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## **Demand Analysis for Real-Time and Time-Shifted Viewing in the Japanese TV Market**

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### **Key Words:**

Demand analysis, Discrete choice model, Real-time viewing, Time-shifted viewing, Terrestrial TV, WEB survey.

### **Abstract:**

In this study, we analyze the Japanese TV audience's preference for real-time viewing(RTV) and time-shifted viewing(TSV), which includes video-recording, and both pirate and official contents on the internet, using the WEB survey data the authors conducted in August 2016 in Japan.

From the economics point of view, the cost is one of the most important factors affecting consumers' behaviors; however there is no surcharge to view terrestrial TV contents (except NHK), which are the most pervasive in Japan, so it is difficult to investigate the cost effect on TV demand behaviors. In the past studies, individual time value is employed as a proxy of cost. The wage is used as individual time value; however it doesn't well reflect time value on the time he/she views TVs during his/her recreation time. Although this modeling is proper, in fact, the measurement of time value in recreation time is difficult to be measured by his/her wage. In this paper, we employ the different variable as a proxy of individual time value. In the survey we asked the respondents whether he/she watch TVs in three time slots on August 1st and whether he/she record or plan to view the contents broadcasted in these time slots. In addition, we asked whether he/she have time to view TVs easily or not by three scales; 1:no problem to view on that time, 2:OK to view on that time, 3:difficult to view on that time. We inserted this variable as his/her cost proxy to view TV contents, and estimate demand function of RTV and TSV.

Our empirical results show that this variable statistically affects RTV behaviors but not TSV behaviors. Other factors' effects estimated under controlled by the above variable will be presented in the conference.

## 1. Introduction

In Japan, terrestrial TV programs have traditionally been aired for free, with the exception of the NHK subscription fee. Most viewing of internet content at present is also based on a fixed monthly fee approach. Even CS channel contracts, in fact, basically do not take the form of per-view fees. This business model is not much different from those followed in other countries. The literature in behavioral economics also shows a consumer preference for fixed fees. Although recent advances in ICT technology have made per-view charging feasible, it is fair to say that this type of charging has been influenced by the cumbersome procedures formerly required.

Consumers' contents viewing behaviors has been analyzed from various aspects. Goolsbee and Klenow (2006) empirically analyzed the Internet contents consumption behavior using time-use data. Cuñado and de Gracia (2012) studied the impact of media consumption on happiness using social survey data. Carare and Zentner (2012) dealt with TV programs substitutability and television networks' program choices. Wilbur (2016) measured the television advertising avoidance. Belo et. Al. (2016) analyzed Time-Shift viewing behaviors.

The sticking point in economic analysis of consumer behavior as relates to viewing of content is the difficulty of incorporating the price variables normally used in economics into the model, since even though subscriber demand is relatively easy to analyze, no per-view costs are paid depending on whether the content was actually viewed or not. Even in cases where no usage charges are levied on views, given the investment in time for viewing, consumer behavior models generally take account of the time cost of viewers. Wage rates are often employed as a proxy variable for the cost of the time of viewers.

Much of the literature on time cost deals with the transport sector (Moses and Williamson, 1963, Bruzelius, 1979, De Serpa, 1971, Gunn, 2000, Hensher, 2001, Hensher and Goodwin, 2004). This is due to the necessity to measure the time-saving benefits of infrastructure construction in this sector. For this purpose, it suffices to use the original unit of average time-saving benefits for particular groups, by region, individual attribute, or vehicle—in other words, average time-saving benefits. On the other hand, when consumer behavior models of content viewing are analyzed based on microdata, we need individual information in addition to average time value. The literature on the value of time treats the time value of recreation time differently from that of working time. Whereas recreation time can in theory be represented by a model of individual choice predicated on the cost of wage ratio, the actual situation is somewhat different. In general, even if people want to make money by doing work in their free time, they cannot earn wages if there is no work to be had, and work does not normally just appear to conveniently fill in empty slots of time. In other words, it is not appropriate to use working wage rate as a proxy for the value of time spent on recreation. Therefore, in our analysis of consumer behavior involving time spent viewing content during periods

of recreation, it is highly likely that using wage ratio as a proxy for the time value of a given individual is not necessarily an accurate way to express the time cost of viewing content.

Framing the problem in this way, our analysis attempts to express the value of time spent viewing content in a different form from wage ratio. The objective of our analysis is to use a non-wage-ratio approach in examining what kinds of individual attribute variables, time values, and wage ratios influence viewing behavior, taking into account individual time constraints for the period in question.

This study shows, based on the results of an assessment and analysis of the value of viewing time, that for real-time viewing of content, individual time constraints during the time period in question have a strong influence on whether or not content is viewed, while wage ratio has an insignificant influence, and that individual attributes do influence whether content is viewed in real time. In contrast, for time-shifted viewing, statistically speaking, it is wage ratio, the average time constraint for the individual in question, that exerts an influence, not the time constraints for the time period in question, and individual attributes have less effect than for real-time viewing.

This paper is organized as follows. Section 2 describes the design and overview of the data used in the study. Section 3 describes the analysis model. Section 4 presents the estimation results. Section 5 is devoted to summarize the findings of this analysis.

## **2. Data**

Our analysis uses data from an internet survey carried out by the author in August, 2016. This section presents an overview of the survey and the data.

The sample size for the survey was 1200, of which 59% were male and 41% female. Since the survey was intended to capture viewing behavior for particular programs at particular times after showing program listings, we limited ourselves to regions with identical program listings. Specifically, our subjects were residents of seven prefectures: Tokyo, Kanagawa, Chiba, Saitama, Gunma, Tochigi, and a part of Ibaraki. By profession, 13% of respondents were housewives, 12% were part-timers, 3% were students, 14% were unemployed, 7% were self-employed, and 1% were professionals such as doctors and lawyers; the remaining 50% were salaried workers.

We will now explain the question we posed to create the variable for "respondent time constraints at particular times", a notable feature of this analysis. The survey addressed viewing behavior in the three-hour period from 8:00pm to 11:00pm on August 1, 2016. As mentioned above, since the subjects of the survey all lived in related areas, the program lineup for terrestrial broadcasts (other than some local broadcasts) was identical for all respondents. We wrapped up the fieldwork on the respondent's viewing activities on August 1 by August 3, while their memories were still fresh.

Specifically, we asked the following kinds of questions in order to investigate the viewing behavior of the respondents during the specified time periods and individual time constraints during those periods.

First, we organized the questions by dividing the three-hour period into three one-hour segments. We then showed the respondents the program listing for terrestrial broadcasts for the 8:00pm-9:00pm period and asked them to indicate the programs that they viewed in real time or that they viewed or intended to view in some time-shifted fashion. The specific question posed was as follows;

*Question: Here is the listing of programs aired on August 1 (Monday) between 8:00pm and 9:00pm. Please indicate all the programs aired during this period that you viewed, or intend to view recorded versions of or net videos of later.*

For responses to this question, we showed the program listing for terrestrial broadcasts aired during the period and had the respondents answer. In addition, for each program which the respondents said they viewed or planned to view, we had them choose from among the seven alternatives in the following question, in order to gather respondent viewing behavior data.

*Question: For each program you said you viewed or planned to view in the previous question, please indicate how you viewed or will view it. Example: NHK General TV's A Toast to Tsurubei's Family (Tsurubei no kazoku ni kanpai), Summer vacation abroad special, "Sawa Homare's No Holds Barred Trip to San Francisco)".*

1. Viewed as it aired
2. Have already viewed a recording
3. Plan to view a recording
4. Have already viewed using an on-demand service
5. Plan to view using an on-demand service
6. Have already viewed on the net, such as YouTube
7. Plan to view on the net, such as YouTube

Our survey captured respondent viewing behavior for the specified time segment using these two questions. We also posed the following question to examine "individual time constraints during the time period in question" for each time segment.

*Question: Thinking back on watching TV on August 1 (Monday), were you in a position to watch TV in the following time segment if you had wanted to? /8:00pm-9:00pm*

We offered the respondents three choices in this question: 1. I was not in a position to watch TV. 2. I could have watched if I had really wanted to (we are not asking whether you did in fact watch). 3. I was in a position to watch TV without any problems. These three choices are a matter of perception and involve a subjective judgment by the individual respondent, but after reviewing this in advance, including a pre-survey, we chose to give priority to ease of response.

This series of questions captured respondent viewing behavior and individual time constraints during the particular time segment, and along with income and other individual attribute information gathered through general questions, formed the variables used in the analysis model described starting in the next section.

### **3. Estimation Model**

This section describes the viewing behavior model based on the survey data discussed in the previous section. For each of the three hourly segments, we created variables for whether or not any program was viewed in real time (Dr: 1 if there was and 0 if there was not) and for whether any program was viewed in a time-shifted way (Dt: 1 if there was and 0 if there was not), and built a regression model with the two variables as dependent variables. We considered a single program viewed in real-time as constituting real-time viewing, and for time-shifted viewing we took a single choice of 2, 3, 4, 5, 6 or 7 to the question in the previous section for any of the programs to which the response was "viewed" or "plan to view" as constituting time-shifted viewing.

The actual estimation model is as follows.

$$\begin{aligned} Dr &= \alpha_0 + \alpha_1 \times \text{Cost} + \alpha_2 \times \text{Income} + \alpha_3 \times \text{Age} + \alpha_4 \times \text{Sex} + \alpha_5 \times \text{Family} + \alpha_6 \times D21 + \alpha_7 \times D22 \\ Dt &= \beta_0 + \beta_1 \times \text{Cost} + \beta_2 \times \text{Income} + \beta_3 \times \text{Age} + \beta_4 \times \text{Sex} + \beta_5 \times \text{Family} + \beta_6 \times D21 + \beta_7 \times D22 \end{aligned}$$

Cost is the "individual time constraints for the relevant time segment " from the previous section. We took the choice number (1. I was not in a position to watch TV. 2. I could have watched if I had really wanted to (we are not asking whether you did in fact watch). 3. I was in a position to watch TV without any problems.) which forms an ordinal scale, as is for the variable value. This is not necessarily appropriate since the spacing between the choices differs. For that reason, we based our analysis on dummy-coded variables for the three choices.

Age is respondent age; sex is a dummy variable taking the value of 1 for female and 0 for male. Family is the number of family members living in the house, or 1 for people living alone. D21

and D22 are dummy variables for time segment (based on 8:00pm). These time segment dummy variables can be considered to represent the difference in the program lineup aired during that hour (which is the average trend for respondents).

Both dependent variables Dr and Dt are binary variables. Based on efficiency considerations, since both estimation formulas were to be estimated simultaneously, we performed the estimation using a bivariate probit model, which is a discrete choice model.

#### 4. Estimation Results

In this section we present the estimates from the model described in the previous section. The results are shown in Table 1. For real-time viewing, we see that time constraints have a statistically significant influence, whereas income has no effect. It is fair to say that this suggests the likelihood that normally wage ratio, which represents individual time value, is not an appropriate way to.

Table 1: Estimation Results

<i>Real Time Viewing</i>	<i>Coef.</i>	<i>P-value</i>	<i>Coef.</i>	<i>P-value</i>	<i>Coef.</i>	<i>P-value</i>	<i>Coef.</i>	<i>P-value</i>	<i>Coef.</i>	<i>P-value</i>
<i>Difficulty of viewing</i>	0.7278	(0.000)	0.7209	(0.000)			0.7259	(0.000)		
<i>Dummy of Difficult to veiw</i>					-0.8800	(0.000)				
<i>Dummy of Easy to veiw</i>					0.6244	(0.000)				
<i>Income</i>	0.0001	(0.340)	0.0001	(0.371)	0.0001	(0.369)			0.0000	(0.616)
<i>Number of family</i>	0.0875	(0.000)	0.0876	(0.000)	0.0879	(0.000)	0.0886	(0.000)	0.0851	(0.000)
<i>Age</i>	0.0140	(0.000)	0.0140	(0.000)	0.0140	(0.000)	0.0140	(0.000)	0.0168	(0.000)
<i>Sex</i>	0.2837	(0.000)	0.2835	(0.000)	0.2744	(0.000)	0.2676	(0.000)	0.2775	(0.000)
<i>D9</i>	-0.1687	(0.003)			-0.1716	(0.003)	-0.1678	(0.004)	-0.1091	(0.042)
<i>D10</i>	-0.1958	(0.001)			-0.1980	(0.001)	-0.1948	(0.001)	-0.1102	(0.040)
<i>Constant</i>	-3.3309	(0.000)	-3.4370	(0.000)	-1.7731	(0.000)	-3.2835	(0.000)	-1.7389	(0.000)
<i>Time Shifted Viewing</i>	<i>Coef.</i>	<i>P-value</i>	<i>Coef.</i>	<i>P-value</i>	<i>Coef.</i>	<i>P-value</i>	<i>Coef.</i>	<i>P-value</i>	<i>Coef.</i>	<i>P-value</i>
<i>Difficulty of viewing</i>	0.0049	(0.888)	0.0053	(0.878)			-0.0016	(0.962)		
<i>Dummy of Difficult to veiw</i>					-0.3626	(0.000)				
<i>Dummy of Easy to veiw</i>					-0.3085	(0.000)				
<i>Income</i>	0.0003	(0.007)	0.0003	(0.007)	0.0003	(0.013)			0.0003	(0.008)
<i>Number of family</i>	-0.0165	(0.477)	-0.0161	(0.486)	-0.0148	(0.526)	-0.0142	(0.539)	-0.0161	(0.488)
<i>Age</i>	-0.0044	(0.047)	-0.0044	(0.047)	-0.0042	(0.064)	-0.0040	(0.071)	-0.0044	(0.048)
<i>Sex</i>	0.0032	(0.961)	0.0048	(0.941)	-0.0203	(0.759)	-0.0467	(0.455)	0.0037	(0.955)
<i>D9</i>	0.1125	(0.118)			0.1051	(0.146)	0.1130	(0.115)	0.1114	(0.121)
<i>D10</i>	0.0021	(0.978)			-0.0050	(0.946)	0.0027	(0.971)	0.0019	(0.980)
<i>Constant</i>	-1.2568	(0.000)	-1.2211	(0.000)	-0.9675	(0.000)	-1.1068	(0.000)	-1.2481	(0.000)
<i>ρ</i>	-0.1257	(0.003)	-0.1256	(0.003)	-0.1356	(0.001)	-0.1251	(0.003)	-0.1217	(0.002)

The results for time-shifted viewing, on the other hand, are the converse of those for real-time viewing. However, for time-shifted time constraints, the results for the model incorporating time constraints via dummy variables are different from what would normally be expected. The two dummy variables represent "watching would have been hard" and "could easily have watched", with the base being "I could have watched if I had really wanted to". Negative parameter estimates for both dummy variables indicate that time-shifted viewing is more likely in the intermediate case of "could have watched if I really wanted to", and less likely in other cases. This result may represent a particular type of attitude toward viewing TV content. TV programming in Japan normally is done

by the day of the week. In other words, the same program is aired at the same time of day on the same day of the week for the approximately three-month duration of one cycle. One may speculate that when someone finds it impossible to watch TV at a particular time on a particular day of the week, they will simply resign themselves to not watching anything at that hour. They will end up not even time-shifting the program at that hour. Or if it's convenient for them to watch at that hour then they will watch it in real-time. If there are times they can watch it and times they can't, then they may go to time-shifting.

The results shown in Table 1 pertaining to individual attributes demonstrate that families with more members, older viewers, and women tend to choose real-time viewing. For time-shifted viewing, individual attributes have no influence except that younger viewers tend to choose it. We observe that higher-income viewers tend to choose time-shifting, which is the reverse of the natural effect of time value. However, the higher a person's time value, the more difficult it is for them to make the time to watch TV at a particular hour. In that sense, it is conceivable that people with a higher time value vis-à-vis the benefits of watching TV choose time-shifted viewing.

## 5. Summary of Findings

Our analysis in this paper has demonstrated the following points.

- Individual attributes demonstrate that families with more members, older viewers, and women tend to choose real-time viewing.
- For time-shifted viewing, individual attributes have no influence except that younger viewers tend to choose it.
- Higher-income viewers tend to choose time-shifting, which is the reverse of the natural effect of time value.
- The higher a person's time value, the more difficult it is for them to make the time to watch TV at a particular hour.

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