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## The Impact of Official and Informal Free Goods: An Empirical Analysis of Creative Industries in Japan

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**The Impact of Official and Informal Free Goods:  
An Empirical Analysis of Creative Industries in Japan**

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**Abstract**

The current progress in digitization and the development of information and communication technologies dramatically changed the creative industries' business model. Although new free goods spread broadly as technology develops, economists and company managers are very interested in the impact free goods have on their paid goods. Considering their complementary and substitution effects, we discuss the impact of official and informal free goods on the consumption of paid goods in three creative industries in Japan. We employ an instrumental variables method and a large questionnaire dataset. Official free goods have a significant positive effect on paid goods in the music industry, with an elasticity of 0.11, but no significant effect in the video and book industries. Informal (pirated) free goods have no significant effects in the book industry, but have a significant negative effect in the music and video industries, with elasticities of -0.23 and -0.19, respectively. The above results imply that, employing the business model of offering free goods is a useful strategy in the music industry. On the other hand, the supply of informal free goods affects the producers in the music and video industries negatively.

**JEL Codes**

K42, L82, O34

**Keywords**

creative industry, free goods, file sharing, piracy, freemium, music industry

## 1. Introduction

Creative industries, that is, industries engendering products of culture and intellectual property rights, have been growing at a rate higher than the GDP growth rate in many countries. The Ministry of Economy, Trade and Industry of Japan announced in 2016 that the global market size was expected to reach approximately 700 billion USD in 2020. In addition, creative industries are considered to have a big ripple effect on the economy; the impact of non-creative industries, such as the manufacturing industry, on market size is approximately 1.7 times the impact of creative industries. These points highlight the importance of creative industries.

Given this importance, many countries have put an effort into promoting these industries. In the UK, for example, the Creative Industry Task Force (CITF) was created and the Creative Industries Mapping Document analyzed the importance and contribution of creative industries to the UK economy. More recently, the UK's Department for Culture Media and Sport (DCMS) released its 2007 report, which analyzed the current situation in and problems concerning creative industries. In the USA, creative industries grow at twice the average growth rate in all non-creative industries, and create jobs at a rate that is triple the rate at which jobs are created in other industries.

The current progress in digitization and the development of information and communication technologies, such as the rapid popularization of the Internet and increasingly faster communication lines, dramatically changed the creative industries' business model, including distribution and promotion, forms of consumption, and intellectual property rights. One of the noteworthy changes is the large increase in the distribution of "free goods." With the progress of digitization, the cost of copying contents has decreased substantially. Further, file-sharing software as well as platforms distributing contents (YouTube, iTunes, Spotify, etc.) made file distribution very easy. As a result, a lot of free goods have been distributed via the Internet.

Free goods may be categorized into official and informal. The purpose of offering official free goods is to expand the potential demand by distributing the some or all goods free of charge, to sell the differentiated additional services for a fee, and, consequently, to increase the volume of sales. Examples of this are music videos posted on YouTube and freemium<sup>1</sup> music streaming

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<sup>1</sup> Freemium is the business model whose baseline service is free to use and users pay charge to use premium service (Anderson, 2009).

services for commercial purposes such as Spotify. Spotify allows its users to enjoy unlimited music free of charge as long as they register as members. Moreover, Spotify's users can use additional services, such as high-quality music and offline music, and the fees paid by premium members become the main revenue for Spotify.

Informal free goods are defined as freely available products of piracy that consumers copy, or newly created free goods that use a part of other, previously existing goods. Such free goods are shared among consumers by using video-sharing services such as YouTube, or using file-sharing services such as Torrent.

Although new free goods spread broadly as technology develops, economists and company managers are very interested in the impact free goods have on their paid goods. Free goods are assumed to have both a complementary effect and a substitution effect on paid goods (Blackburn, 2004; Dewenter et al., 2012). The substitution effect means that consumers whose consumption is satisfied through free goods stop purchasing paid goods, causing revenues from paid goods to decrease. This substitution effect shifts the demand function to the left. In contrast, the complementary effect means that consumers who are not planning or are only considering to purchase content become interested in it thanks to free goods, and eventually purchase paid goods. As a result, revenues from paid goods increase. The complementary effect shifts the demand function to the right.

The substitution effect and the complementary effect were discussed already in the past as technological development gave rise to new goods and business models. For instance, although legal battles were held because the advent of radio was perceived to jeopardize the sales of records in the USA in the 1920s, record companies started rampantly bribing radio personalities when it was revealed that radio may dramatically increase the sales of records (Sterling & Kittross, 2001). Further, TV via broadband was perceived as damaging to the film industry until it was suggested that there was a complementary relation between the film and TV industry (Head, 1972).

With such rich historical context, the substitution effect and the complementary effect of new goods have become subject of research. For example, Goolsbee (2001) studied retail services online and in brick-and-mortar stores, and Gentzkow (2007) compared online and print newspapers. In addition, as a lot of free goods are shared especially in recent years, the number

of empirical studies, even if limited to free goods, has increased. Their results differ with respect to the relative size of the substitution and complementary effects. Examples of empirical studies focusing on the substitution effect are Aguiar and Waldfogel (2015), and Aguiar (2015); both found that streaming services replaced music software. In addition, Hiller (2016) demonstrated through a natural experiment that music videos substituted music software. Further, Peitz and Waelbroeck (2004), Liebowitz (2008), Barker (2012), and Leung (2015) showed that sharing pirated music significantly reduced the use of music software. Similar results have been shown recently by, for example, Liebowitz (2016) and Lee (2016) who quantitatively examined the substitution effect in the music industry as regular products are replaced with pirated copies. In other than the music industry, studies, such as McKenzie and Walls (2016), and Smith and Telang (2016), showed that the distribution of pirated copies significantly decreased the box office or sales of film software.

In contrast, Blackburn (2004), and Andersen and Frenz (2010) empirically analyzed the complementary relation between file-sharing of pirated copies and the sales of music software. Nguyen et al. (2014), and Aguiar and Martens (2016) showed similar results for the complementary relation between streaming services and music software. Kretschmer and Peukert (2014) demonstrated the complementary relation between music videos and music software, and Bourreau et al. (2015) conducted an empirical study on the effects of the Radiohead campaign.

Some studies indicated that there are no significant influences. Martikainen (2014) did not show a significant substitution effect of illegal file-sharing on film software, and Fukugawa (2011) suggested that illegal file-sharing did not significantly affect the sales of games.

In empirical analyses, such as the ones cited above, of the substitution effect and the complementary effect, it is important to identify the effects of consumer preferences (the so-called endogeneity problem). In the music industry, for example, consumer preferences – which are contained in the error term – positively affect the consumption of both free and paid goods. In this case, as the result of OLS estimation is overestimation (Wooldridge, 2010), each study may consider various identification strategies.

In this study, we empirically analyze the substitution effect and the complementary effect of free goods in the Japanese creative industries, especially in the music, video, and book

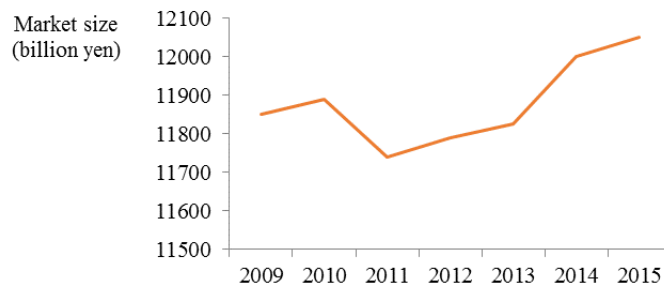
industries. We address the endogeneity problem through two methods. First, we analyze the consumers' behavior by using more than 30,000 data points from a questionnaire survey, asking directly about the consumers' preferences for consumption goods. We add the variables to our model as controls. Second, we ensure the consistency of the estimation results by employing the instrumental variables method.

In addition to the methods employed, the uniqueness of this study is in its cross-sectoral scope. As the substitution effect and the complementary effect may depend on the features of creative goods, analyzing cross-sectoral differences is deemed important. We study three sectors: the music industry, the video industry, and the book industry. We analyze these sectors simultaneously by using the same method and model; next, we obtain the suitable instrumental variables from the variables related to the other sectors, and compare the impact of free goods across the sectors.

This paper is structured as follows. Section 2 introduces the creative industries in Japan. Section 3 presents the model we employ to analyze the impact of using official and informal goods on the consumption of paid goods. Section 4 describes our data and presents the summary statistics. Section 5 shows the estimation results of the model from Section 3. Finally, Section 6 concludes with a brief discussion on the estimation results and the role of free goods in creative industries from perspectives of business and policy.

## **2. Creative Industries in Japan**

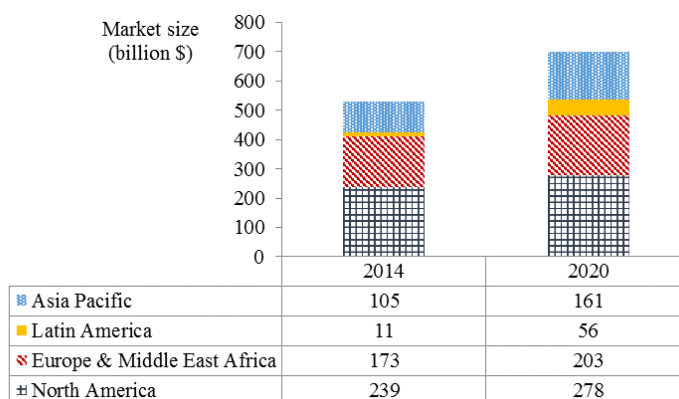
This study offers an empirical analysis of Japan's creative industries. Creative industries are also called contents industries in Japan; the term is the collective name for industries that include the production and distribution of music, movies, books, games, and so on. We adopt this definition in our study. The market size of creative industries in Japan has been increasing after it dropped temporarily due to the great earthquake disaster in 2011. The market size in Japan reached about 12 trillion yen in 2015, which is comparable to the nonferrous metal industry, accounting for at least 2% of Japan's GDP. However, the growth of the market size remains flat because the population in Japan has peaked out.



Source: Digital Content Association of Japan, 2016.

**Figure 1. The market size of creative industries in Japan**

The already large market size of creative industries worldwide is likely to expand further, grow about 3.9% per year, and reach about 700 billion dollars by 2020, according to Japan’s Ministry of Economy, Trade, and Industry in 2016 (Figure 2).



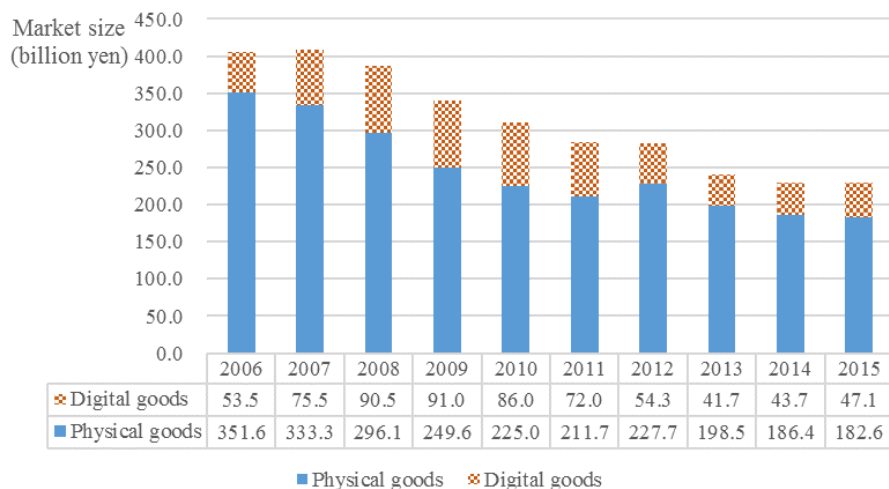
Source: Estimation of the Ministry of Economy, Trade, and Industry of Japan, 2016.

**Figure 2. The projected evolution of the size of creative industries in the world**

Next, we take a closer look at the music industry, the video industry, and the book industry, the three industries that are the subject of this study.<sup>2</sup> Figure 3 depicts the changes in the market size of the music industry in Japan.

<sup>2</sup> We do not consider the game industry in this study. Games are goods encompassing consumers’ own experiences, so pirated copies are not circulating via handy services such as video-sharing websites. Furthermore, mobile games, which belong to a significantly different business model, are becoming mainstream in the game industry.



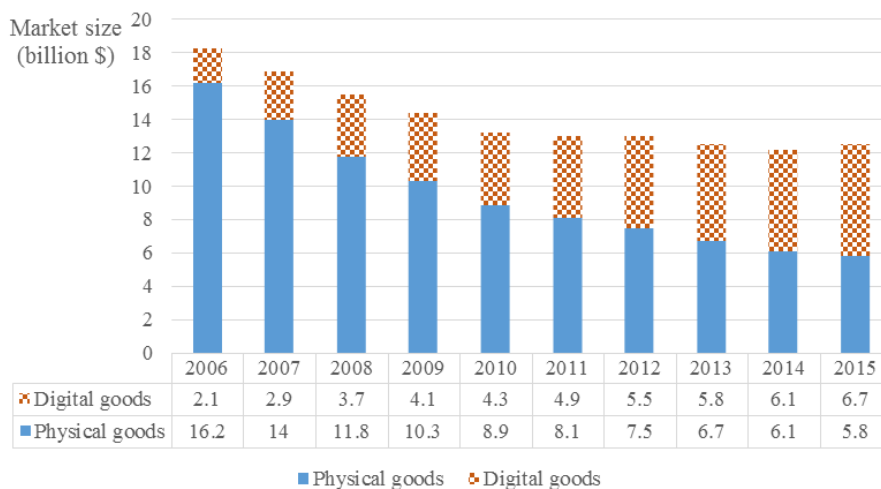


Source: The Recording Industry Association of Japan

**Figure 3. The market size of the music industry in Japan**

The market size for paid goods, which represent the sum of physical goods (CDs, etc.) and digital goods (downloaded music, etc.), in the music industry was about 230 billion yen in 2015. In 2015, its market size was the second largest in the world after the US (International Federation of the Phonographic Industry, 2016). However, the current market size is less than half of the market size of about 60 billion yen in the industry’s heyday in 1998, and the entire industry has been exhibiting a shrinking trend. Both digital and physical goods peaked at about 91 billion yen in 2009, since then the market size has been shrinking.

The shrinking music industry is a worldwide phenomenon. Figure 4 shows the trend in the market size of the global music industry. In recent years, although the industry has been decreasing at a slower rate as the market with digital goods expands rapidly, the overall trend is downward.



Source: International Federation of the Phonographic Industry (2016).

**Figure 4. The trend in the music industry in the world**

Although not as strong as in the music industry, a similar trend can be seen also in the video industry and the book industry in Japan.<sup>3</sup> The increased consumption of pirated goods is often pointed out as one of the causes. To illustrate the scale of the distribution of pirated, it is estimated that 57 million people illegally downloaded pirated goods in the USA in 2016 (Crupnick, 2016), implying lasting, large damage to the industry. Liebowitz (2008; 2016), and Lee (2018) analyzed the actual decrease in the sales of music software due to piracy, and they indicated that the increasing scale at which pirated goods are distributed may result in a shrinking market size. However, Blackburn (2004), Tanaka (2004), and Andersen and Frenz (2010) suggested that pirated goods the complementary effect of exists rather.

Others indicated that official free goods may have a negative influence similar to informal goods. Free goods include a variety of goods, but the services that have grown particularly rapidly in recent years are the freemium services. For example, the number of users of the music streaming service Spotify has increased rapidly in recent years, and now Spotify has more than 100 million users in the world. Aguiar and Waldfogel (2015), and Aguiar (2015) empirically

<sup>3</sup> For example, although the size of the market for books (physical goods) in Japan peaked at about 1,100 billion yen in 1996, now it is about 740 billion yen (All Japan Magazine and Book Publisher's and Editor's Associat, 2016).

analyzed the substitution effect of free music distribution services like Spotify on music software, and found that such services may cause the market size to shrink. In contrast, empirical analyses by Nguyen et al. (2014), and Aguiar and Martens (2016) showed that the music distribution services positively affected the sales of music software, and the reduction in the industrial scale cannot be attributed simply to the increased supply of free goods, without considering other conditions. In addition, since the products of creative industries are to be enjoyed during consumers' leisure time, it has been pointed out that the shrinking market size is also a result of consumers diversifying their hobbies as the Internet becomes more ubiquitous.

### 3. The Model

In this section, we theoretically discuss the substitution effect and the complementary effects of free goods, and construct a demand model of creative industries. The substitution effect means that consumers who satisfy their needs through the consumption of free goods stop purchasing paid goods, thus decreasing the revenues from paid goods. In contrast, the complementary effect means that consumers who are either not planning to purchase content, or are hesitant about purchasing content, after using free goods, become interested in paid content and eventually purchase paid goods. As a result, revenues from paid goods increase.

We formulate these effects following Piolatto and Schuett (2012). First, if there are free goods, the utility of consumer  $i$  from potential consumption goods  $j$  ( $j = 1, 2, \dots$ ) determines consumer  $i$ 's behavior as follows:

$$\begin{aligned} & \cdot u_{ij}^q - p_j \geq \vartheta u_{ij}^q > 0 : \text{purchase paid goods;} \\ & \cdot \vartheta u_{ij}^q > 0 \text{ and } u_{ij}^q - p_j < \vartheta u_{ij}^q : \text{use free goods and do not purchase paid goods;} \end{aligned} \quad (1)$$

where  $\vartheta u_{ij}^q$  is the utility of potential consumer  $i$  when he uses free goods, and we assume that  $0 \leq \vartheta < 1$ <sup>4</sup>.  $p_j$  denotes the price of paid good, and we assume that free goods come at no cost. Further, the utility equals 0 if the consumer does not purchase anything.

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<sup>4</sup> In brief, we assume that the utility from free online distribution is smaller than the utility derived from paid goods. Piolatto and Schuett (2012) also made this assumption.

With no free goods on the market, Eq. (1) shows that as consumers use the free goods, they purchase less of the paid goods. This negative influence is the substitution effect.

However, a variety of potential consumption goods when there are some free goods in the market increases more than when there are no free goods because more options enable consumers to consume content (review and watch) more easily. Denoting the ratio of increased potential consumption goods as  $\theta$ , we can write  $J^v = (1 + \theta)J^q$  ( $\theta \geq 0$ ). Where  $J^v$  is a variety of potential consumption goods when there are some free goods, and  $J^q$  is a variety of potential consumption goods when there are no free goods. In other words, because the cost of obtaining utility  $\vartheta u_{ij}^q$  is 0, consumer can enter the market easily, and they have access to new potential consumption goods; as a result,  $J^v \geq J^q$ . If the goods that increase potential consumption satisfy the condition  $u_{ij}^q - p_j \geq \vartheta u_{ij}^q \geq 0$ , the sales of paid goods increase. This positive effect is the complementary effect.

Considering these effects, in line with Blackburn (2004), we provide the following demand model for each individual  $i$ :

$$Q_i = Q(p(v_i), v_i, \theta(v_i)), \quad (2)$$

where  $Q_i$  stands for the sales of paid goods,  $p$  is the vector of the prices of paid goods in the market,  $v_i$  denotes the usage of free goods, and as in Eq. (1),  $\theta$  is the ratio of the newly increased potential consumption goods, which the consumer recognizes from using the free goods. This model shows, rather intuitively, that the sales of paid goods depend on the price of paid goods, the usage of free goods, and the ratio of consumption targets that the consumer knows from using free goods. In this model,  $p$  and  $\theta$  are functions of  $v_i$ . In addition, when we differentiate Eq. (2), we obtain:

$$\frac{dQ_i}{dv_i} = \frac{\partial Q_i}{\partial v_i} + \frac{\partial Q_i}{\partial \theta} \frac{\partial \theta}{\partial v_i} + \frac{\partial Q_i}{\partial p} \frac{\partial p}{\partial v_i}, \quad (3)$$

Let us interpret each term in Eq. (3). First,  $\partial Q_i / \partial v_i$  represents the substitution effect;  $\partial Q / \partial v_i \leq 0$  because as stated above, it negatively affects the sales of paid goods. Second, in the term  $\partial Q / \partial \theta \cdot \partial \theta / \partial v_i$ ,  $\partial \theta / \partial v_i \geq 0$  because an increase in the usage of free goods

increases the potential consumption targets by raising the awareness of paid goods, and  $\partial Q/\partial\theta_i \geq 0$  since such an increase of potential consumption targets positively affects the sales of paid goods. Therefore,  $\partial Q/\partial\theta \cdot \partial\theta/\partial v_i \geq 0$ . Finally, in the third term  $\partial Q/\partial p \cdot \partial p/\partial v_i$ ,  $\partial Q/\partial p \leq 0$  for general goods, and because it is difficult to predict how sensitively these goods' prices respond to the consumption of free goods,  $\partial p/\partial v_i = 0$ .

Although it is assumed that  $\partial Q/\partial v_i \leq 0$ ,  $\partial Q/\partial\theta \cdot \partial\theta/\partial v_i \geq 0$ , and  $\partial Q/\partial p \cdot \partial p/\partial v_i = 0$  in Eq. (3), theoretically predicting the sign of their sum,  $dQ/dv_i$ , is difficult. Comparing the absolute values of the substitution effect  $\partial Q/\partial v_i$  and the complementary effect  $\partial Q/\partial\theta \cdot \partial\theta/\partial v_i$ , the sign of  $dQ/dv_i$  will be positive if the complementary effect is bigger, and negative if the substitution effect is bigger.

Based on the above discussion, we construct an econometric model for individual  $i$ 's consumption in creative industry (sector)  $c$  (for example, the music industry) following Oberholzer-Gee and Strumpf (2007), Kaiser and Kongsted (2012), and Danaher et al. (2014). However, one of our goals is to distinguish between the official and informal free goods and show the difference between their effects. Therefore, when it comes to free goods' consumption  $v_i$ , we distinguish between the consumption of official goods  $v_i^o$  and the consumption of informal goods  $v_i^u$ :

$$\ln(e_{ic}) = \alpha + \beta^o \ln(v_{ic}^o) + \beta^u \ln(v_{ic}^u) + \gamma l_{ic} + X_i \delta + \varepsilon_{ic}, (4)$$

where  $e_{ic}$  is the payment of individual  $i$  to sector  $c$ ,  $v_{ic}^o$  represents individual  $i$ 's utilization of official free goods in sector  $c$ ,  $v_{ic}^u$  denotes individual  $i$ 's usage of informal free goods in sector  $c$ ,  $l_{ic}$  denotes individual  $i$ 's preference for sector  $c$ ,  $X_{ic}$  is the vector of variables characterizing individual  $i$ , and  $\varepsilon_{ic}$  denotes the error term. In addition,  $\alpha$ ,  $\beta^o$ ,  $\beta^u$ ,  $\gamma$ ,  $\delta$  represent the constant term and the parameters of each of the above non-vector and vector variables, respectively.

Therefore, from estimating these parameters, we can quantitatively test which of the two effects, the substitution or the complementary effect, is bigger in absolute value and how free goods affect the sales of paid goods

## 4. Data and Descriptive Statistics

We use data from the questionnaire survey that the Center for Global Communications, International University of Japan conducted in November 2016. The participants were customers of the Internet research company MyVoice Communication, Inc., and consisted of 30,719 men and women aged between 15 and 69. The questionnaire survey collected information on their consumption of paid and free goods and on their characteristics as consumers, such as their household income, sex, age, and so on, in three sectors – music, movies, and books.

Table 1 shows the summary statistics of the above variables. *Paid goods* is a variable representing consumers' expenditures (in yen) on paid goods, both physical and digital, in the most recent month. In addition, *Free goods* is a variable representing the time (in minutes) during which consumers used official or informal free goods in the most recent week. *Preference* is an ordinal variable representing the consumer's preference and takes five values (a five-point scale with values ranging from 5, "like," to 1, "do not like").

The other independent variables describe consumers' collection preferences, sex, age, marital status (married, unmarried), place of residence, and household income. *Collection preference* is the person like to collect things, and an ordinal variable that takes five values (a five-point scale with values ranging from 5, "like," to 1, "do not like"). *Metropolitan areas* is a dummy variable that equals 1 if the consumer lives in one of Japan's metropolitan areas (Tokyo, Kanagawa, Nagoya, Osaka).

**Table 1. Summary statistics**

	Variables	Unit	Mean	SD	Min	Max
Music industry	Paid goods	yen/month	604.54	2827.35	0	80000
	Free goods (official)	minutes/week	24.27	133.68	0	2100
	Free goods (informal)	minutes/week	61.38	222.70	0	2100
	Preference	1–5 scale	4.01	0.99	1	5
Movie industry	Paid goods	yen/month	604.42	3267.15	0	120000
	Free goods (official)	minutes/week	35.64	167.53	0	2100
	Free goods (informal)	minutes/week	45.25	197.16	0	2100
	Preference	1–5 scale	3.99	0.98	1	5
Book industry	Paid goods	yen/month	1280.85	3973.94	0	120000
	Free goods (official)	minutes/week	10.16	74.60	0	2100
	Free goods (informal)	minutes/week	5.10	53.70	0	2100
	Preference	1–5 scale	3.75	1.17	1	5
Consumer characteristics	Collection preference	1–5 scale	2.85	1.13	1	5
	Male	dummy (1 if male)	0.48	0.50	0	1
	Age	years	47.82	12.47	15	69
	Married	dummy (1 if married)	0.63	0.48	0	1
	Metropolitan areas	dummy (1 if lives in metropolitan area)	0.39	0.49	0	1
	Household income	millions of yen/year	5.92	4.03	0	20
	No. of observations				30719	

Note: The data from the questionnaire survey that the Center of Global Communication at the International University of Japan conducted in November 2016.

Table 1 shows that the usage time of informal free goods is longer than that of official free goods in the music industry and the video industry; the difference is more pronounced in the music industry. In contrast, the usage time of official free goods in the book industry is longer, but, overall, the usage time of free goods is short in this industry. Concerning official free goods, It seems that there are few freemium books available, in particular, people in Japan have a low preference for e-books. In addition, few informal free goods can be used without professional knowledge of ICT, for example, video sharing services such as YouTube in the book industry.

The averages in Table 1 may, however, include people whose expenditures or usage time is 0. For this reason, we examine the consumption of both paid goods and free goods, as well as the ratio of the number of consumers in the particular category of paid/free goods to the total number of consumers in Table 2. Similarly to what the data in Table 1 reveal, there are many users of free music, and there are few users of free books. In particular, we confirm the broad

consumption of informal free goods in the music industry as approximately 40% consumers consume goods in this category.

**Table 2. The consumption of paid and free goods by industry**

	Goods	Number of consumers	Ratio of consumers per category to the total number of consumers
Music industry	Paid goods	5078	16.53%
	Free goods (official)	5809	18.91%
	Free goods (informal)	12178	39.64%
Movie industry	Paid goods	3857	12.56%
	Free goods (official)	5370	17.48%
	Free goods (informal)	7664	24.95%
Book industry	Paid goods	13000	42.32%
	Free goods (official)	2888	9.40%
	Free goods (informal)	1219	3.97%
	No. of observations	30719	100%

Using the data described above, Figures 5 and 6 show the correlation between the usage time of free goods and the consumption expenditure on paid goods in the music industry.<sup>5</sup> Both figures confirm that regardless of the goods being formal or informal, there is a positive correlation between usage time and consumption expenditure in the music industry. The same tendency (not depicted below) is observed also in the video and book industries. These results suggest that the usage of free goods has a complementary relation with the consumption of paid goods.

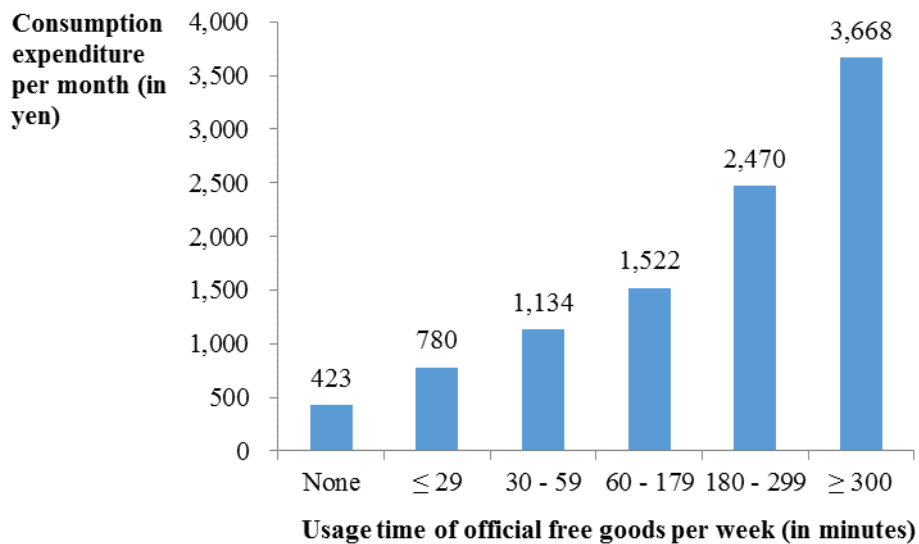
However, as the usage time of free goods may be correlated with the consumer's preference for the sector, endogeneity problems arise. In particular, it is assumed that for consumers who like music, both the consumption of paid music and the consumption (usage time) of free music increase. In Section 5, we address this by capturing the consumer's preference for each industry in our model, analyze the model by employing the instrumental variables method, and estimate

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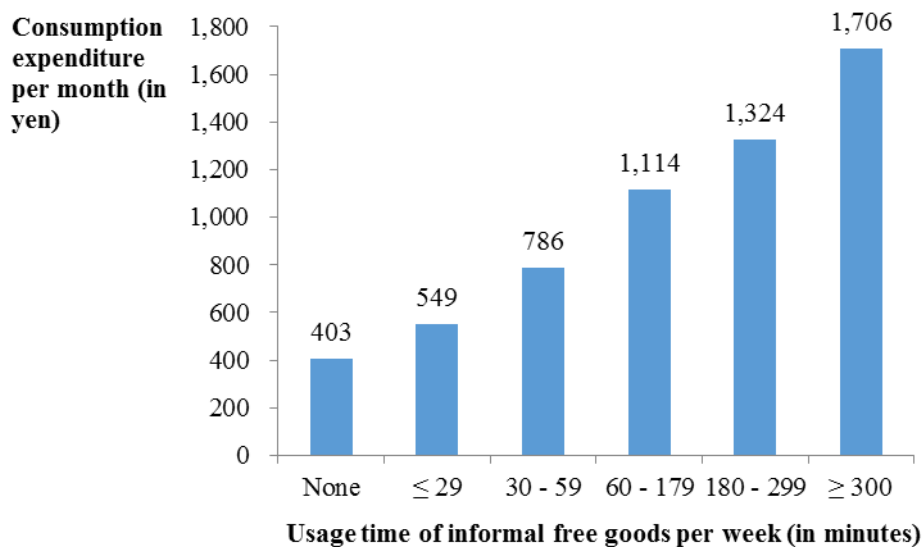
<sup>5</sup> Consumers who used free goods for more than 5 hours a week could choose one of the following five options available in the questionnaire: "more than 5 hours and less than 7 hours," "more than 7 hours and less than 10 hours," "more than 10 hours and less than 20 hours," "more than 20 hours and less than 30 hours," and "30 hours or more." Given the small sample size, in Figures 5 and 6, we merge these five categories into one.



the model's parameters.



**Figure 5. The correlation between the consumption of official free goods and consumer expenditure in the music industry**



**Figure 6. The correlation between the consumption of informal free goods and consumption expenditure in the music industry**

## 5. Estimation Results

In this section, to examine the substitution and complementary effects in the music, movie, and book industries in Japan, we present the results of estimating Eq. (4). As noted in Sections 1 and 4, however, the relation between the consumption of official or informal free goods and the consumption of paid goods is prone to endogeneity bias, so ordinary least squares estimation results in overestimation. Therefore, in this study, we employ the instrumental variables method.

Instrumental variables are required to be correlated with the endogenous variables but not correlated with the error term. We have three candidates for such instrumental variables: the usage time for each type of free goods outside of the given industry (i.e., the industry for which we estimate), the usage time for each type of free goods divided by the consumption expenditure outside of the given industry, and the usage time for each type of free goods divided by consumers' preference outside of the given industry. Although these variables are correlated with the endogenous variables because they capture consumer *i*'s preferences toward the consumption of free goods, they are not correlated with the error term as they are not related with the preferences within the given industry.

Tables 3 and 4 show the results of estimating Eq. (4). We note that all *p*-values are calculated from heteroscedasticity-robust standard errors, and the variables on free goods, household income, expenditures, and paid goods are log-transformed. Table 3 shows the estimation results of the ordinary least squares regression, and Table 4 shows the estimation results of the instrumental variables method. In Table 4, we include some test results pertaining to instrumental variables; the results of underidentification test, that is, the Kleibergen-Paap *rk LM* statistic, and the Hansen *J* statistic. The results of these tests show that the instrumental variables are not correlated with the error term, but sufficiently significantly correlated with the endogenous variables.

**Table 3. Estimation results of the ordinary least squares regression**

	(1)			(2)			(3)		
	Music			Video			Book		
	Coef.	p-value		Coef.	p-value		Coef.	p-value	
Free goods (official)	0.37	0.00	***	0.27	0.00	***	0.43	0.00	***
Free goods (informal)	0.07	0.00	***	0.12	0.00	***	0.16	0.00	***
Preference	0.43	0.00	***	0.26	0.00	***	0.99	0.00	***
Collection preference	0.24	0.00	***	0.23	0.00	***	0.25	0.00	***
Male	0.20	0.00	***	0.26	0.00	***	0.46	0.00	***
Age	-0.01	0.00	***	-0.01	0.00	***	-0.01	0.00	***
Married	-0.32	0.00	***	-0.21	0.00	***	-0.33	0.00	***
Metropolitan areas	0.03	0.29		0.10	0.00	***	0.01	0.88	
Household income	0.13	0.00	***	0.12	0.00	***	0.26	0.00	***
Constant	-1.65	0.00	***	-1.49	0.00	***	-2.50	0.00	***
N	30719			30719			30719		

Note: The p-value is calculated from the robust standard error. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 4. Estimation results of the instrumental variables method**

	(1)			(2)			(3)		
	Music			Video			Book		
	Coef.	p-value		Coef.	p-value		Coef.	p-value	
Free goods (official)	0.11	0.04	**	0.06	0.49		0.21	0.65	
Free goods (informal)	-0.23	0.00	***	-0.19	0.00	***	-0.44	0.60	
Preference	0.66	0.00	***	0.41	0.00	***	1.04	0.00	***
Collection preference	0.29	0.00	***	0.28	0.00	***	0.30	0.00	***
Male	0.37	0.00	***	0.42	0.00	***	0.51	0.00	***
Age	-0.02	0.00	***	-0.01	0.00	***	-0.02	0.00	***
Married	-0.40	0.00	***	-0.34	0.00	***	-0.33	0.00	***
Metropolitan areas	0.07	0.04	**	0.07	0.02	**	0.02	0.70	
Household income	0.11	0.00	***	0.10	0.00	***	0.26	0.00	***
Constant	-1.48	0.00	***	-1.38	0.00	***	-2.24	0.00	***
Underidentification test	639.44	0.00	***	107.48	0.00	***	8.60	0.01	**
Hansen J statistic	1.05	0.59		3.26	0.20		0.06	0.81	
N	30719			30719			30719		

Note: The p-value is calculated from the robust standard error. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Comparing Tables 3 and 4, we find that the coefficients on both endogenous variables (free goods) decline in all specifications. These results indicate that ordinary least squares overestimates the parameters, and irrespective of whether the goods are formal or informal, the

complementary effect is overestimated. Moreover, the coefficient on official free goods is about 0.2 smaller in Table 4 than in Table 3 (this difference corresponds to elasticity), and for informal free goods, this difference is about 0.3–0.6. The differences are fairly large. Therefore, without a suitable identification strategy, our conclusions may be erroneous. With this in mind, we discuss Table 4 below.

The estimates on the control variables are generally similar in the all industries, and all signs are consistent. The parameter estimates on the consumption of paid music, movies, and books suggest that men, younger people, and people living in metropolitan areas (except for books) and in higher-income households spend more, whereas married people spend less. The model delivers interpretable results.

The coefficients on free goods' consumption, our variables of interest, greatly vary depending on the sector. The coefficient on official free goods in the music industry is positive and significant, and the elasticity is about 0.11<sup>6</sup>. This suggests that employing the business model of offering free goods is a useful strategy in the music industry. On the other hand, the consumption of informal free goods, which companies cannot completely control, have a large negative effect in the music and video industries, and the elasticities are approximately -0.23 and -0.19, respectively. Neither official nor informal free goods in the book industry have a significant effect.

We think that there are several reasons behind the differences between the three industries. First, in the music industry, official free goods are deliberately distributed with lower sound quality and limitations imposed on their continuous free use, or they entail promotion mechanisms (e.g., music videos) that persuade users to become fans of the artist. Hence, they have a complementary effect. In contrast to the official free goods, informal free goods on the Internet do not differ significantly from paid goods because storing music content does not require high storage capacity. Therefore, their substitution effect may be relatively large, and they have a significantly negative impact.

Second, although to have a complementary effect, the official free goods in the video industry aim to differ from the paid goods, it is seems that in the current situation, their

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<sup>6</sup> If the usage time of official free goods increases by 1%, the consumption of paid goods increases by about 0.11%.

substitution and complementary effects cancel each other out. The official free goods are differentiated from paid goods by means of, for instance, low image and sound quality, or a limited period of use, but consumers in the video industry put emphasis on knowing the contents rather than the quality of it. Hence, there is no significant complementary effect. Further, although many informal free goods are of lower quality than paid goods, consumers interested only in the content will be satisfied. For this reason, the substitution effect is strong.

Finally, when it comes to the book industry, Japanese tend to have a strong preference for physical goods, and there are few users of free goods, regardless of them being official or informal. As the goods themselves being physical is a differentiating point, the substitution effect is small. Therefore, the availability of free e-books do not have a significant effect on the consumption of paid goods.

## **6. Conclusion**

In this paper, we discuss the impact that official and informal free goods have on the consumption of paid goods in creative industries from the viewpoint of their complementary and substitution effects. We estimate our model using more than 30,000 questionnaire data points. We incorporate variables that capture consumers' personal preferences into our model, and employ the instrumental variable method to address the endogeneity problem. In addition, we use two tests to examine the validity of our instrumental variables.

The results show that official free goods have a significant positive effect on the paid goods in the music industry, with an elasticity of about 0.11. In addition, official free goods have no significant effects in the video and book industries. However, informal free goods (pirated goods) have a significant negative effect in the music and video industries, with elasticities of approximately -0.23 and -0.19, respectively. Informal free goods have no significant effects in the book industry.

The above results imply that, at least for the Japanese creative industries, the supply of official free goods positively affects the producers in the music industry, whereas the supply of informal free goods affects the producers in the music and video industries negatively. The latter result is in line with findings from the literature that confirm the existence of a substitution

effect in the music industry, such as Liebowitz (2008; 2016) and Barker (2012), and in the video industry, for example, McKenzie and Walls (2016), and Smith and Telang (2016). Although our empirical analysis uses data from a questionnaire survey, an approach different from those employed in the above studies, we show that a substitution effect exists.

This study has a limitation that warrants recognition. Although paid goods, the subject of analysis in this study, are composed of physical goods and digital goods, we do not consider events such as live performances or promotional sales of goods. In particular, the spread of informal free goods enhances their positive influence on the music industry, as shown in the empirical studies by Van Eijk et al. (2010), Mortimer et al. (2012), and Murillo (2013). The rapid growth of the live music industry in Japan implies this as well. Hence, to know the influence that free goods have on suppliers in creative industries, the analysis needs to consider additional aspects present in these industries.

With the proliferation of the Internet and the appearance of increasingly faster communication lines in the future, the presence of free goods in creative industries is expected to increase. It is thus necessary to advance the study of this subject both theoretically and empirically, so that we can gain better insight into how to use these goods most effectively and how to formulate appropriate policies.

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