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Conjoint Analysis of Consumer Preferences for Broadband Services in Japan

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This paper applies conjoint analysis to consumer preferences of Japan's broadband services such as ADSL, CATV Internet, and FTTH. The stated preference method has advantages in analyzing innovative and qualitatively changing services from a long-term point of view. We make two points. First, we find that the actual availability of FTTH has an effect on consumers' stated preferences: consequently, the WTP for 1 Mbps is about ¥32 ($0.29) for users with access to FTTH, while it is about ¥45 ($0.41) for those without access to FTTH. Second, we show that stated preference and revealed preference may vary for a certain population: consequently, the WTP for 1 Mbps is about ¥32 ($0.29) based on the former, while it is about ¥20 ($0.18) based on the latter.

Keywords: broadband, conjoint analysis, nested logit, stated preference, revealed preference

JEL Classification Numbers: L86, L96

1. Introduction

Whether stated or revealed, "heterogeneous and changing customer demand" is an important force driving the evolution of an industry. This is true especially in the rapidly evolving telecommunications industry (see Bohlin et al., 2001; Fransman, 2001 for details). The purpose of this paper is to analyze the heterogeneous and rapidly changing customer demand for broadband (BB), high-speed Internet access services by using conjoint analysis.

Japan has shown strong development of its BB services in recent years. According to the Ministry of Internal Affairs and Communication (MIC), the number of BB users overtook that of narrowband (NB) users in December 2004. There are in fact three categories of BB: (1) asymmetric digital subscriber line (ADSL) (71.6% in share), (2) cable television (CATV) Internet (15.4%), and (3) fiber to the home (FTTH) (13.0%). It is noted that the Japanese FTTH market initially took off in the world although the ratio of ADSL users is still high. Today Japan's broadband service is reputedly the world's lowest in price and fastest in speed. An International Telecommunication Union (ITU) Internet Report entitled the *Birth of Broadband* compared rates per 100 kbps among various countries as of September 2003, showing that Japan ($0.09) is much cheaper than the USA ($3.53), the UK ($6.37), and others.

However, with the rapid spread of BB services, the problem of the "digital divide" is now becoming an important social issue. This term means that there is a large disparity in the availability of BB services between urban and provincial regions. MIC reports that, as of October 2004, although FTTH is now starting to become available in cities and towns with a population of more than 50,000, there is hardly any provision of FTTH starting in towns or villages with smaller populations. For ADSL, on the other hand, the critical mass is a population of 5,000[1)]. At this point, it would be a valid question to ask how the availability of FTTH could influence consumers' preferences. It is thought that consumers who can access FTTH have more information on the quality of FTTH service, leading to the following question: which type of consumer rates high-speed Internet access higher, consumers who have more information or who have less? This question is interesting because high-speed Internet access can be considered as a sort of "experience good." FTTH is a just emerging service and therefore has characteristics that we discover only after we actually use it. The question above is the first one to be pursued in this paper.

Next, note that there are two kinds of data source of consumer preferences: the first is revealed preference (RP), and the second is stated preference (SP). RP data relate to consumers' actual choices in the real world, whereas SP data relate to those in experimental or survey situations. The advantage of RP is that RP more accurately reflects the actual choices, though its disadvantage is that RP is limited to situations already existing. On the other hand, the advantage of SP is that the experiments can be designed to be as flexible as the researcher wants, while the disadvantage is that what people say they will do is often not the same as what they actually do. Thus, RP can be used to forecast short-term departures from current equiribria, while SP should be more useful for forecasting changes in evolving demand (see Louviere et al., 2000; Train, 2003 for details). Since high-speed Internet access has the characteristic of an "experience good," its SP and RP may differ, leading to the question of which preference is higher for the high-speed Internet access, SP or RP, provided that a consumer can access FTTH? This question is interesting because future information policy must take into account not only RP,

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[1)] The details are given as follows: (1) 50,000 or more (478 cases): FTTH (93.9%), ADSL (100%); (2) 10,000 through 50,000 (1,186 cases): FTTH (33.8%), ADSL (99.2%); (3) 5,000 through 10,000 (783 cases): FTTH (10.6%), ADSL (89.9%); (4) 5,000 or less (676 cases): FTTH (2.1%), ADSL (48.8%) (note: the numbers represent the percentage of communities where the service is at least partially available; source: http://www.soumu.go.jp/s-news/2005/050201_1.html).

Table 1 FTTH availability and revealed/stated preference data

		FTTH availability	
		Available	No available
Data	SP data	I (this paper)	II (this paper)
	RP data	III (Ida&Kuroda, 2006)	IV

but also SP, to resolve the problem of the digital divide. The question above is the second one to be pursued in this paper.

It is worthwhile summarizing the four following combinations based on the availability of FTTH and the revealed/stated preference data in Table 1. Domain I represents the SP data of consumers who can access FTTH; Domain II, the SP data of consumers who cannot; Domain III, the RP data of consumers who can avail of FTTH; and Domain IV, the RP data of consumers who cannot, which are actually null. It is Domains I and II that this paper investigates. On the other hand, Ida and Kuroda (2006) investigated Domain III with using actual data.

The first question of whether the availability of FTTH will influence consumers' preferences can be examined by comparing Domains I and II. Upon examination, we see that it does. The willingness to pay (WTP) for increasing the speed by 1 Mbps is ¥32 ($0.29) for consumers who can access FTTH and ¥45 ($0.41) for those who cannot. That is, WTP of people living in FTTH-unavailable areas is greater than that of people living in available areas. This finding is interesting in that although consumers who have no access to FTTH mostly live in provincial regions, they value high-speed Internet access rather more. The problem of the digital divide has been sometimes ignored on the grounds that there is no demand for high-speed Internet access in provincial regions. Our conclusion demonstrates, however, that the demand for high-speed access in provincial regions is not necessarily small.

The second question of whether the SP and RP of a consumer are the same can be investigated by comparing Domains I and III; on investigation, we see that they are not. The WTP for increasing the speed by 1 Mbps is ¥32 ($0.29) based on SP data, while it is ¥20 ($0.18) based on RP data. SP is obtained from the estimation with the virtual experimental survey, whereas RP is derived from actual market data. Thus we can interpret the former as the actual demand at present and the latter as the potential demand in the near future. Our finding suggests that the demand for high-speed Internet access will evolve because its SP is higher than its RP.

This paper is composed of five sections. Section 2 introduces conjoint analysis and formalizes econometric models. Section 3 explains the data, and Section 4 shows the estimation results and compares SP with RP. Finally, Section 5 provides conclusions.

2. Analytical Framework

In this section, we survey conjoint analysis and discuss its econometric models, focusing on logit model.

2.1. Conjoint Analysis

The key approach of this paper is "conjoint analysis," or the stated preference method (SPM)[2]. In this procedure, we assume a service to be a profile that is composed of attributes. In a BB service context, for example, speed, price, the availability of IP phones, the distribution of TV programs, and the symmetry between uploading and downloading are considered attributes.

Particular analysis purposes shape the contours and amount of the attributes that should be introduced into a profile. If we include too many attributes, the respondents will have difficulty answering the questions[3]. On the other hand, if we adopt too few attributes, the description of alternative will become inadequate. In our research, the pretests were prudently carried out three times, and then we determined the attributes and levels. Since the number of profiles becomes too large if we consider all possible combinations of the attributes, we adopt an orthogonal planning method to avoid this problem. The profiles used in this research are presented in Table 2.

Table 2 Questionnaire: attributes and levels

Attributes	Levels					
Price	¥2,500	¥3,000	¥3,500	¥4,000	¥4,500	¥5,000
	¥5,500	¥6,000	¥6,500	¥7,000	¥7,500	
Access speed	1 M	10 M	20 M	30 M	100 M	
IP telephony	Available	Unavailable				
TV programs	Available	Partially available		Unavailable		
Provider	NTT (East and West)		Non-NTT			
Symmetry	Symmetric	Asymmetric				

[2] Conjoint Analysis has been studied in the field of marketing research and recognized an effective method to analyze the consumer preference (see Louviere et al., 2000 for detail in methodology), while research has also been done in the field of telecommunications. For example, Madden and Simpson (1997) studied residential broadband subscription demand using conjoint analysis; Zubey et al. (2002) analyze demand substitutability between VoIP and POTS by using conjoint analysis, concluding that it is important to improve the quality of connections between end users and publicly switched telephone network (PSTN) facilities; Savage and Waldman (2005) most recently investigated broadband Internet access, finding that reliability of service, speed, and always-on connectivity are important Internet attributes.

[3] On this point, Miller (1956) pointed out that it is too complex for human beings to process more than six attributes at the same time.

2.2. Econometric Models

Discrete choice models, including a logit model, are normally used as an estimation method in choice experiment research. A logit model is preferable because it is consistent with random utility theory. The random utility function is composed of a non-stochastic term $V(\cdot)$ and stochastic term ε. When an individual n chooses alternative i, the utility is represented as

$$U_{in} = V_{in}(x_{in}, m_{in}) + \varepsilon_{in},\ for\ n = 1...N, i = 1...I \tag{1}$$

where x_i is a vector of attributes of profile i, and m_i is a monetary attribute (e.g. price).

If we suppose that respondents choose an alternative with the aim of maximizing random utility function, the probability of choosing alternative i by consumer n, namely the probability of $U_{in} > U_{jn}(\forall j \neq i)$, is written as

$$P_{in} = prob(V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}) = prob(\varepsilon_{in} - \varepsilon_{jn} > V_{jn} - V_{in}).$$

Assuming that ε is "independent and identical distribution of extreme value type I (IIDEV I)", following McFadden (1974), the choice probability P_{in} can be written as Eq. (2), which is called a conditional logit (CL) model.

$$P_{in} = \exp(V_{in}) \Big/ \sum_j \exp(V_{jn}) \tag{2}$$

For the parameter estimation, we maximize a log likelihood function as presented in Eq. (3) with the maximum likelihood estimation. Note d_{in} is a dummy variable that takes the value of one if individual n chooses profile i and zero otherwise.

$$\ln L = \sum_n \sum_i d_{in} \ln P_{in} \tag{3}$$

Additionally, we assume that the non-stochastic portion V is linear function, indicated in Eq. (4), where X_k is the k-th attribute, X_m is the monetary attribute, and β is the coefficient of alternative i.

$$V = \sum_k \beta_k X_k + \beta_m X_m \tag{4}$$

Having assumed ε as the IIDEV I, the CL model possesses "independence from irrelevant alternatives (IIA)." This IIA property means that the ratio of choice probabilities is only determined by the relevant the two alternatives and is completely independent of any other alternatives. This IIA property will lead to a biased estimation if there exists a high similarity between alternatives in a choice set.

In this paper, there are five alternatives in this multiple-choice question: alternatives 1 and 2 are ADSL, alternative 3 is CATV Internet, and alternatives 4 and 5 are FTTH. There may be strong similarities between alternatives 1 and 2 and between alternatives 4 and 5. The appropriateness of the IIA assumption can be investigated by the Hausman-McFadden test (see Hausman and McFadden, 1984 for details). If the appropriateness of the IIA assumption is rejected by this test, then we should consider other models such as a nested logit (NL) model. In the NL model, we classify the alternatives into categories according to their similarities.

Next, we explain the choice probabilities in the NL model. The probability P_{in} of choosing alternative i in the subgroup $B^k (k \in \{ADSL, CATV, FTTH\})$ is written as Eq. (5) (see Train, 1986, p. 68). Based on Eq. (5), we estimate parameters with the maximum likelihood method. (Note: the NL model equals to CL the model if λ=1.)

$$P_{in} = \exp(V_{in}/\lambda_k)\left(\sum_{j\in B^k}\exp(V_{jn}/\lambda_k)\right)^{\lambda_k - 1} \Big/ \sum_l \left(\sum_{j\in B^l}\exp(V_{jn}/\lambda_l)\right)^{\lambda_l} \qquad (5)$$

Finally, the willingness to pay for an attribute is calculated by substituting a monetary attribute for another attribute. Letting β_s be a speed parameter, for example, we can represent willingness to pay for one-unit increase in speed as $WTP = -\beta_s/\beta_m$.

3. The Data and Descriptive Statistics

In this section, we explain the data and the descriptive statistics. The data are collected through the following survey for analyzing SP and RP on BB services:

> A series of surveys concerning Internet access demand for private use, which was conducted according to "The Guidelines for the Competition Review of Japan's Telecommunications" and "The Implementation Manual for FY 2003" (published by the Ministry of Internal Affairs and Communications, November 2003).

The survey was carried out as a Web questionnaire because using the Internet was inexpensive and quick and also because the object of this research itself was related to the Internet access[4)]. We survey a random sample of two groups to investigate how the actual availability of FTTH influences SP, or how SP and RP of the identical population are different[5)]. Group A, randomly derived from the population who can avail of all alternatives including FTTH, is 105[6)]. Group N, randomly derived from the population who cannot choose FTTH, is 104. We conduct a conjoint analysis for these respondents, asking them the seven questions. Thus, the

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[4)] Since we used web investigation, the data obviously had a bias because the consumer monitors are more interested in broadband, high-speed Internet access than average people. We think, however, that such a sampling bias is allowable because the purpose of this paper is to study the future adoption of such new technology as BB services.

[5)] Ida and Kuroda (2006) also analyzed RP for BB based on the same population.

[6)] Here we deal with Internet access alternatives such as (i) dial up Internet (DU), (ii) ISDN, (iii) ADSL, (iv) FTTH, and (v) CATV Internet.

Table 3 Answers from all samples, group A, and group N

a) Answers from all sample

	ADSL		CATV	FTTH		
Alternatives	1	2	3	4	5	Total
Number	570	259	193	254	187	1463
Sub-total	829		193	441		1463
Prices (¥)						
Mean	2939.9	3534.7	5085.5	6143.7	6612.3	
S.D.	473.1	564.4	522.1	598.1	573.3	
Speed (Mbps)						
Mean	12.5	12.0	25.8	80.2	85.8	
S.D.	5.8	5.9	6.5	31.6	28.2	

b) Answers from group A

	ADSL		CATV	FTTH		
Alternatives	1	2	3	4	5	Total
Number	276	110	110	146	93	735
Sub-total	386		110	239		735
Prices (¥)						
Mean	2916.7	3513.6	5100.0	6213.6	6639.8	
S.D.	465.5	588.3	528.1	603.7	586.8	
Speed (Mbps)						
Mean	12.3	11.5	24.7	80.3	87.2	
S.D.	5.8	6.0	7.3	31.6	27.2	

c) Answers from group N

	ADSL		CATV	FTTH		
Alternatives	1	2	3	4	5	Total
Number	294	150	83	107	94	728
Sub-total	444		83	201		728
Prices (¥)						
Mean	2960.9	3550.3	5066.3	6120.4	6585.1	
S.D.	479.3	547.6	516.6	599.3	561.5	
Speed (Mbps)						
Mean	12.6	12.3	27.1	79.3	84.4	
S.D.	5.8	5.7	5.1	32.1	29.3	

numbers of observations are 105*7=735 for group A and 104*7=728 for group N. The results of the questionnaire are summarized in Table 3.

At first, looking at the answers from all samples, the stated choices of the respondents (with SPM) breakdown as follows: (1) ADSL (57%), (2) CATV Internet (13%), and (3) FTTH (30%). On the other hand, Ida and Kuroda (2006) report that the actual choices (with RPM) are: (1) ADSL (72%), (2) CATV Internet (19%), and (3) FTTH (9%). Note that ADSL is overwhelmingly supported in the SPM as well as in RPM, but the ratio of choosing FTTH in SPM is higher than that in RPM.

Next, comparing groups A and N, the ratio of choosing ADSL is higher in group N (60.1%) than in group A (52.5%); on the other hand, choosing FTTH is lower in group N (27.6%) than in group A (32.5%). Accordingly, we assume that the actual availability of FTTH would influence consumers' preferences and cause different choice behaviors in this conjoint analysis.

4. The Results of the Analysis

In this section, we show the estimation results. First, the influence of the actual availability of FTTH on SP is examined. Second, the discrepancy between SP and RP for the same populations is demonstrated.

4.1. The Estimation Results

First, we estimated the CL model, when it is necessary to examine whether the IIA assumption holds. We calculated the Hausman-McFadden statistic, as defined in (6), which follows a χ^2distribution:

$$\chi^2 = \left(\hat{\beta}_s - \hat{\beta}_f\right)\left(\hat{V}_s - \hat{V}_f\right)^{-1}\left(\hat{\beta}_s - \hat{\beta}_f\right) \tag{6}$$

where f is the full choice set, s is the subset excluding ADSL alternatives, V is an asymptotic variance-covariance matrix (the degree of freedom is 8). We here obtain χ^2=44.21, meaning that the IIA assumption is rejected at 1% level of statistical significance. Therefore, the application of a CL model is not appropriate. Second, we estimate the NL model. The estimation results of both the CL and the NL models are summarized in Table 4. Note that the signs of all significant coefficients make economic sense.

Table 4 shows that the NL model, which partially alleviates the IIA assumption, has a better degree of fitness than the CL model on the basis of McFadden's R^2. Consequently, NL model is better for use than CL model in our case.

4.2. The Influence of the Actual Availability of FTTH on SP

Conjoint analysis studies consumers' preferences based on their virtual choices. It is interesting to consider whether respondents' choices are influenced by the actual availability of alternatives. As stated, the respondents were divided into two groups: group A who can avail of FTTH and group N who cannot. This division is based on the difference of living environments of respondents; the questionnaire

Table 4 Results of parameter estimators with full sample data

		CL model			NL model		
		Coefficients	S.E.	t-value	Coefficients	S.E.	t-value
Price		–0.0004	0.0001	–7.4560	–0.0005	0.0001	–6.7374
Speed		0.0171	0.0017	10.3047	0.0178	0.0018	9.9282
IP telephony		0.3678	0.0577	6.3767	0.3980	0.0693	5.7406
Partial TV program		–0.0445	0.1044	–0.4263	0.0251	0.1264	0.1982
Full TV program		–0.1554	0.1537	–1.0108	0.1398	0.3072	0.4552
NTT dummy		–0.0969	0.0737	–1.3149	–0.2916	0.1137	–2.5655
Symmetry dummy		–0.2991	0.2135	–1.4009	–0.7644	0.6701	–1.1406
	ADSL				0.3689	0.2523	1.4621
IV	CATV				1.0000	—	—
	FTTH				0.5016	0.1769	2.8353
Number of obs.		1463			1463		
Log likelihood (L)		–2174.767			–2172.166		
L(0)		–2354.608			–2354.608		
McFadden's R^2		0.076			0.077		

is the same for the two groups. If this difference in the actual availability of FTTH systematically influences the consumers' SP, the estimated coefficients will be different between the two groups.

To test the null hypothesis that the estimated coefficients are the same between the two groups A and N, we used a likelihood ratio (LR) test (see Ben-Akiva and Lerman, 1985 for details). Concretely, we calculated the quantity of $LR = -2[LL(A + N) - \{LL(A) + LL(N)\}]$ that is asymptotically χ^2 distributed, where LL(X) represents the log-likelihood of group $X \in \{A, N\}$. At this point, we obtain LR = 21.919. Consequently, we rejects the null hypothesis at the 1% level of statistical significance. The actual availability of FTTH significantly changes the consumers' SP.

Table 5 summarizes the estimation results of groups A and N and the values of WTP. It is observed that the WTP for additional 1 Mbps is about ¥32 ($0.29) for group A individuals who can avail of FTTH, while it is about ¥45 ($0.41) for group N who cannot. People without access to FTTH have a higher preference for an increase in access speed than those to whom FTTH is available.

This slightly surprising result can be explained as follows. FTTH is mostly available in urban areas such as Tokyo, Osaka, and Nagoya, while areas without access to FTTH are mainly rural or sparsely populated. In urban areas, the competition between firms who provide ADSL and FTTH is very fierce; therefore, people

Table 5 Comparison of estimation results between two groups

		NL model (A: FTTH available)			NL model (N: FTTH not available)		
		Coefficients	S.E.	t-value	Coefficients	S.E.	t-value
Price		–0.0006	0.0001	–5.4552	–0.0004	0.0001	–4.1955
Speed		0.0189	0.0025	7.4368	0.0171	0.0026	6.6687
IP telephony		0.5284	0.1056	5.0036	0.2999	0.0865	3.4685
Partial TV program		–0.1049	0.1782	–0.5888	0.1562	0.1866	0.8370
Full TV program		0.8156	0.5008	1.6286	–0.4729	0.3197	–1.4792
NTT dummy		–0.3884	0.1589	–2.4440	–0.1670	0.1621	–1.0302
Symmetry dummy		–0.2854	1.2020	–0.2375	–0.9861	0.6743	–1.4624
IV	ADSL	0.2193	0.2562	0.8561	0.7310	0.5574	1.3113
	CATV	1.0000	—	—	1.0000	—	—
	FTTH	0.3615	0.1901	1.9015	0.7701	0.3726	2.0671
Sample number		735			728		
Log likelihood (L)		–1093.883			–1067.324		
L(0)		–1182.937			–1171.671		
McFadden's R^2		0.075			0.089		

	NL model (A: FTTH available)		NL model (N: FTTH not available)	
Attributes	Coefficients	WTP	Coefficients	WTP
Price	–0.000559***	—	–0.000383***	—
Speed	0.0188663***	32.1	0.0170841***	44.6
IP telephony	0.528437***	898.8	0.299875***	783.2
Partial TV program	–0.104942	–178.5	0.156177	407.9
Full TV program	0.81555	1387.2	–0.472934	–1235.2
NTT dummy	–0.388443**	–660.7	–0.166973	–436.1
Symmetry dummy	–0.28544	–485.5	–0.986113	–2575.5

Note: ***Significant at the 1% confidence level. **Significant at the 5% confidence level.

living in the urban areas can easily switch services or providers. On the other hand, there is little or no competition in rural areas, where a single, or at worst no firm, is providing BB services. Therefore, since it is important for group A to seek better, cheaper BB services, they are more aware of price; group N is less concerned because they are primarily concerned with securing access to BB services, rather than price levels. This result is also interesting from a psychological point of view. Schwarz and Vaughn (2002) have stated that individuals are likely to rely on ease of recall when the judgment task is of low personal relevance, but draw on recalled content when the task is of high personal relevance. Therefore, it makes sense that the availability of an alternative leads consumers to severer evaluations.

This conclusion provides interesting implications for the digital divide problem for further diffusion of BB services. Since people with limited access to BB services have a higher WTP for high-speed Internet access, they represent potentially high preferences for them, especially in rural areas where the demand has not yet been actualized[7)].

4.3. The Comparison of SP and RP for the Same Population

We next investigate whether the SP and RP of identical respondents are different[8)]. This paper has so far analyzed SP of BB services. For a comparative analysis of SP and RP, we use the SPM results of group A derived from the present study and the RPM results of Ida and Kuroda (2006), showing that the WTP for 1 Mbps is about ¥20 ($0.18).

According to previous research, SP and RP don't always correspond with each other, even though they are carried out based on the same population. Carson et al. (1996) introduce examples that suggest the ratio of a RP value to a SP value varies from 0.005 to 10.269.

We calculate the quantity of $LR = -2[LL(SP + RP) - \{LL(SP) + LL(RP)\}]$, which is asymptotically χ^2 distributed[9)][10)]. Then, we obtain LR = 1922.292. Consequently, we reject the null hypothesis that SP and RP are the same at the 1% level of statistical significance. As for the WTP of 1 Mbps, the figure of SP is about ¥32 ($0.29), and RP is about ¥20 ($0.18) for the same population.

It is interesting to ask why the WTP of SPM is higher than RPM. Azevedo et al. (2003) introduce a similar example in which the WTP based on SP data is two and a half times higher than the WTP based on RP data. They suggest that respondents tend to consider income constraints to be "softer" in SPM than in RPM. This conclusion is also related to the planning fallacy problem. Buehler et al. (2002) has stated that most predictions are overly optimistic even though

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7) On the other hand, it is true that the demand density of BB services is much smaller in rural areas than in urban areas. Therefore, the problem of the high cost of providing BB services in rural areas still matters. We suggest that the digital divide problem may not be due to excessive low needs but high costs.

8) It is possible that the alternative specific constants obtained from the SP-data estimation are modified (or *calibrated*) to allow them to reflect the known true market shares. At this point, however, we do not adopt this approach because we are concerned not with the market share forecasting but with the WTP calculating that is the ratio of parameter estimates and has nothing to do with constant estimates.

9) This test in fact correspondents to one for combining multiple data sets (i.e., SP and RP data); it is becoming common for researchers to combine them because we may avoid the faults of both data sets; the RP data are likely to be largely invariant, suffer from multi-colinearity while the alternative specific constants obtained from the SP-data estimation are meaningless for studies involving demand forecasting.

10) The estimations are carried out in the following manner: first, we estimate SP and RP data model respectively by using a CL model; second, we estimate the combined models of SP and RP data by using an NL model.

people believe that their current forecasts are realistic. Furthermore, as Louviere et al. (2000) stated, since SPM primarily takes account of innovative or qualitative changes of goods or services, SP is thought to indicate not a temporary preference but a long-term preference. In this respect, it is not surprising that the WTP based on SP data is one and a half times higher than RP data in rapidly evolving BB services.

5. Conclusions

Using conjoint analysis this paper has analyzed consumers' preferences with respect to Japan's BB services. Although BB services are rapidly evolving, the digital divide problem is growing. Two main conclusions are drawn. First, on analyzing whether the actual availability of FTTH influences SP, we found that SP differs depending on the actual availability of FTTH: the WTP for additional 1 Mbps is ¥32 ($0.29) in areas with access to FTTH but more than double that at ¥45 ($0.41) in areas without access to FTTH. Second, our results on the comparative analysis of SP and RP showed that SP and RP differ for the same populations: the WTP for additional 1 Mbps is ¥32 ($0.29) based on SP data, while it is ¥20 ($0.18) based on RP data. These findings will provide interesting insights into understanding innovation and new technology. It has been observed in this paper that there is demand for high-speed Internet access even in provincial regions. We consider that the problem of the digital divide should be rectified in this sense. At the same time, the finding that there is potential demand for high-speed Internet access based on the SP method is important in that even private companies can be profitable in this market. Accordingly it will be crucial to consider the division of roles between the public sector resolving the digital divide and the private sector entering the market. However, this paper has not explicitly considered the 'final demand' for BB services (e.g. IP Video and IPTV) and these impacts on the demand for different technologies/services (e.g. FTTH). These questions await future studies.

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