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Analysis of Subscription Demand for Pay-TV

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† Contact Author. Our conclusions, opinions, and other statements in this paper are those of the authors and are not necessarily of our affiliated organizations. We are very grateful for useful comments from the seminar participants of The Japan Economic Policy Association.

【Summary】

In this paper, we will conduct an analysis from an empirical perspective concerning broadcasting demand behavior and characteristics. More concretely, we will assume three options (subscription patterns), namely, nonsubscription, cable TV subscription, and subscription to broadcasting services via communications satellites (CS), and we will conduct an analysis of broadcasting service demand behavior using a discrete choice model.

According to our result, price elasticity is low for cable TV and CS subscribers, which is a contrast to the United States, where price elasticity for paid broadcasting is high. It shows that factors other than price continue to have a strong influence on demand behavior (subscription choices) in the Japanese market for regular and paid broadcasting (the multichannel market) and that the market has not yet entered the phase of price competition between cable TV and CS broadcasting.

With regard to channel number elasticity, the figures are high for basic channel service and low for special channel services. This indicates that basic services are an important concern for viewers. This suggests that, in line with reports that the spread of cable TV in the United States was promoted by difficulty in receiving terrestrial broadcasts, basic channel services may be more important than special channels as keys to the spread of paid broadcasting in Japan.

Keywords: Subscription demand, Broadcasting service, Pay-TV, Discrete choice model, Price/Channel elasticity

(*JEL* Classifications: L51, L82, R22)

1. Introduction

In order to evaluate the effects on the welfare of broadcasting services resulting from the shift to multichannel broadcasting, it is necessary to clarify the structure of demand for broadcasting services in the context of this switch. It has also been noted that "desirable" market conditions for the maximization of social welfare, funding approaches (public, commercial, and paid broadcasting), levels and structures of competition (including monopoly, oligopoly, and competitive markets) all depend greatly on demand-side features, such as substitutability among programs and channels.[1]

Analyses of demand for broadcasting services include ones that focus on the measurement of their economic value and ones that focus on evaluation of competitive conditions in the broadcasting market; in the United States the latter sort have been more commonly conducted as part of antitrust/competition policy. In particular, against the backdrop of the further intensification of competition with the spread of satellite broadcasting and the entry of cable companies and regional telephone companies into the market, in recent years analyses have been directed at the cable TV market and DBS (direct broadcast satellite) broadcasting.[2] Kieschnick and McCullough (1998) made the following three points about the policy utility of demand analyses of broadcasting services:

(i) They offer grounds for judgment in discussion of the position of terrestrial broadcasting as the only medium that allows non-affluent households to watch programs and of the maintenance of universal service and public utility.

(ii) They offer grounds for judgment concerning media concentration and business efficiency in connection with the FCC's (Federal Communications Commission's) ownership rules concerning regional broadcasters, including the question of whether cable stations should be taken into consideration or not.

(iii) They offer grounds for judgment about policy measures (intervention) aimed at maintaining local terrestrial broadcasters—such as the idea that imposing a "must carry" rule on cable TV and satellite broadcasters does not ensure the financial

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[1] Spence and Owen (1977).

[2] Karikari et al. (2003) conducted an analysis of the factors behind spread of paid broadcasting, taking DBS broadcasting into account, showing that it progressed in areas where cable TV charges were high because of regulation and did not progress in areas where the entry of cable companies and regional phone companies had created intense competition. Also, Goolsebee and Petrin (2004), using subscriber data in a discrete choice model, estimated the own-price elasticity and cross-price elasticity of cable service (basic and premium) against DBS broadcasting and terrestrial broadcasting. They showed that demand for premium cable service and for DBS broadcasting was much more elastic than that for basic cable service, and that subscribers saw DBS and premium cable as substitutable services.

health of all (terrestrial) broadcasters, but it does aim for the survival of a basic number of broadcasters—and about market neutrality (competitive environment).[3]

Given the fact that the spread of cable TV has already created a multichannel broadcasting market in the United States, it may not be possible to apply arguments advanced there to today's Japan without modification. But there is an undeniable possibility that points like the market environment, business efficiency, media concentration, and the "national minimum" may also become issues here. In particular, it seems quite plausible that points like business efficiency and media concentration (item ii above) and the promotion of a multichannel market and the maintenance of a national minimum (item iii above) will fully merit consideration in Japan.[4] In this paper, we will conduct an analysis from an empirical perspective concerning broadcasting demand behavior and characteristics, including the move toward multichannel broadcasting and subscription activity in paid broadcasting, taking into account the progress toward multichannel broadcasting.

Section 2 of this chapter sums up the characteristics of broadcasting service demand. Section 3 explains the methodology of our empirical study. Section 4 presents the results of our study. Section 5 discusses the implications to be drawn from these results.

2. Broadcasting Service Demand Behavior

The relationship between the shift to multichannel broadcasting and broadcasting service demand behavior has not been made entirely clear up to this point. In this section, prior to our empirical analysis, we will sum up this behavior with a focus on multichannel broadcasting.

Broadcasting service demand has two aspects: viewing decisions and the purchase of channel subscriptions. Purchasing channel subscriptions does not in itself produce any direct utility; utility only achieved through viewership. The level of utility rises with the increase of viewing time (volume of use), and marginal utility tends to diminish; in these respects broadcasting service demand is like demand for ordinary goods and services. If viewing time is taken as a given, then the level of utility rises with the viewing of programs that are close to the preferences of the viewers. Particularly in

[3] *Turner Broadcasting System Inc. v. FCC*, 117 Sup. Ct. 1174 (1997).

[4] In some respects this sort of consideration has already begun, as in the review of the principle of nonconcentration, but there is room for further discussion of issues like the position of paid broadcasting.

the case of broadcasting services, which the suppliers offer unilaterally within short periods, there is an issue of probability involved in viewers' being able to see the sort of programs that they prefer, but the larger the number of available channels is, the better the chances are that they will be able to find programs matching their preferences. So it would seem that increasing the number of channels available (i.e., increasing diversity) should increase users' utility per viewing hour. And we can think of the utility function as a function of the number of channels and the amount of viewing time.

As limiting conditions, with respect to the purchase of channel subscriptions, it would seem that the same sort of budgetary constraints would apply as in the case of the use of ordinary goods and services, while with respect to viewing, inasmuch as this is a time-consuming leisure service, time constraints act as important limiting conditions. So we may consider that broadcasting services demand (viewing time and channel purchases) behavior should be formulated in the shape of the double constraints of budget and time.[5]

Above we have assumed that channels and cost burdens can be freely chosen, but it is probably appropriate to view the choice as involving the provision of channel services that have been packaged to some degree. Particularly in Japan's case, purchasing a TV set and paying reception fees[6] allows one to use basic channel services; selection of channel services to which one is not yet subscribed, along with the acceptance of cost burdens, is conducted through discrete choices to subscribe to paid broadcasting services based on comparison of the available channels and cost in the case of nonsubscription against the available channels and cost in the case of subscription. Based on this perspective, here we will assume three options (subscription patterns), namely, nonsubscription[7], cable TV subscription, and subscription to broadcasting services via communications satellites (CS),[8] and we will conduct an analysis of broadcasting service demand behavior using a discrete choice model.[9]

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[5] For the relationship between a specific broadcasting demand model and an empirical model, see Shishikura et al. (2005).

[6] These may be considered a sort of fixed charge.

[7] This is defined to include those households that use public broadcasting (including broadcasting satellite, or BS, services and terrestrial commercial broadcasting.

[8] Note that these options are not entirely mutually exclusive.

[9] In the discrete choice model, a consumer is assumed to acquire utility from various features (price, quality, content) of a good. It is further assumed that utility U_{in} can be expressed as the linear combination of V_{in}, a deterministic term explained by the above features, and stochastic terms ε_{in}, with actor n choosing among a set of alternatives A_n in such a way as to maximize his or her utility. The conditions for actor n to choose alternative i are expressed as follows:

$$U_{in} = V_{in} + \varepsilon_{in} > U_{jn} = V_{jn} + \varepsilon_{jn} \quad i \neq j \text{、} \quad j \in A_n$$

Multiple estimation methods exist, depending on what sort of distribution is assumed for the above

3. Empirical Choice Model of Broadcasting Services Demand

We assumed the following linear function for deterministic term V_{in} (Model 1).

$$V_{in} = \alpha_1 D_{i=CATV} + \beta_1 Bch_i + \beta_2 Ech_i + \beta_3 Mch_i + \varphi_1 p_i + \delta_1 D_{i=ANT} Y_n$$

We use the number of channels in three categories of service, namely, basic (Bch_i), extended basic (Ech_i), and special (Mch_i), as the basic attribute variable for the various subscription states, and charges (amount paid, p_i) as the variable indicating the cost burden.[10] $D_{i=CATV}$ and $D_{i=ANT}$ are dummy variables that are equal to 1 when subscribed to cable TV and when not subscribed to paid broadcasting, respectively. We also include household income (Y_n) as a household-specific attribute.[11] The data are non-aggregated data[12] from a questionnaire survey.[13] See Table 1 for the descriptive statistics for each of the variables. We also conducted an estimation for a case where viewing time for each category is included (Model 2), namely, basic ($Bwatch_i$), extended basic ($Ewatch_i$), and special ($Mwatch_i$), as the variable indicating viewing preferences.[14]

$$V_{in} = \alpha_1 D_{i=CATV} + \beta_1 Bch_i + \beta_2 Ech_i + \beta_3 Mch_i + \gamma_1 Bwatch_i + \gamma_2 Ewatch_i + \gamma_3 Mwatch_i + \varphi_1 p_i + \delta_1 D_{i=ANT} Y_n$$

To sum up the conditions for the attribute variables for each type of subscription status, those who choose nonsubscription have access only to the basic

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stochastic terms.

[10] "Basic" service refers to public broadcasting channels providing "comprehensive programming" (including education, news, and entertainment) and commercial channels. "Extended basic" refers to public and commercial channels transmitted by broadcast satellite (digital and analog). "Special" refers to channels providing special programs, such as films and music.

[11] We also looked at other attributes, such as the number of household members and their average age, but we did not find any significant results, so we have omitted them here.

[12] The average value is used for the attributes of alternatives that were not chosen, but since the numbers of channels available to nonsubscribers and to cable TV subscribers vary from region to region, regional averages were used as the opportunity number of viewable channels for nonsubscribers and cable TV subscribers. The average for the entire sample was used for CS subscribers, because there are no regional differences in this service.

[13] The survey was conducted in March 2004 by the Institute for Information and Communications Policy (IICP) and the Foundation for MultiMedia Communications (FMMC), directed at households in Tokyo and surrounding prefectures and in the Hokuriku region. Note that the geographical target was limited to these two regions; also, prior adjustments were made in order to secure a certain number of subscribers for sampling. Weighting was applied in such a way as to match the nationwide spread of services in setting the sampling shares for aggregation purposes, but we have some reservations about the estimation results. For details see Shishikura et al. (2005).

[14] We also made estimates for cases that allowed for regional variables, such as dummies for each prefecture and a regional (Hokuriku) dummy, as well as for household attributes, such as the number of household members, but we did not find significant results for any of these, so we have omitted them here.

channels,[15] and their cost burden consists of payment of the reception fees collected by public broadcaster NHK (Japan Broadcasting Corporation). Those who choose cable TV subscription have access to additional basic channels and also to special channels, and their cost burden consists of the cable TV charges in addition to the NHK charges.[16] Those who choose CS service have access to special channels in addition to the basic channels available to nonsubscribers, and their cost burden consists of the NHK charges plus the charges for the number of channels for which they have contracted.

The difference between cable TV and CS services is expressed in the numbers of additional basic and special channels to which they provide access and in the cost burden. The choice to subscribe to one or the other is made in consideration of the channels available to nonsubscribers and the users' preferences and cost burdens with respect to the basic channels and special channels.

----------Insert Table 1 about here ----------

4. Empirical Results

Below we give an overview of the estimation results for three logit models, namely, multinomial, nested,[17] and mixed, in our two discrete choice models (See table 2). With regard to the sign condition and statistical significance of each variable, basic channel service both satisfies the sign condition and achieves an adequate level of significance, while special channel service meets the sign condition but does not have a high level of significance. The coefficient of extended basic channel service fails to meet the sign condition and also has a low level of significance. With respect to level of charges, the sign condition is met in all cases, and the level of significance is adequate overall.

----------Insert Table 2 about here ----------

It is difficult to identify which of the three methods of estimation is most appropriate. Pseudo R2 (McFadden's R2) is high in each model, and no major differences were found for the goodness of fit. Also, we conducted IIA (Independence from Irrelevant

[15] The number of available basic channels varies, however, depending on whether the household has access to BS services, on the residential environment, and on the region (number of terrestrial channels).
[16] The degree of freedom of choice, however, is not high, and the charges are set under fixed-rate plans.
[17] For the nested structure we use (nonsubscription) vs. (cable TV vs. CS). In other words, we assume that households first decide whether or not to subscribe to paid broadcasting and, if they choose to subscribe, they then choose between cable TV and CS.

Alternatives) tests to determine the appropriateness of the assumption that the disturbances are independent and homoscedastic among the alternatives, but neither the Hausman test nor the likelihood ratio test for the model without the CS alternative showed any clear tendency (Table 3). Even in the mixed logit with relaxed constraints for dispersion of the parameters, the level of significance of the correlation parameters was not very high. Though there were some differences in estimation results among the methods, these were not great, so below we will focus our consideration mainly on the results for the mixed logit model, which has the least constraints and good significance of coefficients.

----------Insert Table 3 about here ----------

In Table 4 we present our calculations for the elasticity with respect to charges and channels. For charges, all the values are less than 1, indicating inelasticity. For channels, basic service shows an extremely high elasticity of more than 6, but special channel service shows extremely low elasticity of under 0.3.

----------Insert Table 4 about here ----------

5. Implications

Let us now sum up the implications of the above empirical results. With regard to price elasticity, it may be natural that price elasticity is low for nonsubscribers with no room for choice, but the figures for cable TV and CS subscribers are also on the low side, which is a contrast to the United States, where price elasticity for paid broadcasting is high.[18]

Price elasticity is a useful indicator of the progress of competition in a market, but we may take the above findings to show that factors other than price continue to have a strong influence on demand behavior (subscription choices) in the Japanese market for regular and paid broadcasting (the multichannel market) and that the market has not yet entered the phase of price competition between cable TV and CS

[18] See Goolsbee and Petrin (2004). Though it is not possible to compare line by line, because the methods of estimation and the formulations are different, the elasticity values they find are in the range of 1.5 to above 2, which are high by comparison with the figures for Japan even after allowing for such differences.

broadcasting.[19]

With regard to channel number elasticity, the figures are high for basic channel service and low for special channel services. Though we should probably not consider concrete values to be certain, it does seem clear that there is a major difference in elasticity between the two.[20] This is highly significant when considering cable and CS from the perspectives of their spread and the competition between the two. It suggests the possibility that the broadcasting market, including the paid broadcasting market, may be heavily impacted in the period to come depending on how basic channel services are (re)transmitted. It also suggests that in cases where there are differences in the numbers of basic channels that can be directly received because of geographical or other conditions, basic channel transmission may have an impact on the competition between cable and CS for subscribers.[21]

If we look at viewing times, we find that even among households subscribed to paid broadcasting, the basic channels (terrestrial broadcasts) still account for the overwhelming majority of hours; this indicates that basic services are an important concern for viewers. This suggests that, in line with reports that the spread of cable TV in the United States was promoted by difficulty in receiving terrestrial broadcasts, basic channel services may be more important than special channels as keys to the spread of paid broadcasting in Japan.

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[19] Own-price elasticity for CS and cable is high by comparison with that for nonsubscription, and the figures for the two are close; it is thus possible to judge that cable and CS are in somewhat of a competitive relationship regarding services and prices.

[20] The difference in elasticity between the two reflects the dearth of channels and the substitutability of the content provided. This may be taken to reflect the fact that basic channel services are provided generally on a comprehensive-programming basis, consisting largely of original content, while much of the content of special channel services competes with other services, such as packaged video, and the same programs are broadcast repeatedly.

[21] In terms of policy implications this may offer a certain perspective concerning the proper shape of retransmission for basic channel services (the “must carry” rule).

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Table 1. Basic Statistics for the Variables

Alternative		Expression	Nonsubscribed	Cable TV	CS
Number of respondents			139	221	153
Number of channels (average)	Basic	Bch_i	6.918	9.529	6.819
	Extended	Ech_i	0.667	8.000	1.961
	Special	Mch_i	0.000	19.718	21.606
Charges (average monthly payments)		p_i	1600.714	7471.639	5484.806
Viewing time (average)	Basic	$Bwatch_i$	699.990	650.761	577.862
	Extended	$Ewatch_i$	6.579	28.257	28.147
	Special	$Mwatch_i$	0.000	48.339	91.935
Average annual income		Y_n	592.086	708.145	760.784

Table 2 Estimation Results for Models 1 and 2

	Model 1						Model 2					
	Multinomial logit		Nested logit		Mixed logit		Multinomial logit		Nested logit		Mixed logit	
Variable	Coefficient	SD	Coefficient	SD	Coefficient	SD	Coefficient	SD	Coefficient	SD	Coefficient	SD
Cable subscription constant	-1.1354 **	0.4798	-1.1866 **	0.5166	-1.1358 ***	0.4324	-0.9429 *	0.4984	-1.1371 **	0.5700	-0.9438 **	0.4360
Basic channels	1.8660 ***	0.1612	1.8799 ***	0.2233	1.8676 ***	0.1056	1.9816 ***	0.1739	2.1552 ***	0.2773	1.9824 ***	0.1166
Extended basic channels	-0.0078	0.0718	-0.0037	0.0735	-0.0078	0.0514	-0.0101	0.0753	0.0052	0.0835	-0.0100	0.0523
Special channels	0.0162 a	0.0124	0.0200 a	0.0147	0.0162 a	0.0126	0.0075	0.0129	0.0169	0.0163	0.0074	0.0133
Charges	-0.0001 *	0.0001	-0.0001 a	0.0001	-0.0001 **	0.0001	-0.0002 **	0.0001	-0.0002 **	0.0001	-0.0002 ***	0.0001
Basic channel viewing hours	-	-	-	-	-	-	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003
Extended basic channel viewing hours	-	-	-	-	-	-	-0.0025	0.0024	-0.0028	0.0026	-0.0025	0.0021
Special channel viewing hours	-	-	-	-	-	-	0.0046 ***	0.0011	0.0052 ***	0.0013	0.0046 ***	0.0009
Income (nonsubscriber households)	-0.0005 a	0.0003	-0.0007 a	0.0004	-0.0005 a	0.0004	-0.0006 a	0.0003	-0.0009 *	0.0005	-0.0006 a	0.0004
Free	-	-	0.9875 ***	0.1669	-	-	-	-	0.8592 ***	0.1534	-	-
Pay	-	-	0.9683 ***	0.1668	-	-	-	-	0.8311 ***	0.1518	-	-
δ (cable constant)	-	-	-	-	0.0079	0.2833	-	-	-	-	0.0145	0.2869
δ (BCH)	-	-	-	-	0.0373	0.0883	-	-	-	-	0.0272	0.0937
δ (ECH)	-	-	-	-	0.0011	0.0303	-	-	-	-	0.0031	0.0309
δ (P)	-	-	-	-	0.0011	0.0058	-	-	-	-	0.0008	0.0057
δ (MCH)	-	-	-	-	0.0000	0.0000	-	-	-	-	0.0000	0.0000
δ (WBCH)	-	-	-	-	-	-	-	-	-	-	0.0000	0.0002
δ (WECH)	-	-	-	-	-	-	-	-	-	-	0.0002	0.0019
δ (WMCH)	-	-	-	-	-	-	-	-	-	-	0.0001	0.0008
δ (Income)	-	-	-	-	0.0000	0.0002	-	-	-	-	0.0000	0.0002
ln Likelihood	-227.8573		-227.6987		-227.7971		-218.2827		-217.4627		-218.2356	
ln Likelihood (zero coefficient constraint)	-563.5881		-614.8215		-563.5881		-563.5881		-614.8215		-563.5881	
McFadden's R2	0.5933		0.6267		0.5910		0.6093		0.6425		0.6059	
Sample	513		513		513		513		513		513	

***: 1% significance
**: 5% significance
*: 10% significance
a: 20% significance

Table 3　Goodness of Fit and IIA Test Results for Each Model

	Method			IIA test	
	Multinomial	Nested	Mixed	Hausman	Likelihood
Model 1	76.0%	76.2%	86.4%	Dismissed (5% level)	Cannot be dismissed
Model 2	77.0%	76.8%	87.1%	Cannot be dismissed	Cannot be dismissed

Table 4. Price and Channel Elasticity

	Price		Basic channel service		Special channel services	
Model 1	ε_{Own}	ε_{Cross}	ε_{Own}	ε_{Cross}	ε_{Own}	ε_{Cross}
Unsubscribed	-0.138	0.049	8.059	-3.445	0.000	0.000
Cable TV	-0.504	0.379	6.423	-7.593	0.189	-0.135
CS	-0.450	0.192	7.660	-3.859	0.243	-0.108
Model 2	ε_{Own}	ε_{Cross}	ε_{Own}	ε_{Cross}	ε_{Own}	ε_{Cross}
Unsubscribed	-0.186	0.066	8.569	-3.642	0.000	0.000
Cable TV	-0.677	0.508	6.818	-8.060	0.087	-0.062
CS	-0.603	0.259	8.115	-4.111	0.111	-0.050