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## Conference Paper

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# **Analysis of the economic value of leaks of personal data.**

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## **Abstract**

In this research, willingness to pay to prevent a leak of personal data—namely, the person's name, address, email address, and video viewing history—and also the willingness to accept compensation in the event of a leak of this data were estimated using the contingent valuation method.

From the results of the estimates, it was found that there were major differences in the willingness to pay and the willingness to accept for leaks of personal data. The willingness to pay was about from 3,100 yen (23 euro) to 3,800 yen (28 euro), while the willingness to accept was about from 14,600 yen (108 euro) to 15,800 yen (117 euro).

## **1. Background and purpose of the analysis**

In recent years, the utilization of personal data has progressed in a variety of services. But on the other hand, alongside the utilization of personal data, attention has become focused on the important problem of leaks of this data. Within this sort of situation, Japan is in the middle of revising its law on protecting individual information and is also investigating a range of other measures relating to the utilization of personal data.

Much of the research on personal data has been legal research; namely, into what kind of legal system is preferable from the perspective of privacy. However, there has been very little economic research, such as research on the question of to what extent does personal data have economic value. Moreover, there has been even less research that attempted to empirically clarify its economic value.

In recent years, the effectiveness of big data related to personal data, which is the accumulation of large volumes of such data, has been noted. But similarly, a sufficient body of research on clarifying the value of this big data has not been accumulated. As only a few analyses are found in Manyila et al. (2011) and SAS (2012).

Therefore in this research, we attempt to clarify the economic value of personal data from the perspective of consumers, who are the providers of personal data. Specifically, we investigate services for watching videos, which is a typical Internet service, and clarify economic value in the form of the amount of compensation to be paid for the leak of personal data through the use of such video services.

## 2. Past examples of compensation paid in regard to data leaks

The value of compensation paid with regard to accidental leaks of personal data serves as a reference for the economic value of personal data. The table shows examples of compensation paid in Japan in relation to past accidental leaks.

Date	Leaked information	Scale	Amount awarded
1998	Waseda University; Lecture attendance revealed to the police	1,400 cases	Y5,000
1999	Uji City; Basic Resident Register data	Around 220,000 people	Y15,000
2000	TBC Group; Information on potential beauty treatment customers	Around 6.6mn people	Y35,000 (court judgment)
Jun 2003	Lawson; Card member information	Around 1.15mn members	Y5,000 shopping voucher
Nov 2003	famima club; member information	Around 180,000 members	Y1,000 QUO card
Jan 2004	Yahoo! BB; subscriber information	Around 5.9mn subscribers	Y500 cash voucher
Apr 2009	Mitsubishi UFJ Securities; customer information	Around 50,000 people	Y10,000 shopping voucher
Jul 2014	Benesse; customer information	28.95mn people	Electronic money, “book card” or donation, equivalent to Y500
Sep 2014	DoCoMo; customer information	One company, 1,053 individuals	(to be decided)
Sep 2014	JAL	As many as 750,000 cases	(to be decided)

Source: Compiled by the authors based on data from the website of the Mizuho Chuo legal practice

However, the extent to which these compensation amounts reflect the actual economic value of the personal data is not clear. With voluntary compensation by the companies involved, consumers have no choice but to accept the amount offered. When the amount

has been calculated by a court, the sensitivity of the personal data, etc., involved is likely to have been taken into account, but such factors are hard to assess. This point also makes it clear that the economic value of personal data must be continually estimated, alongside research into methods of assessing that economic value, to facilitate a broad consensus of perception among consumers, companies and government.

### **3. Earlier research**

Earlier research relevant to this study includes that in the area known as Economics of Privacy, as well as empirical studies relating to privacy concerns.

Hui and Png (2006) and Acquisti et al. (2014), among others, have reviewed the Economics of Privacy. As for empirical studies on privacy concerns, Milne and Boza (1999), Earp and Baumer (2003), and Dommeyer and Gross (2003) have shown, for example, that the level of such concern is influenced by age. Specifically, they have demonstrated that older people are more worried about this than younger people and are more cautious about revealing information.

However, these studies did not directly estimate the economic value of personal data. Such estimates have been attempted by Koguchi and Jitsuzumi (2015) and Jitsuzumi and Koguchi (2013).

### **4. Analysis methods**

For our analysis, an online questionnaire survey was conducted. It was conducted on Apr, 28, 29 and 30, 2015, after a pilot survey to determine the financial amounts for the scenarios in the survey. There were 1,264 respondents.

In the analysis, Willingness to Pay and Willingness to Accept were estimated with regard to three cases. The outline of, and the survey questions for, each case are as follows:

- ① Basic Case: Name, email address and home address are leaked via the Internet.
  - ② YouTube + Basic Case: On top of the personal data in the Basic Case, the past three years' YouTube use history is leaked.
  - ③ Adult Movie + Basic Case: On top of the personal data in the Basic Case, the past three years' history of viewing adult movies is leaked.
- Question (Willingness to Pay):  
Please consider the situation where your Internet provider has accidentally leaked

[each of the three cases above inserted]. Hypothetically, how much would you be willing to pay to use a putative service that completely erased all the leaked information from the Internet?

- Question (Willingness to Accept):

Please consider the situation where your Internet provider has leaked [the three cases above variously inserted]. In this situation, hypothetically, what level of compensation would be satisfactory to you as an apology for the leak?

Estimation was carried out using the Contingent Valuation Method. Single-bounded dichotomous choice questions were adopted, with each respondent asked six questions, i.e. questions about Willingness to Pay and Willingness to Accept in the three cases. The financial amounts in the questions were set at four levels: Y100 / Y500 / Y5,000 / Y15,000. These four levels were evenly allocated to the respondents.

In estimating, to render the three cases comparable, only the sample established via the questions as having viewed both YouTube and adult movies was used. As a result, the size of the sample ultimately used in the estimation was 645. Also, Weibull regression was used in the estimation, as below.

S, the acceptance rate curve with regard to the amount offered, is defined as:

$$S(T) = \exp \left[ - \exp \left( \frac{\ln T - \mu}{\gamma} \right) \right]$$

Here, T is the amount offered and  $\gamma$  and  $\mu$  are the Weibull distribution parameters. Estimation was carried out, with this coefficient substituted in the following log likelihood function:

$$LL = \sum_{i=y} \ln S(T_i) + \sum_{i=n} \ln [1 - S(T_i)]$$

Here, y represents a set of individuals (i) who accepted the value offered (Ti) and n a set of individuals who rejected it at that amount.

## 5. Estimation results

Estimation results are as follows:

	Basic Case	YouTube + Basic Case	Adult Movie + Basic Case
WTP	3,799 yen (28 euro)	3,107 yen (23 euro)	3,754 yen (28 euro)
WTA	15,739 yen (117 euro)	14,636 yen (108 euro)	n/a

Looking at the results of the estimation, Willingness to Pay stood at 3,799 yen (28 euro) for the Basic Case scenario, at 3,107 yen (23 euro) for the Youtube + Basic Case scenario, and at 3,754 yen (28 euro) for the Adult Movie + Basic Case scenario. Meanwhile, Willingness to Accept stood at 15,739 yen (117 euro) for the Basic Case scenario, and at 14,636 yen (108 euro) for the Youtube + Basic Case scenario.

However, as it stands, some results are hard to explain, such as the fact that the Willingness to pay figure under the Basic Case scenario is greater than that under the Youtube + Basic Case scenario (where more types of personal data have been leaked than in the Basic Case). Further investigation into these points is ongoing.

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