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Consumer preferences for service portability in Japan's mobile phone market

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Abstract: Japan's mobile phone market has been oligopolized by three incumbents who are seeking vertically integrated business models, which may prevent competitors from using platform layers to provide original services. We conduct two types of conjoint analysis to measure consumer-stated preferences and draw two main conclusions from the analyses. First, the average consumer is willing to pay more than JPY 2,000 (US $18) to increase mobile service portability. Second, the average consumer's willingness to pay (WTP) corresponds to JPY 100~200 (US $1~2) per song for securing music download platforms. In addition a dilemma exists in consumer preferences, namely the choice between free mobile service portability and convenient music download platforms.

Running title: mobile service portability
Keywords: mobile phone, portability, platform, conjoint analysis, mixed logit
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I. INTRODUCTION

Japan's third generation (3G) mobile phone services, which have developed rapidly, are among the best telecommunication services worldwide. As of December 2006, the number of contracts had reached 100 million, and the mobile Internet penetration rate was almost 90%. Japan's mobile phone market is currently oligopolized by three incumbent operators: NTT DoCoMo, AU, and SoftBank. Due to the scarcity of radio waves, entry into the mobile phone market is difficult[1]. Table 1 displays the number of existing contracts for mobile phones, mobile Internet, and 3G services after 2001. As of March 2007, NTT DoCoMo's market share was more than 50%, while AU's market share was around 30%. Further, the mobile Internet penetration rate was 87%; in particular this figure exceeded 90% for NTT, which began its *i-Mode* service in 1999, the first in the world to do so. The number of 3G users now overwhelmingly exceeds that of 2G users. With regard to the migration from 2G to 3G, AU has been the most successful: 95% of its users are currently using 3G services. Although NTT struggled at the beginning, more than 70% of its users have migrated to 3G services. SoftBank—formerly Vodafone Japan lagged behind because it was rather passive in the deployment of its 3G networks. In addition new services such as those offering the use of picture mail, music downloads, GPS, and electronic money are also becoming common in our daily lives.

<Table 1>

In October 2006, the Japan's Ministry of Internal Affairs and Communication (MIC) introduced a mobile number portability (MNP) service to promote competition in the country's highly restrictive mobile phone market. At present, users can switch carriers without changing their mobile phone numbers by paying around JPY 5,000 (US $45, given JPY 110 = US $1). However a year after this service was introduced, the utilization rate remained only 3%. One reason is because users cannot transfer other services related to mail addresses, music data, game applications, and handsets between

[1]As an exception, E-mobile, which specializes in data communication services, entered the market in March 2007.

carriers, since the platform layer has not been sufficiently opened for competitors in Japan's mobile phone market. This lack of mobile service portability leads to increased switching costs and impedes effective competition. This paper analyses how much users are willing to pay for increased mobile service portability.

Among the existing literature, Korean studies are particularly noteworthy[2]. Kim (2005), who estimated consumer-stated preferences for 3G services including video telephony, global roaming, and multimedia mobile Internet applications, concluded that consumers generally valued video telephony over multimedia mobile Internet and global roaming services. Kim et al. (2005) estimated consumer-stated preferences for future multi-use converged mobile terminals and demonstrated that consumers preferred a keyboard and a medium-sized display over the availability of diverse applications and high-quality Internet services. Lee et al. (2006a) estimated consumer-stated preferences for MNP services and argued that switching costs have been lowered since such services were introduced. Among Japanese studies, Iimi (2005) demonstrated a significant network effect in Japan's mobile phone market. Ida and Kuroda (2008) examined the substitution patterns of the demand for mobile phones and concluded that demand substitutability was stronger within the provider category than within the standard category. As an example, the closest substitute for NTT's 3G service was NTT's 2G service rather than AU's 3G service. Nakamura (2008) conducted a conjoint analysis and discussed the WTP for not only MNP but also e-mail address portability among users[3].

This paper will further develop these previous studies including Lee et al. (2006a) and Nakamura (2008), in order to better understand consumer WTP with respect to mobile service portability. A platform layer, which is a key function for securing portability, smoothly circulates diverse contents and applications over

[2]Few papers have studied the demand for mobile telephone services, particularly for 3G services, as previously pointed out by Taylor (2002, p.130). Tishler et al. (2001), Kim and Kwon (2003), Iimi (2005), and Doganoglu and Grzybowski (2007) investigated consumer preferences for mobile phone services using logit models.

[3]For previous research using conjoint analysis, see for example, Bryan and Parry (2002), Cuccia and Cellini (2007), Ida et al. (2008), Kim et al. (2005), Lee et al. (2006b), Madden and Simpson (1997), and San Miguel et al. (2000).

telecommunications networks. Examples of mobile platforms include authentication, charging, subscriber IDs, handset IDs, GPS, copyright management, and so on. Unless a sufficient number of mobile platforms are opened, service portability will decrease, user switching costs will increase, and effective competition will be impeded. To investigate how much consumers are willing to pay for increased mobile service portability, in December 2007, we conducted a consumer survey in collaboration with MIC, with 1,142 respondents.

Two conclusions are drawn in this paper. First, if the portability of services relating to mail addresses, music data, game applications, and handsets is secured, consumers will benefit greatly, since they will be able to switch carriers without difficulty. Thus the portability of services will promote market competition. Measuring the average consumer's WTP for increased mobile service portability, the total value was found to exceed JPY 2,000 (US $18). Second, focusing on music download services provided through official or unofficial sites, we conclude that consumer conveniences was dependent on the type of platform, which in turn is dependent on the type of site. Measuring the average consumer's WTP for securing music download platforms, the total value corresponds to JPY 100~200 (US $1~2) per song. Moreover an increase in the number of platforms leads to the diffusion of music download services. Therefore, it is evident that consumers have significant preferences for both diverse services that are realized by free portability and for convenient services that are enabled by vertically integrated business models. To resolve this dilemma, it is necessary to construct a flexible business model that simultaneously realizes open portability and convenient platforms.

This paper is organized as follows. Section II explains the survey method and basic statistics. Section III discusses the conjoint analysis and estimation models used in this paper. Section IV describes the estimation results for mobile service portability. Section V presents the estimation results for music download platforms. Finally, Section VI provides some concluding remarks.

II. SURVEY METHOD AND BASIC STATISTICS

In December 2007, we conducted a sample survey in collaboration with MIC to collect data on the individuals' usage of mobile phone services. The survey was conducted with

monitors registered with a consumer investigative company. We obtained 1,142 responses from individuals currently using mobile phone services, including 281 who have previously used MNP services[4]. The socio-demographics, which include gender, age, occupation, and household income, are described in Table 2. While carrying out the sampling, we considered the geographical characteristics, gender, and age structures of Japanese people. We observed that consumer choices differed between the users and non-users of MNP services. With respect to the MNP users, the market share was 66.9% for AU, 18.2% for SoftBank, and 14.9% for NTT. On the other hand, with respect to the non-users of MNP, the market share was 54.4% for NTT, 27.6% for AU, and 15.1% for SoftBank. The current major use of the services is indicated in Table 2. Among the respondents of the survey, 20% replied that they frequently use music download services and online games, while 50% stated that they only use e-mail and Web browsing.

Furthermore, most MNP users previously subscribed to NTT or other small carriers such as Tu-Ka. SoftBank and AU were found to be more popular among those who wished to switch carriers. Moreover, 30% of the respondents replied that they are willing to use services that allow them to transfer e-mail addresses, music data, and handsets. Generally, official sites are preferred to unofficial sites for downloading data, since the former are more convenient. On the other hand, 50% of the respondents stated that they are interested in unofficial sites because they are less expensive and include diverse contents. The contents of the frequently viewed sites include news, music downloads, and so on. However, it is important to note that 30% claimed that they have never visited any such site. Finally, 20% stated that they avail of pay content services.

<Table 2>

III. CONJOINT ANALYSIS AND ESTIMATION MODEL

In this section, we explain the conjoint analysis and estimation models used in this study.

[4]According to an MIC report, the percentage of users availing of MNP services is 5.8%. In this paper, we increase the sample size of those who availed of MNP services in order to conduct comparisons between users and non-users.

Conjoint analysis assumes that a service is a profile composed of attributes. If an excessive number of attributes and levels is included, respondents would find it difficult to answer the questions. On the other hand, if too few are included, the description of the alternatives becomes inadequate. Since the number of profiles becomes unwieldy if we consider all possible combinations, we adopted an orthogonal planning method to avoid this problem (see Louviere et al. 2000, Ch. 4, for details). After conducting several pretests, we determined the appropriate alternatives, attributes, and levels.

We conducted two types of conjoint analyses. In the first analysis, we measured consumer WTPs with respect to increased mobile service portability. At this point, *portability* implies that consumers can continue to use the services that they previously used. Figure 1 depicts a representative questionnaire. The alternatives, attributes, and levels were given as follows:

①. Cost of switching carriers (COST): JPY 1,000, 2,000, 3,000, 4,000, or 5,000
②. Mobile number portability (NUMBER): Always Yes
③. Portability of mail addresses (MAIL): Yes or No
④. Portability of music data (MUSIC): Yes or No
⑤. Portability of game applications (GAME): Yes or No
⑥. Portability of other contents (OTHERS): Yes or No
⑦. Portability of handsets (HANDSET): Yes or No

<Figure 1>

In the second conjoint analysis, we measured consumer WTP with respect to securing music download platforms. At this point, we assume that a *platform* provides easy access to music data, convenient payment methods, and the ability to copy data without restrictions in music download services. Figure 2 depicts a representative questionnaire. The alternatives, attributes, and levels were given as follows:

①. Price per song (PRICE): Free with advertisements, JPY 100, 200, or 300
②. Easy access to desired music (ACCESS):
- Use links to official portal sites and direct searches for music data (Yes)
- Seek music data using a search engine (No)

③. Enter credit card numbers (PAYMENT):
- Customers need not enter credit card numbers since carriers charge collectively for all services (Not required)
- Customers must enter credit card numbers each time (Required)

④. Free portability of music data (PORTABILITY):
- Customers can freely copy music data to PCs (Yes)
- Customers cannot copy music data to PCs (No)

<Figure 2>

Finally, we explain the estimation models. Conditional logit (CL) models, which assume independent and identical distribution (IID) of random terms, have been widely used in past studies. However, independence from the irrelevant alternatives (IIA) property derived from the IID assumption of the CL model is too strict to allow flexible substitution patterns. The most prominent scheme is a mixed logit (ML) model which accommodates differences in the variance of random components (or unobserved heterogeneity). ML models have sufficient flexibility to overcome the limitations of CL models by allowing random taste variation, unrestricted substitution patterns, and the correlation of random terms over time (McFadden and Train 2000). See the APPENDIX for a detailed description of ML models.

Accordingly, by setting 100 Halton draws[5] we can demonstrate variety in the parameters at the individual level through the maximum simulated likelihood (MSL) method for estimation. Furthermore, since a respondent completed eight questions in the questionnaire for the conjoint analysis, the data thus obtained form a panel, and we can apply a standard random effect estimation. Thus, we can calculate the estimator of the conditional mean of the random parameters.

IV. ANALYSIS OF MOBILE SERVICE PORTABILITY

[5]The adoption of Halton draws is an important problem that should be examined further (Halton 1960). Bhat (2001) found that 100 Halton sequence draws are more efficient than 1,000 random draws for simulating an ML model (Train 2003).

In this section, we examine the estimation results of mobile service portability, which are presented in Table 3, based on the following classifications:

①. Experience of using MNP services: All data, MNP users, and non-MNP users
②. NTT users classified by standards: All NTT users, NTT 3G users, and NTT 2G users
③. AU users classified by standards: All AU users, AU 3G users, and AU 2G users
④. SoftBank users classified by standards: All SoftBank users, SoftBank 3G users, and SoftBank 2G users

<Table 3>

In Table 4 the ratio of mobile phone users who wish to switch their current carriers is calculated based on the estimation results. Here, we investigate the following four scenarios with respect to mobile service portability:

①. No portability, excepting MNP, at JPY 5,000 (US $45) (JPY 5,000, no portability)
②. All portability, including MNP, at JPY 5,000 (US $45) (JPY 5,000, all portability)
③. No portability, excepting MNP, at JPY 3,000 (US $27) (JPY 3,000, no portability)
④. All portability, including MNP, at JPY 3,000 (US $27) (JPY 3,000, all portability)

The following results are obtained. In Scenario 1, which presents the closest approximation of the present situation, more than 10% are willing to switch from their present carriers; specifically, 16% of the users who used MNP services and 12% of the users who did not. In Scenario 2, where all portability is available for the price of JPY 5,000, around 40% would consider switching. In Scenario 4, where all portability is available at JPY 3,000, around 50% would consider switching.

<Table 4>

Next, Table 5 demonstrates how the market share would change as a result of the above changeovers. The changeover rates are not significantly different among the carriers. However, since the numbers of subscribers are currently very different, excessive imports or exports become asymmetric among carriers. In Scenario 1—which has the least number of changeovers—there are potentially 3 million net changeovers. In Scenario 4—which has the highest number of changeovers—there are potentially 10 million net changeovers. Therefore, an increase in mobile service portability tends to equalize market share even if the rates of changeover are uniform among carriers.

<Table 5>

Finally, Table 6 presents the WTP values for increased mobile service portability. The average consumer WTP values for securing portability with respect to mail addresses, music data, other contents, and handsets range from JPY 500~800 (US $5~7)[6]. Summing up these values, the total WTP value exceeds JPY 2,000 (US $18). Specifically, the total WTP values are JPY 2,992 (US $27) for MNP users and JPY 2,184 (US $20) for non-MNP users. In addition, the total WTP values are JPY 2,518 (US $23) for an NTT 3G user and JPY 1,512 (US $14) for an NTT 2G user. As far as 3G users are concerned, we do not observe conspicuous differences in their WTP values among the carriers. However, note that the WTP values for securing mail address portability are higher for NTT 3G users, while those for securing music data portability are higher for AU 3G users. These results may reflect the different advantages and disadvantages of the individual carriers.

<Table 6>

According to our analysis, since the number of MNP users was low, competition was not sufficiently promoted in the Japanese mobile phone market. However, this does not

[6]Note that only the WTP values pertaining to the portability of game applications are negligible.

imply that subscribers are not willing to switch carriers. Two methods effectively actualize consumers' potential preferences: decreasing switching costs and increasing mobile service portability.

V. ANALYSIS OF MUSIC DOWNLOAD PLATFORMS

In this section, we examine the estimation results for music download platforms. The estimation results, presented in Table 7, are examined based on the following classifications:

①. Purchasing pay content: All data, Pay content users, and Non-pay content users
②. NTT users classified by standards: All NTT users, NTT 3G users, and NTT 2G users
③. AU users classified by standards: All AU users, AU 3G users, and AU 2G users
④. SoftBank users classified by standards: All SoftBank users, SoftBank 3G users, and SoftBank 2G users

<Table 7>

In table 8, the ratio of mobile phone users who wish to download music data is calculated on the basis of the estimation results. We investigated the following three scenarios with respect to the platforms:

①. No platform is available at JPY 300 (US $3) (JPY 300, no platform)
②. All platforms are available at JPY 300 (US $3) (JPY 300, all platforms)
③. All platforms are available for free (Free, all platforms)

The following results are obtained. In Scenario 1, which closely approximates the present unofficial fee-charging sites, less than 10% are willing to download music data. Specifically, 9% of those who use pay content services and 4% of those who do not are willing to download music data. In Scenario 2, which closely approximates the present official fee-charging sites, 20–40% respondents state that they will use music download services. In Scenario 3, where they can download music data for free, 70–90%

respondents are interested in downloading music data.

<Table 8>

Furthermore, Table 9 indicates the respondents' WTP values with respect to securing music download platforms. An average consumer's WTP values for ACCESS, PAYMENT, and PORTABILITY are equal to over 20 yens per song. Summing up these values, the total WTP value corresponds to JPY 100~200 (US $0.90~1.80). The total WTP values are JPY 187 (US $1.70) for those who often download music data that has to be paid for and JPY 68 (US $0.60) for those who do not. In addition, the total WTP values are JPY 98 (US $0.90) for an AU 3G user and JPY 23 (US $0.20) for an AU 2G user. As far as 3G users are concerned, we do not observe conspicuous differences in WTP values among the carriers. It is interesting, however, that the WTP values for PAYMENT are higher for NTT 3G users, while those for ACCESS are higher for AU 3G users. Once again, these results may reflect the different advantages and disadvantages of the individual carriers.

<Table 9>

We are confronted with difficult policy issues. Thus far, mobile carriers have successfully established vertically integrated business models through which they simultaneously operate portal sites and collect fees. While vertical integration is beneficial to consumers since it enables services to be conveniently bundled, it may also enhance monopolistic power in the music download market. One desirable policy is to maintain vertical integration for consumer convenience, and, at the same time, flexibly unbundle incumbent platform functions such that competitors can offer original services.

VI. CONCLUDING REMARKS

Japan's mobile phone market has been oligopolized by three incumbent operators (NTT DoCoMo, AU, and SoftBank) who are seeking vertically integrated business models, which may prevent competitors from using platform layers to provide original services.

Two points are analyzed in this paper. First, consumers are willing to pay more than JPY 2,000 (US $18) on average for increased mobile service portability. Second, consumers are willing to pay JPY 100~200 (US$ 1~2) per song on average for securing a music download platform. Consumers have significant preferences for both diverse services that are realized by free portability and for convenient services enabled by vertically integrated business models. To deal with this dilemma, it is important to construct a flexible business model that makes open portability and convenient platforms compatible. Note that this finding does not imply that government regulation is required in the mobile phone market, since carriers are not necessarily abusing their dominance. On the other hand, careful monitoring is crucial.

APPENDIX: ML MODEL

Assuming that parameter β_n is distributed with density function $f(\beta_n)$（Revelt and Train 1998）, the ML specification allows for repeated choices by each decision maker in such a way that the coefficients vary over people but are constant over choice situations for each person. The logit probability of decision maker *n* choosing alternative *i* in choice situation *t* is expressed as

$$L_{nit}(\beta_n) = \prod_{t=1}^{T} [\exp(V_{nit}(\beta_n)) / \sum_{j=1}^{J} \exp(V_{njt}(\beta_n))],$$

which is the product of normal logit formulas, given parameter β_n, the observable portion of utility function V_{nit}, and alternatives *j=1, …, J* in choice situations *t = 1, …, T*. Therefore, ML choice probability is a weighted average of logit probability $L_{nit}(\beta_n)$ evaluated at parameter β_n with density function $f(\beta_n)$, which can be written as

$$P_{nit} = \int L_{nit}(\beta_n) f(\beta_n) d\beta_n .$$

In the linear-in-parameter form, the utility function can be written as

$$U_{nit} = \gamma' x_{nit} + \beta_n' z_{nit} + \varepsilon_{nit},$$

where x_{nit} and z_{nit} denote observable variables, γ denotes a fixed parameter vector, β_n denotes a random parameter vector, and ε_{nit} denotes an independently and identically distributed extreme value (IIDEV) term.

Since ML choice probability is not expressed in the closed form, it is necessary to perform simulations for the ML model estimation. We can also calculate the estimator of the conditional mean of the random parameters—conditioned on an individual's specific choice profile y_n—given as

$$h(\beta \mid y_n) = [P(y_n \mid \beta) f(\beta)] / \int P(y_n \mid \beta) f(\beta) d\beta .$$

Note that there are two approaches for estimating ML models: classical and Bayesian. This paper adopts the former, since in the classical approach, one or more fixed coefficients can be included without difficulty, while in the Bayesian approach, fixed coefficients cannot be derived from the random coefficients for each person (Train 2003, pp. 311–312). Recall that the WTP value for an attribute is the ratio of the attribute's coefficient to the price coefficient. If the price coefficient is held constant, the WTP distribution is simply a scaled distribution of the attribute's coefficient. On the

other hand, WTP distribution is more complex when the price also varies.

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Table 1: Japan's mobile phone market

	2001.3	2002.3	2003.3	2004.3	2005.3	2006.3	2007.3
NTT DoComo	36,026	39,635	42,874	45,927	48,825	51,144	52,621
NTT IP access	21,700	32,160	37,760	41,080	44,020	46,360	47,570
NTT 3G	0	89	330	3,045	11,500	23,463	35,530
AU	14,939	15,849	17,317	20,591	23,132	25,438	28,188
AU IP access	6,720	9,640	12,540	15,700	18,260	20,520	23,530
AU 3G	0	0	6,805	13,509	17,934	21,828	26,720
SoftBank	9,977	11,617	13,323	15,002	15,041	15,210	15,909
SB IP access	6,160	10,130	12,160	12,960	12,870	12,870	13,260
SB 3G	0	0	25	137	917	3,038	7,660
Total	60,942	67,101	73,514	81,520	86,998	91,792	96,718
IP access	34,580	51,930	62,460	69,740	75,150	79,750	84,360
3G	0	89	7,160	16,691	30,351	48,329	69,910

Note: Figures are thousand (1,000).

Table 2: Current major service usages

Socio-demographics

	No.of Samples	Gender (Male)	Age	Married	Working	University graduation	Annual household income (JPY)
MNP users	281	50.2%	39.4	67.6%	61.9%	56.2%	4.5 M
Non MNP users	861	51.1%	33.5	61.1%	52.5%	52.8%	4.4 M
Total	1142	50.9%	35.0	62.7%	54.8%	53.7%	4.4 M

Type of providers and standards

	NTT 3G	NTT 2G	AU 3G	AU 2G	SoftBank 3G	SoftBank 2G	Others
MNP users	14.2%	0.7%	64.4%	2.5%	17.1%	1.1%	0.0%
Non MNP users	46.9%	7.5%	26.2%	1.4%	10.3%	4.8%	2.9%
Total	38.9%	5.9%	35.6%	1.7%	12.0%	3.9%	2.2%

Frequently used services (multiple answers)

	Music download	Game	TV phone	E book	Moving picture	E money	TV/Radio	GPS	None
MNP users	19.6%	14.6%	2.1%	3.9%	7.8%	12.1%	21.0%	7.1%	50.5%
Non MNP users	22.9%	22.1%	3.1%	2.7%	7.3%	8.9%	11.6%	5.7%	51.1%
Total	22.1%	20.2%	2.9%	3.0%	7.4%	9.7%	13.9%	6.0%	51.0%

Past MNP usage

	Past choice (NTT)	Past choice (AU)	Past choice (SB)	Past choice (Others)
MNP users	31.7%	13.9%	19.6%	35.6%
Non MNP users	-	-	-	-
Total	31.7%	13.9%	19.6%	35.6%

Future MNP usage

	Want to use	Future choice (NTT)	Future choice (AU)	Future choice (SB)	Future choice (Others)
MNP users	22.4%	33.3%	7.9%	34.9%	23.8%
Non MNP users	17.0%	11.6%	35.6%	32.9%	19.9%
Total	18.3%	17.0%	28.8%	33.4%	20.8%

Future other portability usage (multiple answers)

	Mail address	Contents	Handsets
MNP users	38.4%	35.6%	40.9%
Non MNP users	31.1%	28.1%	27.8%
Total	32.9%	29.9%	31.0%

Current usages of official and/or unofficial sites

	Only official	Mainly official	Both	Mainly unofficial	Only unofficial
MNP users	25.3%	11.7%	50.2%	7.8%	5.0%
Non MNP users	26.1%	10.3%	47.6%	10.0%	5.9%
Total	25.9%	10.7%	48.2%	9.5%	5.7%

Want to use official or unofficial sites

	Official sites	Unofficial sites
MNP users	55.2%	44.8%
Non MNP users	52.7%	47.3%
Total	53.3%	46.7%

Frequently viewed contents (multiple answers)

	News	Music download	Movie	Game	E book	SNS	Shopping	Auction	No use
MNP users	46.6%	17.8%	5.3%	8.9%	3.2%	5.7%	10.0%	11.4%	37.4%
Non MNP users	47.9%	22.5%	5.0%	13.4%	2.0%	7.9%	9.2%	8.1%	33.3%
Total	47.5%	21.4%	5.1%	12.3%	2.3%	7.4%	9.4%	8.9%	34.3%

Financial transaction method (multiple answers)

	Carriers	Credit card	E money	No use
MNP users	17.8%	2.8%	1.1%	82.2%
Non MNP users	21.7%	2.3%	0.7%	77.1%
Total	20.8%	2.5%	0.8%	78.4%

Figure 1: Representative questionnaire (i)

	Alt 1	Alt 2	Alt 3
Cost of switching carriers	JPY 3000	JPY 1000	
Mobile number portability	Yes	Yes	
Portability of mail address	Yes	Yes	
Portability of music data	Yes	No	No choice
Portability of game applications	No	No	
Portability of other contents	Yes	No	
Portability of handsets	No	No	
Choose one			

Figure 2: Representative questionnaire (ii)

	Alt 1	Alt 2	Alt 3
Price per song	JPY 100	Free with advertisements	No choice
Access to a desired music	No	Yes	
Enter credit card numbers	Required	Not reqired	
Portability of music data	Yes	No	
Choose one			

Table 3: Estimation results (i)

		All data			MNP users			Non MNP users		
		No. of Sample	1142*8		No. of Sample	281*8		No. of Sample	861*8	
		Max LL	-6678.2		Max LL	-1813.7		Max LL	-4842.2	
		Initial LL	-10036.9		Initial LL	-2469.7		Initial LL	-7567.2	
		McFadden R2	0.335		McFadden R2	0.266		McFadden R2	0.360	
		Estimates	S.E.		Estimates	S.E.		Estimates	S.E.	
COST	MEAN	-0.0014	0.0001	***	-0.0009	0.0001	***	-0.0015	0.0001	***
	S.D.	0.0011	0.0000	***	0.0008	0.0001	***	0.0012	0.0001	***
MAIL	MEAN	1.0116	0.0689	***	0.7530	0.1181	***	1.1139	0.0867	***
	S.D.	1.3365	0.0839	***	1.0653	0.1583	***	1.3659	0.1111	***
MUSIC	MEAN	0.6800	0.0556	***	0.5989	0.1146	***	0.6953	0.0711	***
	S.D.	0.4894	0.1385	***	0.7576	0.2372	***	0.6260	0.1487	***
GAME	MEAN	0.0540	0.0441		0.0687	0.0855		0.0821	0.0522	
	S.D.	0.0547	0.1107		0.1331	0.1940		0.1110	0.1335	
OTHERS	MEAN	0.7086	0.0533	***	0.6440	0.1116	***	0.6857	0.0596	***
	S.D.	0.3495	0.1723	**	0.9535	0.1750	***	0.3838	0.1181	***
HANDSET	MEAN	0.7502	0.0624	***	0.7388	0.1285	***	0.8019	0.0734	***
	S.D.	0.4996	0.1539	***	0.9758	0.2105	***	0.2583	0.3815	

Note: ***1% significance level, **5% significance level, *10% significance level

		All NTT			NTT 3G			NTT 2G		
		No. of Sample	511*8		No. of Sample	444*8		No. of Sample	67*8	
		Max LL	-2947.4		Max LL	-2617.7		Max LL	-312.0	
		Initial LL	-4491.1		Initial LL	-3902.3		Initial LL	-588.9	
		McFadden R2	0.344		McFadden R2	0.329		McFadden R2	0.470	
		Estimates	S.E.		Estimates	S.E.		Estimates	S.E.	
COST	MEAN	-0.0014	0.0001	***	-0.0013	0.0001	***	-0.0022	0.0003	***
	S.D.	0.0012	0.0001	***	1.2235	0.1131	***	1.4141	0.2645	***
MAIL	MEAN	1.1735	0.1022	***	0.6734	0.0926	***	1.0405	0.2661	***
	S.D.	1.2952	0.1319	***	0.0348	0.0710		0.0774	0.2371	
MUSIC	MEAN	0.7270	0.0786	***	0.6720	0.0788	***	0.3740	0.2980	
	S.D.	0.2867	0.3983		0.7940	0.1066	***	0.4107	0.2830	
GAME	MEAN	0.0351	0.0669		0.0012	0.0001	***	0.0020	0.0003	***
	S.D.	0.1793	0.1806		1.3310	0.1237	***	0.5737	0.4354	
OTHERS	MEAN	0.6417	0.0755	***	0.4707	0.2215	**	0.3827	0.3391	
	S.D.	0.3563	0.2209		0.0723	0.1630		0.3668	0.3476	
HANDSET	MEAN	0.6917	0.1000	***	0.4042	0.1811	**	0.7396	0.3288	**
	S.D.	0.6924	0.2182	***	0.8763	0.1705	***	0.0359	0.4434	

Note: ***1% significance level, **5% significance level, *10% significance level

		All AU			AU 3G			AU 2G		
		No. of Sample	425*8		No. of Sample	407*8		No. of Sample	19*8	
		Max LL	-2564.6		Max LL	-2445.4		Max LL	-112.7	
		Initial LL	-3735.3		Initial LL	-3902.3		Initial LL	-167.0	
		McFadden R2	0.313		McFadden R2	0.316		McFadden R2	0.325	
		Estimates	S.E.		Estimates	S.E.		Estimates	S.E.	
COST	MEAN	-0.0012	0.0001	***	-0.0012	0.0001	***	-0.0010	0.0003	***
	S.D.	0.7952	0.1124	***	0.9102	0.1106	***	0.6412	0.4191	
MAIL	MEAN	0.6132	0.1025	***	0.7014	0.1028	***	0.2307	0.3610	
	S.D.	0.0102	0.0721		0.0251	0.0741		-0.2021	0.3482	
MUSIC	MEAN	0.7846	0.0922	***	0.8402	0.0924	***	0.4692	0.3593	
	S.D.	0.8082	0.0978	***	0.8359	0.1008	***	0.1355	0.5205	
GAME	MEAN	0.0009	0.0001	***	0.0011	0.0001	***	0.0011	0.0004	***
	S.D.	1.5180	0.1500	***	1.3101	0.1228	***	0.6688	0.5616	
OTHERS	MEAN	1.0999	0.1623	***	0.9992	0.1606	***	0.2889	0.4377	
	S.D.	0.0654	0.1903		0.0802	0.1741		0.0703	0.5895	
HANDSET	MEAN	0.6107	0.1659	***	0.7450	0.1497	***	0.3085	0.4851	
	S.D.	0.2518	0.5370		0.2213	0.3841		1.3144	0.6857	

Note: ***1% significance level, **5% significance level, *10% significance level

		All SoftBank			SoftBank 3G			SoftBank 2G		
		No. of Sample	181*8		No. of Sample	137*8		No. of Sample	44*8	
		Max LL	-992.1		Max LL	-830.6		Max LL	-141.8	
		Initial LL	-1590.8		Initial LL	-1204.1		Initial LL	-386.7	
		McFadden R2	0.376		McFadden R2	0.310		McFadden R2	0.633	
		Estimates	S.E.		Estimates	S.E.		Estimates	S.E.	
COST	MEAN	-0.0016	0.0001	***	-0.0013	0.0001	***	-0.0041	0.0011	***
	S.D.	1.0588	0.1624	***	0.9987	0.1784	***	1.5144	0.4848	***
MAIL	MEAN	0.4590	0.1451	***	0.4909	0.1467	***	0.8603	0.4630	
	S.D.	0.3136	0.1203	***	0.3284	0.1321	**	0.1646	0.3465	
MUSIC	MEAN	0.6997	0.1297	***	0.6730	0.1341	***	0.7310	0.4586	
	S.D.	0.7953	0.1662	***	0.8677	0.1807	***	0.7484	0.5023	
GAME	MEAN	0.0014	0.0002	***	0.0010	0.0001	***	0.0024	0.0007	***
	S.D.	1.0183	0.1972	***	1.0470	0.1943	***	1.0910	0.4713	**
OTHERS	MEAN	0.6447	0.2372	***	0.4355	0.2692		0.8136	0.5962	
	S.D.	0.1640	0.2687		0.3237	0.3383		0.0826	0.5168	
HANDSET	MEAN	0.4889	0.2269	**	0.3126	0.2610		0.6164	0.6662	
	S.D.	0.5270	0.4096		0.8134	0.2944	***	0.1370	0.5849	

Note: ***1% significance level, **5% significance level, *10% significance level

Table 4: Ratio of mobile phone users who want to switch carriers

	All Data	MNP users	Non MNP users	NTT	NTT 3G	NTT 2G	AU	AU 3G	AU 2G	SoftBank	SoftBank 3G	SoftBank 2G
JPY 5,000 no portability	14%	16%	12%	14%	14%	10%	13%	13%	22%	11%	12%	6%
JPY 5000 all portability	39%	45%	37%	39%	41%	29%	40%	41%	32%	34%	41%	15%
JPY 3000 no portability	19%	23%	17%	19%	19%	14%	19%	19%	26%	16%	18%	7%
JPY 3000 all portability	51%	57%	49%	51%	53%	37%	54%	55%	39%	46%	55%	22%

Table 5: Changes in market shares

JPY 5,000 no portability

	No. of Contracts	No. of export	No. of import	Net flow
From NTT	53000	7383	4199	-3185
From AU	29000	3899	5261	1362
From SoftBank	18000	1994	3816	1822

JPY 5000 all portability

	No. of Contracts	No. of export	No. of import	Net flow
From NTT	53000	20695	12683	-8012
From AU	29000	11662	14945	3283
From SoftBank	18000	6153	10882	4729

JPY 3000 no portability

	No. of Contracts	No. of export	No. of import	Net flow
From NTT	53000	9995	5932	-4063
From AU	29000	5466	7180	1714
From SoftBank	18000	2865	5213	2349

JPY 3000 all portability

	No. of Contracts	No. of export	No. of import	Net flow
From NTT	53000	27069	17050	-10019
From AU	29000	15666	19633	3967
From SoftBank	18000	8287	14338	6052

Note: Figures are thousand (1,000).

Table 6: WTP for increasing mobile service portability

	All Data	MNP users	Non MNP users	NTT	NTT 3G	NTT 2G	AU	AU 3G	AU 2G	SoftBank	SoftBank 3G	SoftBank 2G
MAIL	728	804	720	811	907	645	647	730	649	676	761	373
MUSIC	489	639	449	502	499	474	499	563	233	293	374	212
GAME	39	73	53	24	26	35	8	20	-204	200	250	40
OTHERS	510	687	443	443	498	171	638	674	475	447	513	180
HANDSET	540	789	518	478	588	187	658	671	137	508	661	184
Total	2,306	2,992	2,184	2,258	2,518	1,512	2,450	2,658	1,289	2,125	2,560	989

Note: All figures are JPY.

Table 7: Estimation results (ii)

		All data			Pay contents users			Non pay contents users		
		No. of Sample	1142*8		No. of Sample	247*8		No. of Sample	895*8	
		Max LL	-6383.9		Max LL	-1546.7		Max LL	-4803.5	
		Initial LL	-10036.9		Initial LL	-2170.9		Initial LL	-7866.1	
		McFadden R2	0.364		McFadden R2	0.288		McFadden R2	0.389	
		Estimates	S.E.		Estimates	S.E.		Estimates	S.E.	
PRICE	MEAN	-0.0207	0.0007	***	-0.0152	0.0010	***	-0.0226	0.0009	***
	S.D.	0.0123	0.0006	***	0.0099	0.0010	***	0.0123	0.0007	***
ACCESS	MEAN	0.3106	0.0727	***	0.4184	0.1231	***	0.3115	0.0903	***
	S.D.	1.0555	0.0931		0.8085	0.1702	***	1.1740	0.1222	***
PAYMENT	MEAN	0.8525	0.0916	***	1.3271	0.1676	***	0.7173	0.1087	***
	S.D.	2.2239	0.1147	*	1.8863	0.2151	***	2.3909	0.1493	
PORTABILITY	MEAN	0.6839	0.0785	***	1.0994	0.1512	***	0.5131	0.0887	***
	S.D.	1.9531	0.0931	***	1.7499	0.1637	***	1.9912	0.1129	***

Note: ***1% significance level, **5% significance level, *10% significance level

		All NTT			NTT 3G			NTT 2G		
		No. of Sample	511*8		No. of Sample	444*8		No. of Sample	67*8	
		Max LL	-2863.3		Max LL	-2504.4		Max LL	-341.5	
		Initial LL	-4491.1		Initial LL	-3902.3		Initial LL	-588.9	
		McFadden R2	0.362		McFadden R2	0.358		McFadden R2	0.420	
		Estimates	S.E.		Estimates	S.E.		Estimates	S.E.	
PRICE	MEAN	-0.0200	0.0010	***	-0.0198	0.0010	***	-0.0227	0.0035	***
	S.D.	0.2704	0.1109	**	0.3146	0.1248	**	0.0603	0.3080	
ACCESS	MEAN	1.0524	0.1410	***	1.0553	0.1447	***	-0.1088	0.4601	
	S.D.	0.6570	0.1121	***	0.7037	0.1236	***	-0.1635	0.3616	
PAYMENT	MEAN	0.0127	0.0008	***	0.0112	0.0008	***	0.0182	0.0033	***
	S.D.	1.3318	0.1557	***	1.3700	0.1430	***	0.5275	0.4160	
PORTABILITY	MEAN	2.3214	0.1804		2.3754	0.1991		3.4571	0.6699	***
	S.D.	2.0303	0.1531	***	1.9448	0.1492	***	2.4379	0.4209	***

Note: ***1% significance level, **5% significance level, *10% significance level

		All AU			AU 3G			AU 2G		
		No. of Sample	425*8		No. of Sample	407*8		No. of Sample	19*8	
		Max LL	-2429.6		Max LL	-2316.4		Max LL	-111.1	
		Initial LL	-3735.3		Initial LL	-3735.3		Initial LL	-158.2	
		McFadden R2	0.350		McFadden R2	0.352		McFadden R2	0.298	
		Estimates	S.E.		Estimates	S.E.		Estimates	S.E.	
PRICE	MEAN	-0.0186	0.0009	***	-0.0197	0.0011	***	-0.0180	0.0048	***
	S.D.	0.0098	0.0010	***	0.0108	0.0008	***	0.0115	0.0036	***
ACCESS	MEAN	0.3683	0.1142	***	0.4116	0.1181	***	0.0071	0.5066	
	S.D.	0.8382	0.1824	***	1.0239	0.1941	***	1.2961	0.5769	**
PAYMENT	MEAN	0.6759	0.1379	***	0.7258	0.1430	***	0.4454	0.4649	
	S.D.	2.0973	0.1790		2.0463	0.1866		0.9469	0.6768	
PORTABILITY	MEAN	0.7051	0.1299	***	0.7915	0.1348	***	-0.0460	0.6113	
	S.D.	2.0879	0.1525	***	2.1009	0.1683	***	1.9029	0.6907	***

Note: ***1% significance level, **5% significance level, *10% significance level

		All Softbank			Softbank 3G			Softbank 2G		
		No. of Sample	181*8		No. of Sample	137*8		No. of Sample	44*8	
		Max LL	-949.8		Max LL	-731.8		Max LL	-204.7	
		Initial LL	-1590.8		Initial LL	-1204.1		Initial LL	-386.7	
		McFadden R2	0.403		McFadden R2	0.392		McFadden R2	0.471	
		Estimates	S.E.		Estimates	S.E.		Estimates	S.E.	
PRICE	MEAN	-0.0261	0.0024	***	-0.0242	0.0023	***	-0.0310	0.0073	***
	S.D.	0.3617	0.2217		0.0650	0.2476		0.3958	0.4145	
ACCESS	MEAN	0.9965	0.2478	***	1.0353	0.2385	***	-0.0429	0.6252	
	S.D.	0.6502	0.1814	***	1.0229	0.2051	***	-0.7136	0.5148	
PAYMENT	MEAN	0.0131	0.0014	***	0.0122	0.0017	***	0.0260	0.0065	***
	S.D.	1.3255	0.2548	***	1.5362	0.2831	***	0.5242	0.6646	
PORTABILITY	MEAN	2.5654	0.3530	***	1.7965	0.2975	***	3.6463	0.7834	***
	S.D.	1.7837	0.2361	***	1.6598	0.2844	***	2.4871	0.6648	***

Note: ***1% significance level, **5% significance level, *10% significance level

Table 8: Ratio of those who want to download music data

	All Data	Pay contents users	Non Pay Contents users	NTT	NTT 3G	NTT 2G	AU	AU 3G	AU 2G	SoftBank	SoftBank 3G	SoftBank 2G
JPY 300 no platform	6%	9%	4%	7%	6%	9%	5%	5%	10%	4%	3%	8%
JPY 300 all platforms	29%	45%	25%	31%	31%	23%	30%	30%	34%	21%	25%	15%
Free all platforms	74%	87%	70%	73%	75%	55%	74%	74%	66%	73%	81%	52%

Table 9: WTP for securing music download platform

	All Data	Pay contents users	Non pay contents users	NTT	NTT 3G	NTT 2G	AU	AU 3G	AU 2G	SoftBank	SoftBank 3G	SoftBank 2G
ACCESS	15	28	14	14	16	3	20	21	0	14	3	13
PAYMENT	41	87	32	53	53	-5	36	37	25	38	43	-1
PORTABILITY	33	72	23	33	36	-7	38	40	-3	25	42	-23
TOTAL	89	187	68	99	105	-9	94	98	23	77	88	-12

Note: All figures are JPY.