increasing	Well Above	\$10	100	\$0.30
\$55	Increasing	Just Above	\$39	200	\$0.32
\$55	Increasing	Just Below	\$55	300	\$0.31
\$55	Increasing	Well Below	\$55	400	\$0.30
\$62	Decreasing	Well Above	\$36	100	\$0.18
\$62	Decreasing	Just Above	\$60	200	\$0.05
\$62	Decreasing	Just Below	\$62	300	\$0.16
\$62	Decreasing	Well Below	\$62	400	\$0.13
\$62	Equal	Well Above	\$25	100	\$0.25
\$62	Equal	Just Above	\$50	200	\$0.25
\$62	Equal	Just Below	\$62	300	\$0.25
\$62	Equal	Well Below	\$62	400	\$0.25
\$62	Increasing	Well Above	\$15	100	\$0.32
\$62	Increasing	Just Above	\$41	200	\$0.43
\$62	Increasing	Just Below	\$62	300	\$0.33
\$62	Increasing	Well Below	\$62	400	\$0.32

## Appendix 2

### Scales from Lambrecht and Skiera (2006)

#### Insurance Effect

- For the security of knowing that my Internet access [*rental car*] costs will never go above the amount agreed upon, I'm willing to pay a little more than average.
- Even if a flat rate is somewhat more expensive for me than a usage-driven rate, I'm happy because my costs won't exceed the fixed amount.

#### Taxi Meter Effect

- The flat rate is great because I don't have to worry about the costs.
- It isn't as fun to surf the Internet [*use a rental car*] when I think about the costs increasing every minute [*mile*].
- It's only when I have a flat rate that I can really enjoy surfing the Internet [*using a rental car*].
- When I'm paying a flat rate, I feel much freer and more relaxed about using the Internet [*rental car*] than with a variable rate.

#### Convenience Effect

- It takes so long to figure out which rate is better that the effort normally isn't worth it.
- It's too much trouble to find out the prices for Internet access [*rental cars*].
- The money you can save by picking a better rate than the one you have now doesn't make up for the time and effort involved.
- It takes so long to switch to a cheaper rate that the effort isn't worth it.

NOTE. — The phrases underlined were replaced by those in italics to make the question pertinent to the rental car domain.