Simplifying difficult calculations: consumer choice of two-part tariffs

Joseph P. Redden
Carlson School of Management, University of Minnesota, Minneapolis, Minnesota, USA, and

Stephen J. Hoch
Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania, USA

Abstract

Purpose – This paper aims to outline a decision process for how consumers choose among two-part tariffs which consist of a flat fee plus a per unit charge for usage over an allowance. The paper also seeks to examine what types of decision aids help consumers choose lower cost tariffs.

Design/methodology/approach – The approach used is two experimental studies.

Findings – Most consumers do not choose a tariff by calculating an expected cost because of usage uncertainty. They instead rely on simple comparisons of the overage rate, usage allowance, and flat fee attributes. These heuristics lead to systematic biases, beyond what actual true cost justifies, for favorable comparisons on these attributes. An online calculator improved choice of the lower cost option from 65 percent to 80 percent, yet this increased to 91 percent if people were also forced to consider a range of usage levels.

Practical implications – Consumers struggle to choose the lowest cost tariff, especially with uncertain usage. Consumers should realize the biases in their decision shortcuts and use the presented decision aids. Firms can leverage these biases by offering larger usage allowances (often done) and smaller overage rates (often not done), or correct them with decision aids.

Originality/value – Much work on tariffs assumes consumers calculate a cost, but the authors question this assumption, and show that consumers instead use simple attribute comparisons to deal with uncertain usage. An understanding of the specific heuristic consumers use allows the authors to better account for past effects, predict and establish new effects, and design effective decision aids. Results indicate tariff biases largely result from information processing shortcomings.

Keywords Two-part tariffs, Decision heuristics, Information processing, Consumer behaviour, Decision making

Paper type Research paper

Firms often use two-part tariffs[1] which consist of a flat fee plus a per unit charge for usage beyond an allowance. We see increasing use of such tariffs in consumer settings such as cell phones, car rentals, car leases, broadband services, utilities, and time shares. Given this trend, it is important that marketers understand how consumers choose among tariffs. This paper details the decision heuristics consumers frequently rely on, the biases that result from these heuristics, and decision aids that encourage lower cost choices.

Traditional economic analyses assume that consumers choose among two-part tariffs based solely on an expected cost they calculate (e.g., Dolan, 1987; Miravete, 2003). Other considerations beyond cost also have been highlighted (Lambrecht and Skiera, 2006; Nunes, 2000; Train *et al.*, 1987), but a cost calculation is typically still the core starting point. For example, Lambrecht and Skiera (2006, p. 221) write "though consumers choose their tariff on the basis of the expected billing rate, in general, they prefer flat rates because of tariff-specific characteristics". We question the assumption that consumers always calculate an expected cost, and propose that they often rely instead on simpler attribute comparisons that cause unintended biases in their choices.

Consumers struggle with calculating a total price when it has multiple dimensions (Estelami, 2003; Viswanathan *et al.*, 2005). In the case of a two-part tariff, this calculation is inherently a difficult task because it requires three mathematical operations (subtraction, multiplication, addition) that must be repeatedly integrated across the range of usage. For example, note the difficulty of estimating the cost of the following: \$28 for 350 units and \$0.22 for each additional unit with usage uniformly varying from 300 to 700 units[2]. We confirmed this difficulty with a pilot group of 172 college students (average SAT score $>$ 2100) who estimated the average cost of six different two-part tariffs with likely overage fees. They struggled as their estimates had an average unsigned error of over 29 percent.

Consumers often respond to such mathematical difficulties by altogether avoiding an explicit calculation (Viswanathan *et al.*, 2005), especially when the arithmetic operations are more difficult (Estelami, 2003). We posit that usage uncertainty is a critical factor for whether consumers calculate an expected cost. Consumers with certain usage will find the cost calculation challenging, yet perhaps still manageable. However, when usage becomes uncertain, consumers now must perform some type of calculus integration so many will no longer try to calculate the

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expected cost. We propose that they will instead rely on the extent of favorable comparisons across each of the individual attributes, a general cognitive shortcut (Russo and Dosher, 1983; Viswanathan *et al.*, 2005). For instance, past work on partitioned pricing has shown that consumers separately process and differentially weight the base price and the shipping surcharge (Morwitz *et al.*, 1998). We apply this notion to usage-based tariffs, and propose that consumers use a similar decision process. Specifically, when facing uncertain usage, consumers rely on basic comparisons on the three attributes of a two-part tariff (the overage rate, the dollar amount of the flat fee, and the number of units in the usage allowance). A simple set of rules then is to favor smaller flat fees, larger usage allowances, and lower overage rates with little regard for the usage level. We further propose that reliance on such heuristics leads consumers to overprefer plans with favorable attribute comparisons, beyond what is justified by the true difference in total cost. We formalize these predictions below:

H1a. When usage is certain, consumers choose tariffs based on total cost considerations more than simple attribute comparisons.

H1b. When usage is uncertain, consumers choose tariffs based on simple attribute comparisons more than the total cost.

H2. When usage is uncertain, favorable comparisons on the three attributes influence tariff choice even after adjusting for the true total cost.

Two empirical studies support our predictions and provide evidence for the proposed process. Our findings contribute in several ways to the literature. First, among myriad possible cognitive shortcuts, we identify the specific heuristic of attribute comparisons as a basis for tariff choice when usage is uncertain. Second, our proposed process provides a deeper understanding of past findings that consumers prefer two-part tariffs with larger usage allowances more than the true cost justifies (Lambrecht and Skiera, 2006; Train *et al.*, 1987). We suggest that rather than being just an intrinsic preference for flat rates, these prior findings are also attributable to information processing shortcomings, an often ignored explanation of pricing phenomenon (Estelami, 2003). Third, our proposed process explains why we find a similar overpreference for pricing plans with lower overage rates and lower flat fees, effects not yet documented in the literature. Fourth, our findings inform the design of effective decision aids for policy makers, consumers, and channel partners. In particular, decision makers need help with both the simple mathematical operations at a single usage level (i.e., a calculator), as well as the integration of cost differences across the range of usage (i.e., evaluate at multiple points). Simply giving people a calculator is not enough as they do not know how to use it to incorporate usage uncertainty.

In the following studies, our setup differs from past approaches to tariff choice in several notable ways. We limit ourselves to choice sets with just two-part tariffs to isolate preference for particular attributes of a two-part tariff (such as a larger usage allowance) from preference for a particular format (such as flat rate vs pay per use). We also systematically vary each of the attributes to test for multiple biases, as opposed to recent field studies in which every plan in the data had exactly the same overage rate (Lambrecht and Skiera, 2006). Finally, we always provide consumers full information about their usage to eliminate usage misestimation, a factor often cited in past work (Lambrecht and Skiera, 2006; Nunes, 2000). These differences allow us to focus on our primary topic of how consumers decide among two-part tariffs, and how to help them make lower cost choices.

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 chose between two rental car options for each of 32-day trips. They were given the tariff 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 were constructed by randomly selecting from the pricing plans shown in the Appendix, Table AI. These 24 pricing plans reflect a range of total costs at the usage midpoint ($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. 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" to increase task novelty and mask the similarity of the choice trials. Mileage measures were divided by a conversion rate (uniformly distributed between 1 and 2 on each trial), and prices were multiplied by the same conversion rate. The resulting usage allowance, flat fee, and overage rate were rounded to the nearest tens unit, dollar, and penny respectively. 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. Approximately half ($n = 81$) of the participants were given an exact length of each trip that was always 250 miles (pre-conversion). The remaining participants ($n = 87$) were told the length of the trip was equally likely to fall anywhere between 175 and 325 miles (pre-conversion). We predict that participants will rely less on a calculated cost and more on the attribute comparisons when uncertain about their usage.

After the final choice, participants were asked two questions about their choice process. First, to see if they 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 used a seven-point scale (1 = "Not Important" and 7 = "Very Important") to rate the importance of "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". Finally, participants also estimated the total cost for each of the 24 plans in the Appendix, Table AI 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.

Journal of Product & Brand Management
Volume 20 · Number 7 · 2011 · 549–556

Results

Plan choice

Before performing any analysis, we removed the data for outlying participants with an extremely large error in the cost estimate (top 5 percent of deviation from true cost when averaged for the two plans). The remaining 5,107 choices were analyzed using a repeated-measures 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 true total cost (by integrating the total cost across all usage levels) to allow testing for biased choice in the economic sense. We coded these variables as percentage differences using the larger of the two values as the denominator 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 ($\chi^2(1) = 91.16$, $p < 0.0001$), the usage allowance ($\chi^2(1) = 17.09$, $p < 0.0001$), and the overage rate ($\chi^2(1) = 21.89$, $p < 0.0001$). There were no main effects for the estimated cost ($\chi^2(1) = 0.95$, $p > 0.32$), or the flat fee ($\chi^2(1) = 0.48$, $p > 0.48$). However, the main effects were qualified by an interaction with uncertainty for the actual cost ($\chi^2(1) = 21.51$, $p < 0.0001$), the flat fee ($\chi^2(1) = 4.34$, $p < 0.04$), the usage allowance ($\chi^2(1) = 9.82$, $p < 0.01$), and the overage rate ($\chi^2(1) = 18.59$, $p < 0.0001$), but not the estimated cost ($\chi^2(1) = 1.15$, $p > 0.28$). Participants relied more on the attribute comparisons, and less on the actual cost, when usage was uncertain versus certain (see model 1 in Table I). For uncertain usage, even after adjusting for differences in estimated and actual total cost, participants preferred more favorable simple comparisons on the attributes as predicted. None of the effects of favorable comparisons were present for certain usage, presumably because participants could better gauge the actual cost. Indeed, an additional analysis showed that the estimated cost and actual cost were more highly correlated when usage was certain versus uncertain ($r = 0.74$ vs $r = 0.56$, $\chi^2(1) = 96.45$, $p < 0.0001$).

Table I Choice model fit and regression coefficients in Study 1

	Model			
	1	2	3	4
Model fit (AIC)	2,851	3,292	2,871	3,402
	3,088	3,481	3,286	3,258
Estimated cost	$+0.02^{NS}$	-5.39^{**}		
	-0.77^{*}	-2.47^{**}		
Actual cost	-14.42^{**}		-14.09^{**}	
	-6.88^{**}		-8.30^{**}	
Flat fee	$+0.32^{NS}$			-2.03^{**}
	-0.65^{*}			-2.20^{**}
Usage allowance	$+0.21^{NS}$			$+1.88^{**}$
	$+1.50^{***}$			$+2.58^{**}$
Overage rate	-0.03^{NS}			-0.72^{**}
	-0.87^{**}			-1.37^{**}

Notes: 1st row has coefficients when usage is given as just the expected usage; 2nd row has coefficients when usage is given as a uniform distribution; NS = non-significant; $^{*}p < 0.05$; $^{**}p < 0.001$

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 2-4 in Table I). 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 total 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). This suggests that participants largely chose by making the three attribute comparisons only when usage was uncertain.

We also performed two additional analyses to see if fatigue drove reliance on the attribute comparisons. First, we created a new dummy variable for fatigue that equaled zero for the first eight choice trials, and equaled one for trials not in the first quarter of the study. When this fatigue variable was added to the original choice model (model 1), all of the interaction terms with fatigue were non-significant (all $p > 0.37$). Second, we also reran our original choice model and included the cumulative number of choices made as a continuous variable. The only evidence of fatigue effects was that reliance on the actual cost decreased slightly over time ($\chi^2(1) = 4.50$, $p < 0.04$). The interactions between the number of choices previously made and the other factors were all non-significant (all $p > 0.06$). These analyses indicate that reliance on the attribute comparisons for making choices was not driven by fatigue with the task.

Use of attribute comparisons

We next analyzed the descriptions participants gave of the 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, uncertain usage led to fewer participants making a calculation ($M = 41$ percent vs 74 percent, $\chi^2(1) = 18.34$, $p < 0.0001$). The participants not making a calculation were instead more likely to mention comparisons of the flat fee ($M = 16$ percent vs 3 percent, $\chi^2(1) = 9.34$, $p < 0.01$), the usage allowance ($M = 48$ percent vs 16 percent, $\chi^2(1) = 20.12$, $p < 0.0001$), and the overage rate ($M = 22$ percent vs 10 percent, $\chi^2(1) = 5.42$, $p < 0.02$). 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. 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 ($\chi^2(1) = 17.91$, $p < 0.0001$), the usage allowance ($\chi^2(1) = 17.49$, $p < 0.0001$), and the overage rate ($\chi^2(1) = 4.41$, $p < 0.04$). Attribute comparisons influenced choice more for participants who deemed comparisons on that attribute to be more important. This again suggests that participants relied on comparisons of the attributes when choosing.

Journal of Product & Brand Management
Volume 20 · Number 7 · 2011 · 549–556

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 uncertainty about their usage. This means that the typical view in the literature that people calculate a cost and adjust for other plan preferences (e.g., see Lambrecht and Skiera, 2006) is not what people are actually doing in most choice settings. 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. 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 information processing shortcomings. The next study will provide decisions aids for accurate cost estimation 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 true actual cost. We would posit that a common approach may be to estimate just the difference in cost rather than the total 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.

This study also provided some process evidence that participants relied on attribute comparisons for choice. First, when asked to describe the process they used, participants 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 participants believed that a favorable outcome on that attribute was more important. Participants chose as if they compared each attribute and then assigned it a relative importance weighting. The importance ratings indicated that the usage allowance ($M = 4.8$) and overage rate ($M = 5.0$) comparisons were weighted more than the flat fee ($M = 3.9$; both pair-wise comparisons have $p < 0.0001$). We attribute this to viewing overage charges as a "loss", which past research has shown people will pay more to avoid than acquiring an equal-sized gain (Kahneman and Tversky, 1979; Thaler, 1980).

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 addressing this decision process. In the previous study, participants chose the lowest cost plan only 70 percent of the time even though random guessing would give 50 percent. This improved to only 73 percent 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 calculate the cost.

We propose that two things make calculations hard to use: 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:

H3. Providing consumers a total cost calculator decreases reliance on attribute comparisons, and increases choice of the plan with the lowest true cost.

H4. For consumers who already have a total cost calculator, encouraging them to consider a range of usage levels further increases choice of the plan with the lowest true cost.

This study examines the effectiveness of these two decision aids (calculator and considering a range of usage) in isolation and in combination. This not only further tests our notions of the decision process, 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 for certain features.

Method

A total of 313 undergraduates completed this study for undergraduate course credit. The design replicated the previous study with three 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 participants 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) × 2 (choices across range: absent; present) between-subjects design. Thus, participants had either no decision aid ($n = 80$), just an online calculator ($n = 76$), just forced choices across the usage range ($n = 82$), or both decision aids ($n = 75$). Third, 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.

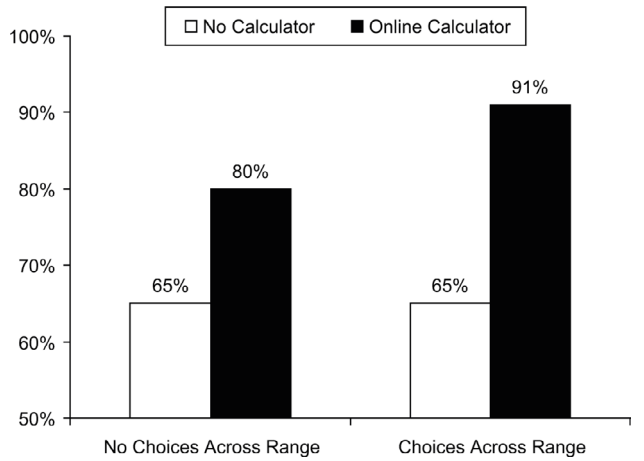
Results

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 ($\chi^2(1) = 128.21$, $p < 0.0001$), and requiring choices across the range ($\chi^2(1) = 20.96$, $p < 0.0001$), as well as an interaction ($\chi^2(1) = 21.45$, $p < 0.0001$).

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 percent of the time. Providing only an online calculator helped those participants choose the lower cost plan 80 percent of the time, a significant increase from the case without decision aids ($\chi^2(1) = 39.31$, $p < 0.0001$). In contrast, only requiring choices across the range led those participants to still choose the lower cost plan just 65 percent of the time, the

Figure 1 Choice of lower cost plan by condition in Study 2



same rate as without any decision aids ($\chi^2(1) = 0.01$, $p > 0.94$). However, requiring choices across the range did help if those participants also had the online calculator as they chose the lower cost plan 91 percent of the time, a significant increase from the case with just the online calculator ($\chi^2(1) = 27.38$, $p < 0.0001$). In isolation, an online calculator led to lower cost choices while considering a range of usage levels did not. Together, the decision aids had a synergistic relationship as a calculator helped more when participants also considered a range of usage levels.

Plan choice

We next tested the influence of attribute comparisons using a repeated-measures binary logit model on the plan chosen. The model included differences for the actual cost (i.e., the correct expected total cost integrating over the range of usage), 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 ($\chi^2(1) = 223.90$, $p < 0.0001$) that was qualified by interactions with having an online calculator ($\chi^2(1) = 95.58$, $p < 0.0001$), making choices across the range ($\chi^2(1) = 18.50$, $p < 0.0001$), and having both of these decision aids ($\chi^2(1) = 24.32$, $p < 0.0001$).

The estimated coefficients in Table II show that participants' 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 ($\chi^2(1) = 17.66$, $p < 0.0001$), while just making choices across the range did not ($\chi^2(1) = 0.97$, $p > 0.32$). However, making choices across the range further increased reliance on cost when a calculator was already available ($\chi^2(1) = 22.46$, $p < 0.0001$).

The analysis also found support for reliance on the attribute comparisons as there were main effects for the overage rate ($\chi^2(1) = 15.62$, $p < 0.0001$) and the usage allowance ($\chi^2(1) = 40.35$, $p < 0.0001$). There was not a statistically significant effect for the flat fee ($\chi^2(1) = 0.39$, $p > 0.53$). Although we expected the flat fee comparison to somewhat influence choice as in the previous study, the lack of this one finding is not entirely surprising. The flat fee comparison is likely the least important because it does little to protect against overage fees which may be viewed as a particularly painful loss (Kahneman and Tversky, 1979; Thaler, 1980). Here, a higher flat fee is apparently the accepted cost of insurance to limit exposure to potentially unlimited overage fees.

There were not any interactions between the presence of the decision aids and the three attribute comparisons (all $p > 0.10$). 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.

Discussion

We again found evidence that participants preferred two-part tariffs with favorable comparisons on the usage allowance and overage rate, beyond what is justified by their effects on total cost. 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, in most market settings, the flat fee might be the most important attribute because that financial commitment cannot be recovered when usage is low. However, people

Table II 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	$+0.69^{NS}$	$+0.22^{NS}$	-0.55^{NS}	$+0.18^{NS}$
Usage allowance	$+1.03^{**}$	$+0.97^{*}$	$+1.15^{*}$	$+1.29^{**}$
Overage rate	-0.49^{*}	-0.55^{**}	-0.29^{NS}	-0.16^{NS}

Notes: NS=non-significant; $^{*}=p < 0.01$; $^{**}p < 0.001$

Journal of Product & Brand Management
Volume 20 · Number 7 · 2011 · 549–556

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 participants choose lower cost plans. Not surprisingly, an online calculator improved their choice of the lower cost plan from 65 percent to 80 percent. 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 some of the tariff preferences in the literature, such as the flat rate bias (Lambrecht and Skiera, 2006; Train *et al.*, 1987), are attributable to the cognitive shortcuts adopted to deal with the difficulty of the necessary calculations. However, even with the calculator, participants still chose the higher cost plan 20 percent of the time. We attribute this to two reasons:

1 people likely still rely on heuristics for plans with similar cost; and
2 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 percent when participants 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 associated 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. The comparisons are apparently hard to ignore as cues as they still served as a sort of "tiebreaker".

General discussion

Marketers are increasingly using two-part tariff pricing in a range of industries. Past research on two-part tariff choice has typically assumed that consumers perform some type of total cost calculation to make a choice. We find, however, that consumers deal with uncertain usage by avoiding cost calculations, and instead relying on simple comparisons such as "Which plan has the lower overage rate?". The present research tests for the use of these comparisons, and outlines their role in a general process for choosing among two-part tariffs. This information processing approach lets us 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, biases that we demonstrate for the overage rate and the flat fee.

Main findings and managerial implications

Two studies demonstrate that consumers often choose two-part tariffs by making simple comparisons of the three attributes. Reliance on these heuristics leads people to prefer, more than the true cost justifies, two-part tariffs with a smaller flat fee, a larger usage allowance, and a lower overage rate. 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 the overage rate. We attribute this pattern of findings to:

- the increased difficulty of performing calculations when usage is uncertain;
- the ease in comparing the attributes independent of usage; and
- beliefs about the greater importance of attributes that limit the extent of out-of-pocket fees.

We also find that providing an online calculator helps one manage the mathematical operations, and considering their preference across a range of usage levels incorporates usage uncertainty. These two decision aids together helped people pick the lower cost plan 91 percent of the time. This suggests that the tariff biases in past work are at least partially the result of using simplifying heuristics rather than solely an inherent preference.

The present research also speaks to 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 (J.D. Power and Associates, 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.

Given the demonstrated shortcomings of the consumer decision process, firms should also consider providing decision aids to consumers as well as channel intermediaries. Certainly, firms offering a truly lower price would benefit from decision makers having a more accurate assessment of the price. In our final study, a calculator was not enough as participants still struggled to deal with the uncertainty. Firms may need to explicitly push consumers to consider how their preference would vary across a range of usage if they want a cost-driven decision. More generally, armed with a better understanding of how consumers are making their choices, firms should be able to more optimally leverage non-linear pricing plans like two-part tariffs. This could include creating favorable attribute comparisons, especially on the usage allowance and overage rate, and then highlighting these advantages. We already see some of these approaches in the telecom industry with the popularity of rollover minutes (effectively a larger usage allowance) and unlimited minutes (an overage rate of zero).

Limitations and future research

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, participants took a reasonable amount of time to make each choice in the two studies (median time of 21 seconds). Future work could explore how the use of simplifying heuristics depends on individual differences (e.g., need for cognition, mathematical abilities, deal proneness), and situational differences (e.g., incentives, obscure brands, many alternatives, easier calculations). 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), although variations in usage likely inhibits such learning. Third, the usage allowance ranged from 40 percent to 160 percent of expected usage in our stimuli. At some point, providing a much larger usage allowance may

Journal of Product & Brand Management
Volume 20 · Number 7 · 2011 · 549–556

provide 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 consumers may rely even more on attribute comparisons in these settings due to the great amount of usage uncertainty.

In addition to these boundary conditions, future work could also explore when consumers rely less on these attribute comparisons. These comparisons did not matter in our studies when people were certain about their usage, and they likely would not have mattered if people similarly had been fairly certain about their usage within a very narrow range. Previous work by Iyengar *et al.* (2008) suggests other conditions where attribute comparisons may also 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.

Our work demonstrates that researchers cannot assume that consumers evaluate the complex price of a two-part tariff in an accurate and unbiased fashion, or that they even try to calculate a cost. We have shown that consumers instead use heuristics that lead to suboptimal choices with regard to cost, but we cannot make conclusions as to whether consumers 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; Prelec and Loewenstein, 1998). 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 more attractive options.

Notes

1 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 *et al.*, 2007).

2 In the case of uniform usage across a range, the expected cost equals (FlatFee*(UsageAllowance − MinUsage))/(MaxUsage − MinUsage)+(FlatFee*(MaxUsage − UsageAllowance) + 0.5*OverageRate*(MaxUsage2 − UsageAllowance2) − OverageRate*UsageAllowance*(MaxUsage − UsageAllowance))/(MaxUsage − Min Usage).

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Appendix

Table AI Pricing plan stimuli

Cost for 250 units ($)	Rate direction	Usage versus allowance	Flat fee ($)	Usage allowance	Overage rate ($)
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

About the authors

Joseph P. Redden is an Assistant Professor of Marketing in the Carlson School of Management at the University of Minnesota. Joseph P. Redden is the corresponding author and can be contacted at: redde007@umn.edu

Stephen J. Hoch is the Patty and Jay H. Baker Professor of Marketing in the Wharton School at the University of Pennsylvania.