

A Behavioral Economic Interpretation of the Preference for Flat Rates: A Case of Post-Paid Mobile Phone Services

Hitoshi MITOMO Dr., Professor, Graduate School of Global Information and Telecommunication Studies, Waseda University, Japan, and
Visiting Professor, Center for Information and Communication Research, Stockholm School of Economics, Sweden
email: mitomo@waseda.jp

Tokio OTSUKA Dr., Guest Researcher, Institute for Digital Society, Waseda University, Japan

Kiminori NAKABA Graduate student, Graduate School of Information and Telecommunication Studies, Waseda University, Japan

Abstract: This paper aims to test empirically the existence of biased preference for flat rates for mobile phones and examine how psychological factors can affect the preference. We define such preference as “flat-rate preference” and interpret it in terms of behavioral economic concepts.

Behavioral economics, in spite of its difficulties for empirical applications, provides deeper insight into human behavior since it includes psychological factors in decision-making processes and allows irrational choices of consumers. By applying several important concepts of behavioral economics, we seek to investigate more reasonable explanations of mobile users’ flat-rate preference. Loss aversion, reference dependence, the shape of probability weighting function, mental accounting, ambiguity aversion and cognitive dissonance are the concepts employed for examining the preference. Non-parametric methods are applied in the empirical analysis based on the data collected for mobile phone services through an online survey in Japan.

We could successfully show the existence of the flat-rate preference in terms of loss aversion and reference dependence although we failed to identify the influences of the shape of the probability weight function. The other three concepts could also be recognized as factors conducive to the preference.

1. Introduction

Flat rates have been recognized as a favorable pricing arrangement for promoting the usage of telecommunications services. Selective tariffs are often applied to the services and a flat rate is an attractive option. A user can choose a charge plan which is considered to be suitable to his/her usage. In many cases, a flat rate is preferred to a measured rate. Various services, from plain old telephony to broadband access, have been supplied under flat rates. A major reason for this would be that users want to avoid uncertain bill payments. Fluctuations in phone bill payments under measured rates must be stressful for them. For local telephone services, Train (1987) found the empirical evidence that users tended to choose a fixed charge system than one depending on the usage even in the case where they received the same amount of phone bill. He defined this phenomenon as “flat-rate bias”.

On the other hand, traditional economics has emphasized the importance of measured rates since they are believed as the only parameter that can achieve economic efficiencies. As far as flat rates are applied, user demand is not sensitive to the price, and the usage would be unnecessarily increased, and small scale users might be excluded in the usage. For service providers, the supply would be increased in response to the increased demand while the revenue is not proportional to the demand. Flat rates do not achieve efficient resource utilization. Consequently, very few analyses of flat rates can be found in the literature of pricing.

We will focus more on what is behind users’ biased choice on flat rates, so that we define users’

inclinations to prefer flat rates as *flat-rate preference*. We investigate the reasons for such biased preference, which traditional economics has failed to explain, by employing several important concepts established in behavioral economics. We will show the results of empirical tests illustrating how the concepts successfully explain the existence of flat-rate preference. This paper is organized as follows: Section 2 overviews a flat rate applied to the services in the Japanese telecommunications market. Section 3 explains the behavioral economic concepts to be applied to explain the flat-rate preference. Section 4 shows the results of the empirical tests. Post-paid mobile phone services are selected for the tests since they have been supplied under both flat and measured rates. Section 5 concludes the paper.

2. Telecommunications Services in Japan and Consumers' Flat-Rate Preference

A variety of pricing rules have been applied in telecommunications markets. Two major pricing rules are measured rates and flat rates (see Table 1). In Japan, plain old telephony services, both local and long-distance, have been supplied with measured rates, more specifically with two-part tariffs. Measured rates have also been applied to most mobile phone services, but flat rates are now included in selective tariffs. On the other hand, broadband access services such as DSL and FTTH are typically flat-rate services. Measured rates used to be applied to narrowband access services such as dial-up connections. If tariffs include the both rates for a service, a natural inclination of telecommunications users is to favor a flat-rate service rather than a measured-rate service.

Table 1: Measured and Flat Rates as Applied to Telecom Services

Measured Rate (Incl. two-part tariff)	Measured+Flat	Flat Rate
POTS	Dial-up Mobile (Voice) Mobile (packet) PHS IP phone	Broadband

Consequently, an application of a flat rate has been regarded as an important measure for telecommunications service providers to attract more users. So far, however, they have been very cautious about introducing flat-rate tariff systems. It is because, with flat rates, their revenue is not proportional to usage but almost fixed with the number of subscribers. On the other hand, it is most likely to increase the usage because flat rates allow unlimited usage. The increased usage must require more facility investment and management, which can be a burden on the providers.

Besides the increased demand of users for flat-rate services, the service providers have realized by themselves that flat rates do not necessarily bring about negative consequences. In many cases, the revenue does not fall drastically and sometimes the merit overcomes the demerit. It is because i) flat-rate services can attract more users, but many of them do not use as much as they pay, ii) the revenue is constant and stable, iii) management, calculation and billing are facilitated due to the simplified pricing, and iv) the setting-out of business plans is easier than in the case of measured rates. Furthermore, they have recognized the importance of flat-rate services as flat rates give users greater satisfaction. Successful flat-rate mobile services in Japan are, for example, the Willcom's flat-rate voice communication service among their PHS users; the NTT DoCoMo's flat-rate packet communication service called "pake-hodai"; and the au's two-stage flat-rate tariff called "Double-Teigaku". These services have

attracted many users. DoCoMo's "pake-hodai" has especially made many mobile users aware of the convenience of flat-rate services. The monthly charge for DoCoMo's "pake-hodai" is ¥4,095 (incl. tax), and unlimited mobile web access and emails are available. After its introduction, the number of users subscribing to the service has been increasing rapidly.

The flat-rate arrangements could also contribute to solve a problem. Youngsters addicted to mobile communications are typically heavy users. They rely much on packet communication such as i-mode Internet access and e-mail services. They do not recognize how much they have used mobile phones in a month until they receive a phone bill because post-paid billing is common in Japan. They manage to pay the bill on time, but some of them are actually behind their payment. This problem called "pake-shi" has become a social concern. It seems to dissolve after the providers have introduced flat-rate services.

3. Behavioral Economics Interpretations of the Flat-Rate Preference

According to traditional economic theories, only a measured rate (a single price) can work as a parameter and achieve economic efficiency through market mechanisms. Flat rates are not believed to attain higher economic efficiencies. Consumers' preference for flat-rate pricing has been regarded as a consequence of consumers' *risk averse behavior*.

However, we have realized from our experience that human behavior is not necessarily so rational as traditional economics assumes. The hypothesis on consumers' behavior that people maximize their utility represented with well-behaved utility functions would be too simplified. Our decisions or choices often violate the expected utility hypothesis. An interpretation based on risk avoidance is useful but not sufficient for explaining the preference for flat rates. Therefore, "rationality" of consumer behavior should be re-defined by incorporating psychological factors for describing more realistic processes in decision-making in order to reflect diversified human behavior.

Behavioral economics, which was initiated by Kahneman and Tversky (1979) and others, have integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty. Prospect theory, which is one of the important theories in behavioral economics, provides a framework for explaining how people prospect for and behave toward a risk, containing several important concepts such as *loss aversion*, *reference dependence* and *the shape of the probability weighting function*.

Figure 1: The Shape of a Value Function

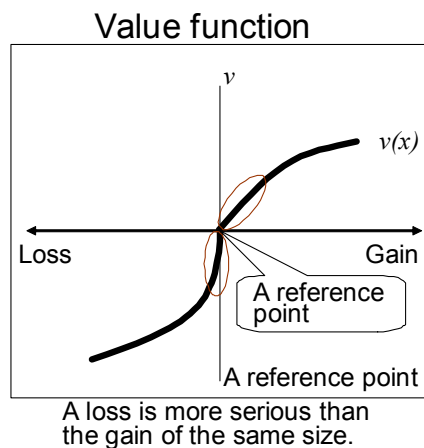
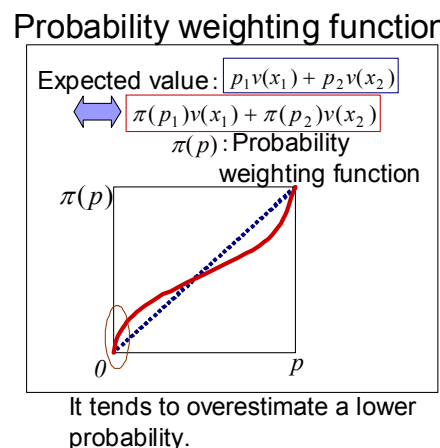


Figure 2: The Shape of the Probability Weighting Function



Figures 1 and 2 illustrate the two functions which characterize the prospect theory: the *value function* which replaces a utility function in the traditional economic theory; and the *probability weighting function* which represents a modified expected value weighted by the subjective evaluation of the probability that a phenomenon is likely to happen.

Loss aversion explains tendencies that losses are weighted substantially more than objectively commensurate gains in the evaluation of prospects and trades (Kahneman and Tversky, 1979). This can be represented in Figure 1 by a steeper curve of a value function in the loss direction than in the gain direction in the neighborhood of the reference point. Reference dependence represents a dependence of preference on one's reference point such as the current endowment, which is shown as the origin in Figure 1. The shape of the probability weighting function shows tendencies that low probabilities are over-weighted while high probabilities are under-weighted than the objective probabilities.

In addition to the three concepts from the prospect theory, we will employ other three concepts of *mental accounting*, *ambiguity aversion* and *Cognitive dissonance*. Thaler (1980) brought out the concept of mental accounting which is an idea that people set up mental accounts for outcomes that are psychologically separate, describing the rules that govern the integration of gain and loss. Ambiguity aversion describes preference for known risks over unknown risks (Camerer, Loewenstein and Rabin, 2004, Ch.1). In other words, measures of certainty affect decisions and people tend to avoid decision-making in uncertain situations. Cognitive dissonance is defined as psychological tension resulting from behavior that conflicts with one's beliefs. These concepts can be applied to interpret the flat-rate preference or tendencies to avoid a measured rate in such a way as follows:

Loss aversion

If a monthly payment is larger than the reference point (= the average monthly bill payment), users tend to overestimate the loss. To avoid the loss, they prefer flat rates.

Reference dependence

If the reference point represents a level of bill payment which a user is accustomed to, the level affects the subjective evaluation of the shift to a flat rate. Users' preference for flat rates does not depend on the absolute level of payment but on the diversion from the reference point.

The shape of the probability weighting function

With a typical probability weighting function, users with a low probability of overuse tend to overestimate the probability. They tend to avoid an extraordinary payment and to choose a flat rate.

Mental accounting

It represents how expenditures are recognized by consumers psychologically (Thaler, 1980). Under a measured rate, users are aware of bill payment every month. Under flat rates, users are not aware of such psychological burden.

Ambiguity aversion

It denotes behavior to avoid uncertainty. Under measured rates, the amount of bill is uncertain, while under flat rates the amount of payment is constant. Then, consumers prefer the latter than the former.

Cognitive dissonance

Once a flat rate is chosen, users won't change it even if a measured rate is reasonable. They feel psychological tension when they have recognized the fact that what they believe is not consistent

with its objective recognition. They will continue to use it.

4. The Empirical Study

4.1. The Questionnaire Survey and the Basic Demographics

An online questionnaire survey was carried out in order to examine the existence of flat-rate preference and to interpret the flat-rate preference in terms of the above six concepts. The survey was conducted in February 2006 and included 232 mobile users in their teens to forties from each of which we collected the same number of samples. They were selected randomly from the pre-registered consumer panels. The questionnaire included 28 questions with regard to the flat-rate preference in addition to 10 questions asking personnel information. Some demographic data of the respondents and their average disposable money are shown in Table 2 and Figure 3.

Table 2: Demographic Information of the Respondents

The number of samples		232
Gender	Male	114
	Female	118
Average monthly disposable money		¥31,254

Figure 3: The Respondents' Average Disposable Money (thousand yen/month)

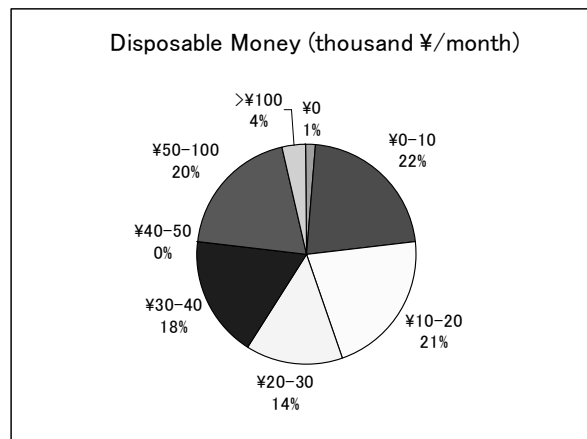


Figure 4 represents the percent shares of the brands of mobile phones used by the respondents. NTT DoCoMo gained a 43% share (including 25% and 18% for 3G and 2G, respectively). au by KDDI holds the second place with an approximately 28% share (21% and 7%). Vodafone, which was purchased by Softbank Mobile, had a 23% share (19% and 4%). The subscriptions in flat-rate services are shown in Figure 5. With regard to voice communication services, 7.8%, 34.1% and 58.1% are using, willing to use and unwilling to use flat-rate services, respectively. As for packet communication services, 22.0%, 34.5% and 43.5% are using, willing to use and unwilling to use the services, respectively. This means that more than 34% of the respondents are willing to use flat-rate services if they are available.

Figure 4: Mobile Phones Used by the Respondents

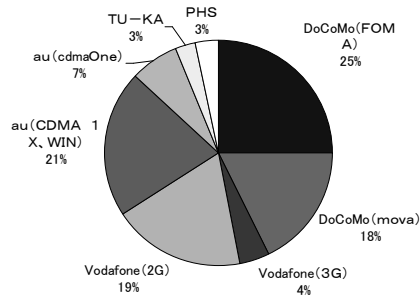
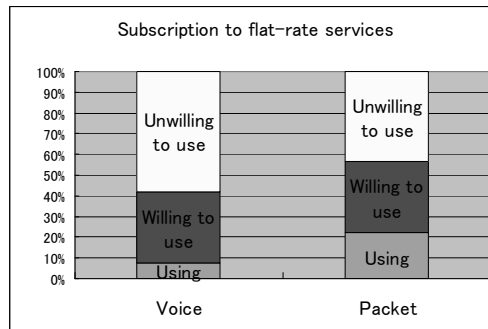


Figure 5: The Subscriptions to Flat-Rate Services



4.2. Interpretations of the Flat-Rate Preference Based on the Behavioral Economic Concepts

This section examines whether the psychological factors can explain mobile users' flat-rate preference in terms of the six concepts quoted from behavioral economics. Statistical methods are applied for testing the hypotheses.

4.2.1. Loss Aversion

In order to interpret the flat-rate preference in terms of loss aversion, we asked the two questions shown below. These two questions are asking the same thing. The only difference is that Q.1 emphasizes the gain of Plan A while Q.2 does the loss.

Q.1

Plan A: ¥7,000/month + ¥6,000 if you exceed the communications allowance
 Plan B: ¥9,000/month + no extra charge
 According to the previous experience, you will not use up the allowance with probability 2/3 when you choose Plan A.

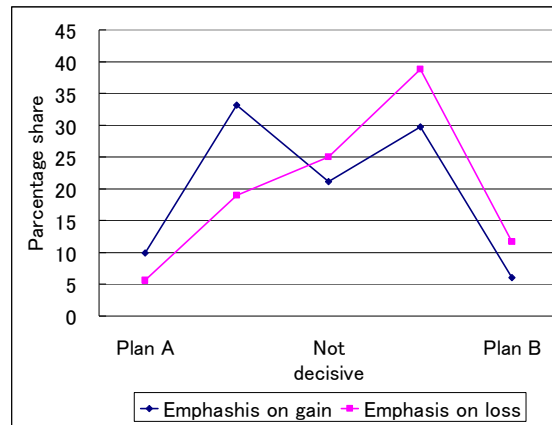
Q.2

Plan A: ¥7,000/month + ¥6,000 if you exceed the communications allowance
 Plan B: ¥9,000/month + no extra charge
 According to the previous experience, you will exceed the allowance with probability 1/3 when you choose Plan A.

The answers to these paired questions are seen in Figure 6. The horizontal axis categorizes the

degree of the preference between Plan A and Plan B in the two questions, and vertical axis show percentage shares of the respondents. Whether the two distributions are identical or not can be tested by applying the Wilcoxon signed rank sum test. The null hypothesis to be tested is that the median of a distribution is equal to some value. The results indicate that the answers to the two questions have significantly different distributions. The choice of the flat rate (Plan B) with emphasis on the loss in Q.2 is significantly greater than with the emphasis on the gain in Q.1 ($p < 0.01$). When the loss is emphasized in choosing a mobile phone tariff, users are more likely to prefer flat-rate services, taking the loss more serious than the gain.

Figure 6: Distribution of the Choices of the Mobile Users over the Preferred Plans in the Two Questions



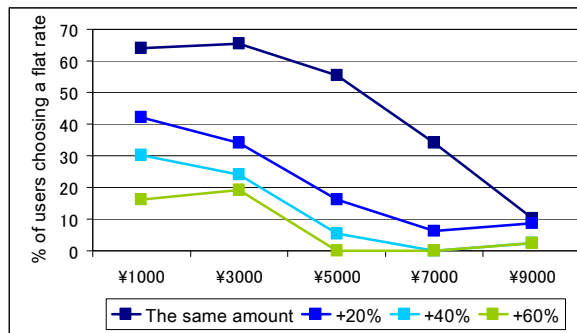
4.2.2. Reference Dependence

To examine whether the concept of reference dependence can explain the flat-rate preference, the respondents were asked to accept the shift from either one of hypothetical average bill levels (as the reference point) with measured rates setting at ¥1,000 through ¥9,000 with fluctuations between -50% and +50%, to one of the flat-rates ranging from the same amount to +60%. The question reveals that the mobile users are aware of the reference point and hate to move from it.

The Settings of the Question: To ask willingness to accept the change from either one of hypothetical average bill levels (as the reference point) with measured rates setting at ¥1,000, ¥3,000, ¥5,000, ¥7,000 and ¥9,000 with fluctuation between -50 to +50% to one of the flat rates ranging over the same amount, +20%, +40% and +60%.

The results are illustrated in Figure 7. The horizontal axis represents the current payment under measured rate, and vertical axis does the percentage of users choosing flat rates. If there is no reference dependency, each distribution should be a uniform distribution, because for those who choose a flat rate their choice should be indifferent to the levels of the current bill payment. To estimating how closely an observed distribution matches an expected distribution, Chi square tests are applied to test the hypothesis that the distributions are uniform. The results indicate that a uniform distribution was rejected to apply to the shape of the curves ($p < 0.01$). We can conclude that different bill payment levels result in different willingness to adopt a flat rate, and thus the flat-rate preference depends on the reference point.

Figure 7: Dependencies on the Reference Points



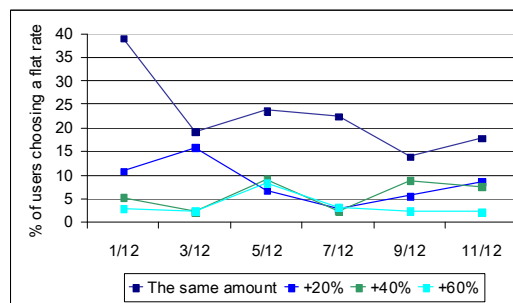
4.2.3. The Shape of the Probability Weighting Function

Tendencies that mobile users overweight lower probabilities can be examined through a question asking their choice on the shift from measured rates with stochastic fluctuations in the phone bills to a flat rate. The hypothesis holds if users with lower probabilities of fluctuations are more likely to choose flat rates than those with higher probabilities. The settings of the question are given as follows:

The Settings of the Question: To ask the willingness to accept the shift from a measured rate with which the respondent has to pay the double of the average with probabilities ranging from 1/12 (once in a year) to 11/12 (eleven times in a year) to one of the flat rates of the same amount, +20%, +40% and +60%.

The results are plotted in Figure 8. The horizontal axis represents the probabilities of fluctuation in the phone bills ranging from once to eleven times a year, and the vertical does the percentage of users choosing flat rates. If the tendencies appear, the left hand side of the curves in the graph should be downward-sloping. In the case, the null hypothesis that the distributions are uniform should be rejected. Chi square tests are applied to test the hypothesis. The results cannot reject the null hypothesis, except for the case of the shift to the flat rate of the same amount ($p < 0.01$). With the data collected through the survey, we cannot find out firm evidence that supports the existence of overweighting lower probabilities.

Figure 8: Stochastic Fluctuations in Phone Bills and the Choice of Flat Rates



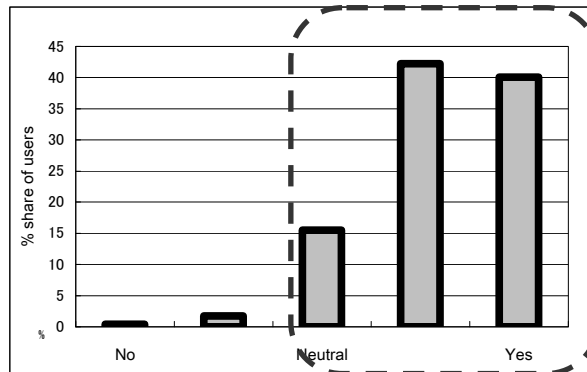
4.2.4. Mental Accounting

Mental accounting is psychological recognition of gain and loss, and the following question was asked to examine whether flat rates were perceived as tariffs reducing psychological costs:

Q. Is it a merit of flat rates that you don't need to be sensitive to bill payment every time you use the service?

The answers were selected from five ordinal scale choices. If the respondents are aware of mental accounting, that is, if they feel the exact amount of payment psychologically cheaper than the actual amount, the distribution of the answers will be diverted from symmetric distributions such as a normal or uniform distribution. The Kolmogorov-Smirnov (K-S) test was applied for checking whether an underlying probability distribution differed from a hypothesized distribution. The null hypothesis assuming that the distribution was a normal or uniform distribution was rejected ($p < 0.01$). The result shows that flat rates relieve the psychological burden of bills and suggest that mental accounting can be embedded in the flat-rate preference.

Figure 9: Flat Rates Reduce Mental Costs



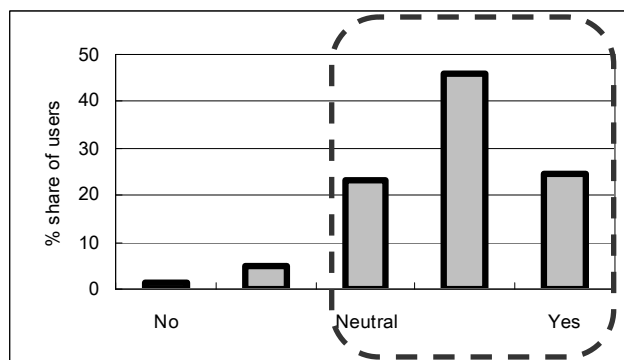
4. 2.5. Ambiguity aversion

Ambiguity aversion is behavior to avoid uncertainty. The influence of ambiguity aversion on the choice of flat rates is examined by asking the following question:

Q. Is it a merit of flat rates that the monthly payment is fixed?

As in the case of mental accounting, the answers were selected from five ordinal scale choices and the K-S test was applied for examining whether the distribution was diverted from symmetric distributions. The result indicates that the null hypothesis of having a normal or uniform distribution was rejected ($p < 0.01$). The concept of ambiguity aversion can support the flat-rate preference.

Figure 10: Uncertainty Avoidance was seen in the Users' Flat-Rate Preference



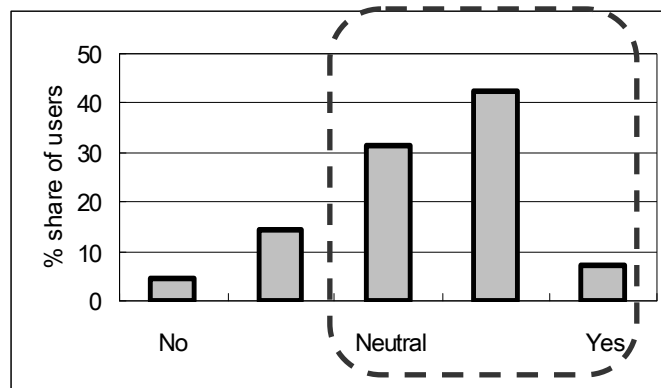
4.2.6. Cognitive Dissonance

Cognitive dissonance represents psychological tension resulting from behavior that conflicts with one's beliefs own inappropriate decision. More concretely, it can be defined as unwillingness to accept the inconvenient truth. Once a flat rate is selected, users believe it is the best and don't want to change to other options even if they are more efficient. This can be examined by asking the following question:

Q. Do you continue use a flat-rate bill plan even if it is not appropriate to your usage of mobile phone?

The K-S test was applied in the same way as the above two cases, and the hypothesis of having a normal or uniform distribution was rejected ($p < 0.01$). The result indicates that the concept of cognitive dissonance can explain the flat-rate preference.

Figure 11: Conflicts with Beliefs can Cause the Flat-Rate Preference



5. Conclusion

In this paper, we have proposed the applications of some important concepts from behavioral economics for more reasonable explanations of mobile users' flat-rate preference. We have examined how the three fundamental concepts from the Prospect Theory such as loss aversion, dependency of reference points and the characteristics of probability weighting function can explain the inclination to flat rates. The other three important factors, i.e., mental accounting, ambiguity aversion and cognitive dissonance have also been employed for explaining the preference. Non-parametric statistical tests have been applied to the data sampled over mobile phone users through an online survey. The results show that, except for the shape of the probability weight function, these concepts can be recognized as promotive factors of the preference. Table 3 summarizes the results.

Table 3: Summary of the Results from the Empirical Tests

The concepts conducive to the flat-rate preference	The concepts failed to explain the flat-rate preference
Loss aversion Reference dependence	The shape of the probability weighting
Mental accounting Ambiguity aversion Cognitive dissonance	

Flat rates have been increasingly expected as a means of promoting the usage of ICT services. If ICT services are supplied with flat rates, their usage is substantially unlimited and the availability will be increased drastically. Flat rates have been recognized as an important business strategic tool for promoting the usage. The framework adopted in this analysis will be able to afford deeper insights that could provide both mobile operators and policy makers with useful information about users' inclinations to accept flat-rate services. This study is just a first step toward this end.

Further extension and elaboration are necessary to deepen and widen the knowledge of the consequences of flat-rate applications. For example, although non-parametric approaches are useful in investigating the significance of each behavioral economic concept, their relative importance cannot be identified. Parametric approaches will be able to cover the shortcomings of the non-parametric approaches because they deal with the factors affecting decisions within a single framework and can specify the relative importance. Comparison with other services will provide more profound insights into the impacts of flat-rate applications.

References

- Colin F. Camerer, George Loewenstein, and Matthew Rabin eds.(2004), *Advances in Behavioral Economics (The Roundtable Series in Behavioral Economics)*, George Loewenstein, Matthew Rabin (Eds.), Princeton Univ. Press.
- Hardie, B.E., Johnson, J., Fader, P. (1993), Modeling loss aversion and reference dependence effects on brand choice, *Marketing Science*, vol.12 No.4, pp.378-394.
- Kahneman, D. and A. Tversky (1974), Judgment under uncertainty: Heuristics and biases, *Science* 185, pp.1124-1131.
- Kahneman D. and A. Tversky (1979), Prospect theory: an Analysis of decision under risk, *Econometrica* vol.47 (2), pp.263-291.
- Knight, Frank.H. (1921), *Risk, Uncertainty, and Profit*, New York, Houghton Mifflin.
- Lambrecht, A., and B. Skiera (2006), "Paying Too Much and Being Happy about It: Existence, Causes and Consequences of Tariff-Choice Biases", *Journal of Marketing*.
- Mitomo, H. (2001), "An Economic Evaluation of Flat-Rate --- A Simulation of How a Shift from a Two-Part Tariff Changes Economic Welfare", *Journal of The Japan Society of Information and Communication Research* 2001, pp.39-54 (in Japanese).
- Rabin, M. (2002), A Perspective on psychology and economics, *European economic review* 46, pp.657-685.
- Simon, H. (1955), A Behavioral model of rational choice, *The Quarterly Journal of Economics* vol.69, No.1, pp.99-118.
- Thaler, R., (1980), Toward a positive theory of consumer choice, *Journal of economic behavior and organization* vol.1 issue 1, pp.39-60.
- Thaler R. (1985), "Mental Accounting and Consumer Choice", *Marketing Science*, Vol. 4, No. 3, pp. 199-214.
- Train, K. E. (1994), *Optimal Regulation*, MIT Press.
- Train, K. E., D. L. McFadden, and M. Ben-Akiva (1987), "The Demand for Local Telephone Service: A Fully Discrete Model of Residential Calling Patterns and Service Choices", *RAND Journal of Economics*, vol. 18(1), the RAND Corporation, pp.109-123.
- Train, K.E. (1991), *Optimal Regulation*, the MIT Press, 1991.