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Effects of ICT Device Ownership on Consumers' Digital Piracy Behavior

Hyeonbo Sim* · Minki Kim** · Junghoon Moon***

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Ⅰ. Introduction

The development of information and communications technology (ICT), accompanied by the explosion in diverse content available, has impacted the film industry. On the one hand, ICT greatly increases the convenience of movie consumption. For example, whereas movie tickets previously had to be purchased on-site, online booking systems now allow moviegoers to buy tickets in advance, and viewers can pay to watch full-length movies online. On the other hand, there have been increasing concerns about the associated damage to the intellectual property rights (IPR) of movie creators. For example, online piracy - the unpaid for consumption of digitalized products - has grown as a problem and become rampant with the introduction of peer-to-peer (P2P) sites.

In the past, movie piracy involved the illegal copying of DVDs or videocassettes (Rob and Waldfogel, 2007). The clientele targeted by

* Ph. D. Student, Department of Economics, Korea University, First Author, simhyeonbo@gmail.com
** Assistant Professor, College of Business, KAIST, Corresponding Author, minki.kim@kaist.ac.kr
*** Associate Professor, Department of Regional Information, Seoul National University, Co-Author, moonj@snu.ac.kr

those burning DVDs or copying movies using a VCR has simply expanded with the move from offline to online piracy, but the marginal cost of copying is now close to zero. Once a distributor uploads a file to a P2P site, users can pirate the file with a simple click of the mouse (Oberholzer and Strumpf, 2007). As such, the ease of online piracy has played a significant role in the proliferation of piracy, thus negatively impacting the film industry.

Hence, while investigating the behavior and characteristics of users involved in piracy, we came to suspect a link between digital piracy and the possession of tablet PCs[1] and/or smartphones[2]. According to the 2011 smartphone user survey by the Korea Communications Commission, 62% of smartphone users and 57.2% of tablet PC users engage in piracy. A study by Embrain (2012) on the use of smart devices also revealed that movie piracy was most rapidly increasing on smart devices. In the present study, therefore, we look further into how ICT influences the damage to IPR in the movie industry with a focus on digital piracy behavior associated with demographic characteristics and ICT device ownership. It is worth noting that many previous researchers have set the independent variable as individuals' demographic characteristics such as sex, age, and income (Kwong and Lee, 2002; Chiang and Assane, 2008; Dilmperi et al., 2011; Bounie et al., 2006) or psychological characteristics such as ease of use, fit to work, innovation resistance, and work performance (Kim et al., 2011). However, to the best of our knowledge, there has previously been no research using the approach of ownership of media player.

We obtained the data for this study from a 2011 survey of Korean movie consumers conducted by Embrain, a survey institute in Korea. The survey was carried out by mail with a random sample of 2,000 respondents following the component ratio of the Korean population. Hence, the dataset covers a wide age range - from 15 to 55 - unlike previous studies, which focusd on uneven samples of consumers such as college students. As we cover a wide distribution of ages and incomes, we are able to obtain more valid results. To qualify the degree of digital movie piracy, our econometric model specification of piracy behavior consists of two decision stages. In the first stage, we model a consumer's decision on whether to engage in piracy behavior using a P2P site, while, in the second stage, we model how many illegal movie files consumers pirate in a year.

Our findings indicate that possessing a tablet

1) A tablet PC is a personal mobile computing device with a touchscreen rather than a keyboard (Kim and Park, 2012).

2) A smartphone is a hybrid device combining the functions of a digital mobile phone and a personal digital assistant (PDA) with access to various services through the Internet (Laudon and Laudon, 2008; Kim et al., 2011).

PC increases the degree of digital movie piracy. Effectively, convenience encourages people to engage in piracy behavior more frequently. In fact, after categorizing ICT devices into those that are portable and have download ability and those that are not, we find that people with a device equipped with neither function, for example, a video player, engage in piracy less often, whereas people who have a device equipped with both functions are more likely to pirate movies, which is a new finding in the literature. To the best of our knowledge, this is the first study to analyze ICT devices in relation to the degree of piracy behaviors using a quantitative approach based on well-balanced sample data with a broad age spectrum.

The paper is organized as follows. First, in section Ⅱ, we examine the relevant literature in detail, while, in the third section, we configure an empirical model with a data description. In section Ⅳ, we discuss the results of the empirical analysis. Finally, we conclude with this study's limitations in section Ⅴ.

Ⅱ. Literature Review

Research on piracy can be largely categorized by the target, such as music, movies, or software. As each industry has individual characteristics, we describe the research on the music and movie industries separately. Since music files are the smallest of those targeted for piracy, music piracy is the most common form of digital piracy.

2.1. Relationship Between Music Piracy and Purchases

Zentner (2006) surveyed 15,000 Europeans to investigate how music piracy affected actual purchases. His study showed that the use of P2P sites resulted in a 30% decrease in the probability of buying music. His study could be used to predict how movie piracy affects actual movie purchases by showing the cause-and-effect relationship between music piracy and actual sales. Zentner (2005) also studied the effects of file sharing using panel data from several countries. An interesting result was that those countries with greater access to high-speed Internet had highly decreased music sales. This study examined Internet and broadband penetration. Zentner's studies from 2005 and 2006 are highly correlated because high Internet speed allows pirates to engage in illegal downloading more conveniently, which causes a high decrease in music purchases.

Peitz and Waelbroeck (2004) partially agreed with the above opinion. They predicted a significant decline in CD sales in 2001 because of piracy, but mentioned that their data could not be used to explain decreased sales in 2002. Thus, piracy does not necessarily guarantee a decrease in music sales, a finding with which Hui and Png (2003) agree. They found that the demand for music CDs decreases with piracy,

but that piracy itself failed to significantly affect actual sales. When taking into account the drop in demand and price adjustments, the losses incurred based on piracy were no more than 6.6% of profits.

On the other hand, some studies make the opposite argument to that of Zentner (2005; 2006). Oberholzer and Strumpf (2007) argued that piracy behavior has induced high sales of certain albums based on an analysis of file-sharing networks. Their argument is that the more an album is pirated, the more it is actually purchased. This opinion empirically proved the word-of-mouth (WOM) effect in the music industry, causing us to wonder whether the WOM effect is valid in the movie industry. In addition, Rob and Waldfogel (2004) approached piracy in terms of purchases and consumer surplus, stating that piracy behavior reduced individual purchases but increased consumer surplus. Their approach using consumer surplus supports the idea that piracy increases social welfare.

In short, from the literature on the relationship between music piracy and music sales, we could not reach a conclusion on the effects of piracy on the music industry. However, we take interest in the relationship between movie piracy and movie sales.

2.2. Relationship Between Movie Piracy and Purchases

Danaher and Waldfogel (2012) argued that empirical studies have not yet reached a consensus on whether piracy decreases movie sales. Notably, an increase in broadband penetration allows more movie piracy. Nevertheless, Smith and Telang (2010) demonstrated a significant increase in DVD sales with an increase in broadband penetration. However, their study was conducted from 2000 to 2003, when the piracy of movie files was not as easy as it is today, and the few available files were of low quality. Thus, the piracy of movies was not active in those early days because of the low quality of the available movie files.

Danaher and Waldfogel (2012) argued that piracy has caused a slump in international box office sales by showing how movie piracy affected actual movie purchases. Based on this argument, piracy behavior leads to a decrease in movie sales. However, Bounie et al. (2006) asserted that piracy behavior actually leads to higher demand for movies. That is, piracy has no effect on the number of people going to movies but strongly affects video rentals/purchases. Their argument is that the more a particular movie is pirated, the more it is actually purchased. This opinion empirically proved the WOM effect in the movie industry.

Based on this knowledge of the relationship between movie sales and piracy, we want to know what drives illegal movie downloads.

2.3. What Drives Illegal Movie Downloads?

The approach to determining what drives illegal movie downloads generally utilizes demographic factors such as sex, age, and income. Many studies have covered the variables affecting movie piracy behavior (Bounie et al., 2006; Chiang and Assane, 2008; Dilmperi et al., 2011; Kwong and Lee, 2002). Kwong and Lee (2002) and Chiang and Assane (2008) found that male users were more actively engaged in piracy behavior than females were. This may be because men spend more time than women in leisure activities, including movie piracy behaviors (The Economist, 2009; Drake, 2013). Thus, men tended to spend more time pirating movies than women.

Additionally, Kwong and Lee (2002), Dilmperi et al. (2011), and Chiang and Assane (2008) showed that older users were less likely to engage in piracy behavior. The explanation for this could be that the adoption rate of ICT devices is higher among younger users than among older users. Younger users are quicker to learn how to use ICT devices than older users are, so they are more likely to try to pirate movies. This explanation motivates us to study the relationship between ownership of an ICT device and piracy. Another explanation is that the older people are, the fewer complex and minor tasks they want to engage in because they have major tasks, such as jobs and household affairs. Thus, they go to see movies in the theater rather than pirating movies. The premise is that movie piracy is more complicated than simply going to see a movie in the theater because movie piracy involves multiple steps: going to the Internet site, paying the required fee, searching for specific movies, downloading the adware required to download the movie, and copying the movie to the ICT device if desired. As older users are slower to learn how to use computers or ICT devices, they prefer to just go to the theater, where the only necessary step is to buy a ticket.

Bounie et al. (2006) reported a positive relationship between income and piracy behavior. They argue that the strongest effect of piracy is on video purchases and rentals. A possible explanation for their finding is that the more income someone has, the more likely they are to have the equipment to engage in piracy, such as tablet PCs and smartphones. Thus, if we prove that having an ICT device creates more piracy behaviors, then we have strong support for the argument of Bounie et al. (2006).

However, to the best of our knowledge, none of these studies has mentioned the relationship between the possession/use of ICT devices and piracy behavior. We know that piracy behavior is associated with ICT devices. Against this backdrop, this paper seeks to examine how the possession of ICT devices relates to participation in movie piracy and the number of piracy behaviors.

Ⅲ. Empirical Model

3.1. Research Model and Hypotheses

We established six hypotheses to explore the relationship between owning ICT devices and piracy behavior. Portable ICT devices include smartphones and tablet PCs, which can be easily carried around. Our hypotheses are thus focused on these devices. The research model is depicted in Figure 1: Conventional ICT device ownership includes ICT devices offering both portability and download ability, and ICT devices offering neither portability nor download ability. The following sections explain the background to the research model and the results for the research hypotheses.

3.1.1. Intention to Pirate

There have been many studies of intention models, such as the theory of planned behavior (TPB), the technology acceptance model (TAM), and the unified theory of acceptance and use of technology (UTAUT), to predict behavior (Luo and Lee, 2014). Ajzen's (1991) TPB is a well-established intention model for predicting behavior. In his theory, Ajzen (1991) argues that action is affected by attitude, subject norm, and perceived ability (behavioral control). We adopt the TPB because it is more applicable for predicting action based on abilities, resources, and technology than TAM and UTAUT are. Since ICT devices are a form of technology, the TPB is more applicable than the TRA. Knowing that the TPB is applicable to our research, we assume that some individuals have smartphones or tablet PCs and that others do not. Based on this assumption, we can determine whether they plan to engage in movie piracy behavior with ICT devices. Income is also affected by perceived behavioral control, and we can adapt the TPB to the relationship between income and the action

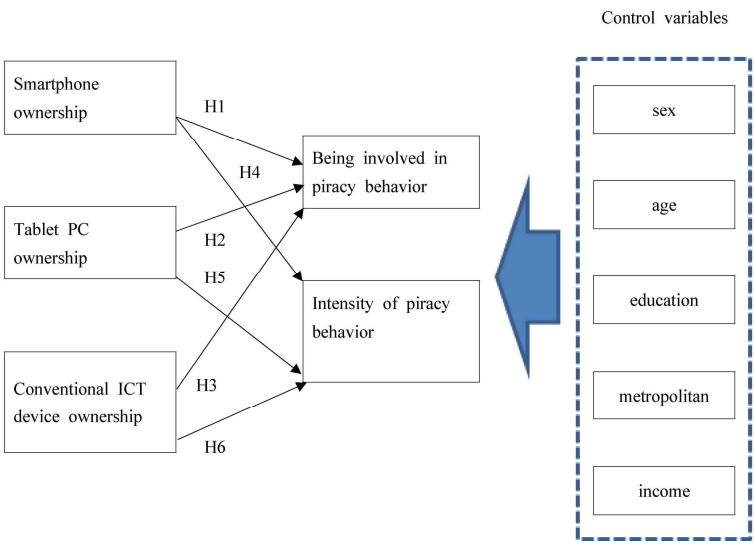

Figure 1. Research Model

of pirating movies illegally. Additionally, the number of illegally pirated movies is also included in the planned behavior. Thus, we see the research model as having two main questions: whether individuals are involved in piracy and how frequently individuals pirate movies illegally if they are involved in piracy.

The acceptance of fresh information technologies by intended users persists as a critical point for researchers of information systems (Agarwal and Prasad, 1998). They define personal innovativeness as an individual's willingness to accept new information technology. As smartphones are the new technology, we can substitute personal innovativeness for willingness to pirate and watch a movie in smartphone. This characteristic led us to formulate hypothesis 1:

H1. Owners of smartphones will be more actively involved in piracy behavior.

The first tablet PC was developed by Microsoft in 2001. However, after Apple developed the iPad, there was a boom in buying such devices. A tablet PC is a hybrid device having the function of an MP3, PMP, and smartphone. Additionally, it is evaluated to the complementary goods of smartphones and the substitutional goods of netbooks (Sim, 2011; Kim and Park, 2012). Tablet PCs have the advantage of convenience with a maximum size limit of 10 inches (SERI, 2010). They also have the function of PMP, allowing the convenient viewing of a movie file. Hence, innovators may want to watch a pirated movie on a tablet PC that is easily portable and convenient. So, we set up hypothesis 2:

H2. Owners of tablet PCs will be more actively involved in piracy behavior.

People can pirate movies through a desktop PC without a smartphone. However, the reason why a smartphone is more convenient is the ability to watch a movie anywhere and anytime due to easy transportability. To pirate a movie is to act in the face of danger of punishment. However, high-level innovators have higher confidence than low-level innovators (Jayanti and Jackson, 1991; Midgley and Dowling, 1978; Chung et al., 2014), since they are more engaged in piracy behavior during a given period. That is the reason why we deduce hypothesis 4:

H4. Owners of smartphones will engage in more piracy behavior during a given period.

After tablet PCs were actively diffused, many people did pre-adopt the technology due to curiosity concerning the new device. However, according to the cognitive dissonance theory (Festinger, 1957), during the period of actually using a tablet PC, there is a gap between expectation and reality. The attitude of post-adoption is the thing which remove the gap (Kim, 2010; Chung et al., 2014). Pirating a movie with a tablet PC is something that people do more

often than not. So, we deduce hypothesis 5:

H5. Owners of tablet PCs will engage in more piracy behavior during a given period.

3.1.2. Detailed Intention to Use an ICT Device to Pirate

ICT devices can be divided based on the functions of portability and download ability. These functions can also affect planned behavior, so we use the TPB. Using the TPB, we can predict how rational individuals will act. Based on common sense, we set the hypotheses as follows. Hypotheses 3 and 6 are related to portability and download ability.

We point out the commonalities between smartphones, tablet PCs, PMPs in terms of portability and download ability. These three devices with portability and download ability have function of seeing media files. They have functions allowing the use of e-book and media files, studying, and playing games. Among users, 24% of people who buy these devices say that they want to buy them to watch media files[3] (SERI, 2010). Since pirated movies are included in these media files, we could expect those who have these devices to be more actively involved in piracy behavior. So, we can state the hypothesis 3:

H3. Those who own ICT devices offering portability and download ability will be more actively involved in piracy behavior.

The video player is an electromechanical device that records analog audio and analog video from broadcast television or other sources onto a removable, magnetic tape videocassette, and can play back the recording (Seth et al., 2013). We may not watch a movie on a video player when moving to another place because the player must be plugged in at a fixed location. Additionally, videocassettes do not have download ability, so we can only borrow videocassettes in the video-rental market. Clearly, video playes do not have either portability or download ability. Since the video players are typically found in people's homes, people will try to watch a movie on their video player if they have one. Therefore, we can infer hypothesis 6:

H6. Those without access to ICT devices offering portability and download ability will engage in less piracy behavior during a given period.

From these hypotheses, we want to determine the relationship between having an ICT device and piracy behavior.

3.2. Description of Variables

The survey was conducted on a random sample

3) Apple Insider <http://www.appleinsider.com>

of 2,000 Korean household respondents after segmenting based on sex, age, or region from the component ratio of the population. That is, the components were segmented to be proportional to the Korean population. For example, the population of Seoul is the largest in Korea, and thus the population of Seoul in our survey is the largest (number = 421, percentage = 21.1%). We provide descriptions of the variables in Table 1.

In Table 1, the age variable was demeaned when the model parameter was estimated because if we did not demean the age variable, then the group mean changed to the model intercept, which could depend on the covariate (Woodridge, 2002). All the variables except numdown and age are dummy variables. A dummy variable takes the value of one to indicate the existence of an effect in the specific group and zero for the remaining observations (Greene, 2007). Additionally, the variables house_ICT, port_down, and nonport_down take the value of one if the individual has at least one of the ICT devices that each variable indicates and zero otherwise. They were categorized tautologically because the individual could simultaneously have a smartphone, a tablet, house_ICT, and so on. We wanted to show the relationship between an individual's ownership of each device and illegally downloading movies.

Table 1. Variable descriptions

Variable	Description	Mean	Std. Dev.
numdown	The number of movie piracy behaviors in a year	16.829	48.805
male	1 if an individual is male	0.513	0.500
age	age ranging from 15 to 55 (the percentage of age of 15-18 = 8.1%, 19-23 = 9.4%, 24-29 = 12.0%, 30-34 = 11.6%, 35-39 = 12.2%, 40-49 = 25.3%, and 50-59 = 21.5%)	36.59	11.414
univ_over	1 if an individual has a university degree or if an individual is a college student	0.711	0.453
metropolitan	1 if an individual is a metropolitan citizen	0.474	0.500
income_1	1 if an individual's family income is 3 – 4.5 million won	0.352	0.478
income_2	1 if an individual's family income is higher than 4.5 million won	0.265	0.441
smartphone	1 if an individual has a smart phone	0.812	0.391
tablet	1 if an individual has a tablet PC such as an iPad or Galaxy Tab	0.225	0.418
house_ICT	1 if an individual has at least one of the following devices: DVD player, Blu-ray player, DivX player, and HDTV	0.711	0.454
portable_down	1 if an individual has at least one ICT device offering portability and download ability (PMP, smartphone, and tablet PC)	0.87	0.336
nonportable_down	1 if an individual has at least one non-portable ICT device with download ability (DVD player, Xbox, Blu-ray player, PlayStation, DivX player, and HDTV)	0.736	0.441
nonportable_downx	1 if an individual has an ICT device offering neither portability nor download ability (video player)	0.485	0.500

Utilizing the survey questionnaire, we present a model that has a dependent variable showing the number of piracy behaviors in a year. The definition of piracy behaviors is characterized in the survey as paying less than one dollar of cyber money to download through an Internet P2P site in a year. Originally, respondents indicated how many piracy behaviors they engaged in over a week, a month, or a year. However, we focus on the year term as the number of piracy behaviors in a week and a month changes over the course of a year. We further classify ICT devices such as smartphones, tablet PCs, DVD players, Blu-ray players, and DivX players into portable ICT devices and non-portable ICT devices. Portable ICT devices include Portable Media Players (PMPs), smartphones, and tablet PCs such as iPads, Galaxy tablets, and so on, while non-portable ICT devices include DVD players, Blu-ray players, DivX players, and HDTVs.

We show the relationship between ICT devices and the number of piracy behaviors in a year in Appendix A. Video players and DVD players have a negative relation to the number of piracy behaviors in a year. This can be interpreted as indicating that videos and DVDs are substitution goods for pirated movie files. On the other hand, Blu-ray players, PlayStations, Xboxes, PMPs, HDTVs, and tablet PCs have a positive relation to the number of piracy behaviors in a year. This can be interpreted to mean that they are complementary goods for pirated movie files. However, DivX players and smartphones are shown to be independent goods to movie piracy behavior. These results are presented in Appendix B. In the statistical results that follow, we show that some ICT devices can affect piracy behavior.

The results for multicollinearity are available in Appendix C. Almost every correlation between the independent variables is less than 0.2, so we can easily see there is no multicollinearity problem. The large correlations are those between income1 and income2, between smartphone and port_down, and between house_ICT and nonport_down. However, the correlations between smartphone and port_down, and between house_ICT and nonport_down can be ignored because these are used in separated models. In other words, for these variables, no multicollinearity problem is found. The correlation between income1 and income2 could be a problem. However, these two variables are dummy variables, being divided by the principle of being mutually exclusive and exhaustive, and the correlation is not large enough, which mitigates the problem. Additionally, based on variance inflation factor (VIF) analysis, we found no multicollinearity. If there is multicollinearity, some VIFs will be larger than 10 (O'Brien, 2007). However, the VIFs of all variables are less than 10. As shown in Appendix D, the highest VIF is 1.44.

3.3. Empirical Methods

It is worth noting that our survey data is effective for analyzing the effects of ICT devices on the movie industry for several reasons. First, Korea displays a definite trend in the purchase of ICT devices. Among its population of 48 million, the number of smartphones users reached 32 million in 2012 (Meeker, 2012). Second, according to The Economist (2011), Korea has the most well-established anti-piracy laws in the world[4]. Third, Korea's download speed is the fastest in the world, which allows consumers to pirate high-quality, large files at high speeds. Pingdom (2011) ranked Korea as the first in wireless Internet speed out of 50 countries, with an average connection speed of 16.63 Mbit per second.[5] Fourth, our data covers a wide age range - from 15 to 55 - unlike the work of Bounie et al. (2006) and Rob and Waldfogel (2007), who focused on an uneven sample of consumers, like college students. As we cover a wide distribution of ages and incomes, we can obtain more valid results. Lastly, based on our detailed descriptions of ICT devices, we can examine how piracy behavior is influenced by two characteristics of ICT devices: portability and download ability.

We model the piracy decision as a two-stage process. In the first stage, people decide whether to engage in piracy behavior using a P2P site while, in the second stage, they decide how many illegal movie files to pirate in a year. The two parts of the model are functionally independent. The first part, called the logit part, uses all 2,000 samples, but the second part, called the count part, uses only the positive count of 1,155 observations (Cameron and Trevedi, 2010).

To test whether piracy behavior can be affected by demographic variables and ICT devices, the probability of engaging in piracy behavior is made a function of the respondents' qualifications:

$$Prob(y_i) = f(X_i) \quad i=1,2,\cdots,2000 \quad \cdots\cdots (1)$$

where y_i represents the number of piracy behaviors from respondent i in a year and X_i is the individual's demographic variables and the variables regarding whether the individual respondent has an ICT device. Since the dependent variable is a count variable, the specification of $E[y|x] = x'\beta$ is inadequate, as it permits negative values of $E[y|x]$ (Cameron and Trevedi, 2005). In other words, the distribution of count data is positively skewed with many observations in the data having zero values (Gardner et al., 1995; Karen, 2010). Additionally, the distribution of counts is discrete, which means it cannot follow a normal distribution. This means that we cannot apply ordinary least square (OLS) estimation. Thus, we consider the count model, which is related to the characteristics of a dependent variable. An

4) As reported on August 20, 2011.

5) Pingdom is a statistics survey institute. It investigates Internet speed based on information from the content delivery network (CDN) provider Akamai, which compares connection speeds worldwide.

alternative model is a Poisson regression model. Poisson distribution has two advantages over an OLS model. The Poisson regression model accepts discrete, skewed distribution, and the restriction of predicted values to nonnegative numbers (Karen, 2010). It differs from the OLS model in two ways. One is the characteristic of errors, which follows Poisson distribution rather than normal distribution (Karen, 2010). The other is that Poisson models are modeling the natural log of the dependent variable, $\ln(y)$, as the linear function of coefficients (Karen, 2010). Another alternative model is the negative binomial model. The difference between the Poisson and the negative binomial model is the sameness between mean and variance. The Poisson model features the same mean and variance. However, variance is larger than mean in the negative binomial model.

One thing we have to consider is that since the number of zero values for the dependent variable is very large (among 2,000 total respondents, the number of zero values is 845), which will be presented by the Vuong test[6], we can consider a zero-inflated model. For the negative binomial (NB) and Poisson models, which represent count models, we can consider Vuong test statistics to test whether they are zero inflated (ZI).

$$V=\frac{\sqrt{N}\overline{m}}{s_m},\quad \overline{m}=\text{mean of } m_i,\quad s_m=\text{standard deviation of } m_i,$$

$$m_i=\ln\frac{\widehat{P}_1(y_i|x_i;\theta_*)}{\widehat{P}_2(y_i|x_i;\gamma_*)} \quad \cdots\cdots (2)$$

Note that θ_* is the pseudo-true value of θ for the conditional model P_1, and γ_* is the pseudo-true value of γ for the conditional model P_2 (Sawa, 1978; Vuong, 1989). By comparing non-ZI and ZI models, we can see that the ZI Poisson (ZIP)'s V is 15.52 and the ZINB's V is 5.55. If the absolute value of V is less than 1.96, then neither the ZI model nor the non-ZI model is preferred. If V is larger than 1.96, then the ZI model is preferred, and if V is less than -1.96, then the non-ZI model is preferred. Thus, the Vuong statistics violate the null hypotheses, in which the data follows a non-ZI model. We can conclude that the ZI model is preferred with a 5% significance level. Thus, we compare the ZIP and ZINB models. However, the mean of the dependent variable is 16.829 and the standard deviation is 48.805, which means the variance of the dependent variable is much larger than the mean of one. Hence, we choose the ZINB model, which has over-dispersed characteristics (Greene, 2007)[7].

6) The Vuong test is used when we want to test the appropriateness of the ZIP or ZINB models (Tomlin and KaSaundra, 2000). In this paper, the Vuong test is used to test between the standard NB and ZINB models (Tomlin and KaSaundra, 2000).

7) In Poisson distribution, the mean and the variance of the population are same. However, in NB distribution, the variance of the population is larger than the mean of the population, which is called

$$\Pr(Y_i = y_i) = \begin{cases} w_i + (1-w_i)(\frac{\tau}{\mu_i+\tau})^{\tau} & , \text{if } y_i = 0 \\ (1-w_i)\frac{\Gamma(y_i+\tau)}{y_i!\Gamma(\tau)}(\frac{\mu_i}{\mu_i+\tau})^{y_i}(\frac{\tau}{\mu_i+\tau})^{\tau} & , \text{if } y_i = 1,2,\cdots, \end{cases} \quad \cdots\cdots (3)$$

Thus, we consider the dependent variable of the number of piracy behaviors to follow a ZINB distribution as follows:

where $\tau^{-1}(\geq 0)$ is a dispersion parameter assumed not to depend on covariates (Ridout et al., 2001); ω_i is the logit probability that the individual i does not engage in piracy behavior, which is between zero and one; $\log(\frac{w_i}{1-w_i}) = Z_i^t\gamma$ is the logit link function; $\log(\mu_i) = X_i^t\beta$ is the log link function; μ_i represents the mean of individual i engaging in piracy behavior; β and γ are the k_1 and k_2 parameter vectors, respectively; and the gamma function is $\Gamma(z) = \int_0^{\infty} t^{z-1}e^{-t}dt$. The sample likelihood function of ZINB can be rewritten as follows:

$$L = \prod_{i=1}^{2000}[w_i + (1-w_i)(\frac{\tau}{\mu_i+\tau})^{\tau}]^{I(y_i=0)} [(1-w_i)\frac{\Gamma(y_i+\tau)}{y_i!\Gamma(\tau)}(\frac{\mu_i}{\mu_i+\tau})^{y_i}(\frac{\tau}{\mu_i+\tau})^{\tau}]^{I(y_i>0)} \quad (4)$$

over-dispersion.

Ⅳ. Results

Table 2 includes the estimation results from the ZIP (columns 2 and 3) and ZINB models (columns 4 and 5). Note that we consider only the ZINB models, and the objective of showing the ZIP models in the Table is simply to compare them with the ZINB models. Thus, we only want to find the implications of the ZINB models. The coefficient estimates in column 4 show that engaging in piracy behavior is affected by sex, age, and university degree. Specifically, in terms of the inflated element of the ZINB model, (a) males tend to have a higher probability of engaging in piracy behavior than females do; (b) the younger people are, the higher the probability that they will engage in piracy behavior; and (c) people who have university degrees have a higher probability of piracy behavior. Thus, H1 and H2 are not supported since the variables for smartphones and tablets are not significant.

Table 2. Parameter estimates and (standard errors) for movie piracy behavior in a year

Variable	Models			
	ZIP 1	ZIP 2	ZINB 1	ZINB2
Count_part				
constant	3.012***	3.262***	2.569***	2.819***
	(0.021)	(0.022)	(0.173)	(0.203)
male	0.087***	0.092***	0.254*	0.276**
	(0.011)	(0.011)	(0.107)	(0.106)
age	-0.0180***	-0.017***	-0.023***	-0.020***
	(0.001)	(0.001)	(0.005)	(0.005)
univ_over	-0.182***	-0.169***	-0.236*	-0.198
	(0.013)	(0.013)	(0.119)	(0.118)
metropolitan	-0.019	0.007	0.017	0.010
	(0.011)	(0.011)	(0.102)	(0.102)
income_1	0.339***	0.358***	0.320**	0.296*
	(0.013)	(0.013)	(0.119)	(0.121)
income_2	0.018	0.064***	-0.080	-0.061
	(0.016)	(0.015)	(0.132)	(0.134)
smartphone	0.160***		0.176	
	(0.017)		(0.146)	
tablet PC	0.275***		0.359**	
	(0.012)		(0.126)	
house_ICT	0.064***		0.048	
	(0.013)		(0.114)	
port_down		-0.094***		-0.063
		(0.018)		(0.169)
nonport_down		0.211***		0.224
		(0.013)		(0.121)
nonport_downx		-0.252***		-0.260*
		(0.011)		(0.106)
Inflate_part				
constant	0.502***	0.701***	-1.025*	-0.484
	(0.140)	(0.171)	(0.426)	(0.449)
male	-0.519***	-0.514***	-0.892**	-0.805**
	(0.096)	(0.097)	(0.273)	(0.282)
age	0.048***	0.049***	0.127***	0.140***
	(0.004)	(0.005)	(0.022)	(0.024)
univ_over	-0.249*	-0.238*	-0.552*	-0.368
	(0.107)	(0.111)	(0.272)	(0.279)
metropolitan	-0.150	-0.145	-0.203	-0.148
	(0.096)	(0.096)	(0.255)	(0.258)
income_1		-0.012		-0.248
		(0.117)		(0.304)
income_2		0.075		-0.396
		(0.129)		(0.357)
smartphone	-0.376**		-0.462	
	(0.122)		(0.287)	
tablet PC	-0.114		0.060	
	(0.115)		(0.291)	
port_down		-0.487***		-0.671*
		(0.143)		(0.327)
nonport_down		-0.151		-0.437
		(0.114)		(0.293)
nonport_downx		-0.047		-0.164
		(0.099)		(0.258)
Dispersion parameter			3.819	3.841

Note: Dependent variable is the number of movie piracy behaviors in a year. * : p < 0.05, ** : p < 0.01 , *** : p < 0.001.

The reason why H1 is not supported is that people can feel inconvenienced when viewing movies on a smartphone because the screen is much smaller than that of either a tablet PC or a desktop PC. Also, people who think piracy is bad behavior may try to go to the movies by reserving tickets through their smartphones rather than pirating a movie. These behaviors are called innovation resistance (Rogers, 1983). They are not the factor of not adopting innovation, but rather the factor which becomes naturally effective in the decision-making process (Kang and Kim, 2009; Kuisma et al., 2007; Chung et al., 2014). Under similar conditions, a smartphone owner is no more likely to participate in piracy behavior. Additionally, the reason why H2 is not supported is that those people who enjoy a magnificent view and the big sound of the theater or who like watching a rerun movie on the TV have no reason to participate in such piracy behavior. These behaviors can also be seen as innovation resistance.

The number of movies pirated in a year is affected by sex, age, university degree, income, and having a tablet PC. Specifically, in terms of the count part of the ZINB model: (a) males tend to engage in more movie piracy behavior than females do; (b) younger people spend more time engaging in movie piracy behavior in a year; (c) people who have a university degree or are college students pirate a lower number of movies; (d) those who have an income of 3 – 4.5 million won engage in more piracy behavior than those who have an income lower than 3 million won do[8]; and (e) people who have tablet PCs engage in more movie piracy behavior. The other coefficients are not significant, so H4 is not supported and H5 is supported. The reason why H4 is not supported is that those who do not use smartphones may participate in piracy behavior through their desktop computer. Further, if they habituated to pirate movie through their desktop computer, rather than a smartphone, they will engage in more piracy behavior during a given period. The ZINB estimated regression equation is as follows:

$$\log(\mu_i) = 2.5693+0.2541\text{male}-0.0227\text{age}-0.2362\text{univ\_over}+0.0166\text{metropolitan} \quad \cdots\cdots (7)$$

$$+0.3201\text{income\_1}-0.0803\text{income\_2}+0.1758\text{smartphone}+0.3594\text{tablet}+0.0484\text{house\_ICT}$$

$$\log\left(\frac{w_i}{1-w_i}\right) = -1.0253-0.8920\text{male}+0.1270\text{age}-0.5522\text{univ\_over}-0.2027\text{metropolitan} \quad \cdots\cdots (8)$$

$$-0.4620\text{smartphone}+0.0597\text{tablet}$$

For interpretation, we consider the logit part and the count part individually. For the logit part,

8) As of 2014, 1 U.S. dollar equals 1,050 South Korean won.

the coefficient of the variable male, which is -0.8920 in the ZINB model, indicates that the variable male has a lower probability of having zero observations, which means that men have a higher probability of engaging in piracy behavior than women do. This is consistent with the work of Kwong and Lee (2002) and Chiang and Assane (2008), who claim that engaging in piracy behavior has a positive relationship with being male. Likewise, the variable univ_over has a lower probability of having zero observations, which means those who have college degrees have a higher probability of piracy behavior. This contradicts Lochner (2004), who claims that schooling has a negative relationship with crime. However, a possible explanation for this difference is as follows. Lochner (2004) considered violent crime, including using force to get something or attacking with the intention of injuring or killing, as well as property crime, including thefts of at least $50 or shoplifting. This kind of crime is serious enough to meet with punishment. However, the penalty for piracy behavior is light. Thus, many rational people have an incentive to engage in piracy behavior. Moreover, violent crime and property crime have a direct effect on individuals, which causes other people to call the police. Then, the police try to uncover the whole truth behind of the crime. However, piracy behavior is different. Even if a movie company calls the police and asks for help to prevent piracy behavior, the police cannot make mass arrests for movie piracy because of the limitation of administrative costs. Only some of those who engage in piracy behavior would be arrested, and many others who engage in piracy behaviors could not be arrested, which explains why many people engage in piracy behavior without feeling such pressure. Based on these two factors, Lochner (2004) and our study provide different results. Additionally, the inflated part of the coefficient of age is positive, which means that the younger individuals are, the higher their probability of engaging in piracy behavior. This is consistent with the work of Kwong and Lee (2002), Dilmperi et al. (2011), and Chiang and Assane (2008), who claim that there is a negative relationship between age and engaging in piracy behavior.

For the count part, the male coefficient = 0.2541 means the number of piracy behaviors in a year increases by 28.9% (because exp(0.2541) = 1.289) for men, holding all other factors constant. Using the same procedure, the number of piracy behaviors in a year decreases by 2.2% with one additional year of age, and 21% if the individual has a university degree. The number of piracy behaviors in a year is 37.7% higher for families earning between 3 million won and 4.5 million won than for those who have a family income of less than 3 million. Moreover, the number of piracy behaviors in a year increases by 43.2% if the individual has a tablet PC. This result partially disproves the findings of Jin (2012) for the following reasons. Jin (2012) found a higher tendency to access

movie content through smart media when users had a positive perception of movie piracy behavior. Moreover, he reported a higher tendency to access movie content through smart media when users had a negative attitude toward movie piracy behavior. He used psychological variables to measure user experience in movie piracy as well as perception and awareness of piracy, but the results were not significant. In other words, the relationship between smart devices and engaging in piracy behavior changed slightly depending on the psychological variables. This is because Jin (2012) carried out a survey of simultaneous measurements of psychological factors and analyzed them from various angles. On the other hand, our study looked at ICT devices in addition to smart media, and found a higher number of piracy behaviors for those with tablet PCs, which differentiates our study from that of Jin (2012).

Another ZINB estimation equation is as follows. More detail is available in Table 2 (refer to ZINB2).

$\log(\mu_i)$ = 2.8190+0.2758male-0.0202age-0.1978univ_over +0.0104metropolitan+0.2957income_1 (7) -0.0605income_2-0.0628port_down+0.2235nonport_down-0.2600nonport_downx

$$\log\left(\frac{w_i}{1-w_i}\right) \quad \cdots\cdots (8)$$

=-0.4843-0.8045male-0.1399age-0.3684univ_over-0.1482metropolitan-0.2483income_1 -0.3964income_2-0.6705port_down-0.4370nonport_down-0.1643nonport_downx

We investigate further by adding the port_down, nonport_down, and nonport_downx variables. Most other variables have a similar result. However, these variables give us a very interesting result. First, people are more likely to engage in more piracy behavior if they have portable ICT devices with download ability because port_down= -0.6705 in the inflated part. This implies that if people have PMPs, smartphones, or tablet PCs, then they can watch movies with these devices, so the probability of engaging in piracy behavior increases. Second, people engage in less piracy behavior if they have video players because nonport_downx = -0.2600 in the count part. This suggests that if people have video players, then they engage in less piracy behavior.

To interpret this other ZINB result, we consider the logit part and the count part again. First, for the logit part, the interpretations of male, age, and univ_over are the same. Additionally, since the coefficient of port_down is negative, people have a higher probability of engaging in piracy behavior if they have smart devices, so H3 is supported. The result for other ICT devices except video players is similar because these individuals can use pirated files. To the best of our knowledge, there is no literature on the relationship between metropolitan citizens and

piracy behavior.

For the count part, the male coefficient = 0.2758 indicates that the number of piracy behaviors in a year increases by 31.8% for males. By the same interpretation, the number of piracy behaviors in a year is 34.4% for higher for families earning between 3 million won and 4.5 million won than for those who have family income below 3 million, holding all other factors constant. Using the same procedure, the number of piracy behaviors in a year decreases by 2% for people who are one year older and 22.9% for people who have video players, holding all other factors constant. Since the coefficient of video-player is significant, H6 is supported. Table 3 shows which of the six proposed hypotheses were supported.

V. Conclusion

This study investigated how ICT influences the damage to IPR in the movie industry with a focus on digital piracy behavior associated with demographic characteristics and ICT device ownership. We show that people with a higher income are more likely to pirate movies more frequently, which is consistent with previous research. Additionally, we also show that possessing a tablet PC increases the degree of digital movie piracy. An individual can download pirated files to a tablet PC, bringing the additional benefit of being able to watch pirated movies anywhere. This convenience encourages people to engage in piracy behavior more frequently. With the advancement of the informatization of society, ICT devices have become highly sought after. However, this may actually have an adverse effect on informatization. As revealed in our study, the fact that piracy behavior becomes more prevalent with the surge in purchases of ICT devices could be an example. After we categorized ICT devices into those that are portable and have download ability and those that are not, we found that people with a device equipped with neither function, for example, a video player, engage in piracy less often in a given period. We can consider the video player

Table 3. Whether the hypotheses are supported or not

Hypothesis content	Supported?
H1. Owners of smartphones will be more actively involved in piracy behavior.	Not supported
H2. Owners of tablet PCs will be more actively involved in piracy behavior.	Not supported
H3. Those who own ICT devices offering portability and download ability will be more actively involved in piracy behavior.	Supported
H4. Owners of smartphones will engage in more piracy behavior during a given period.	Not supported
H5. Owners of tablet PCs will engage in more piracy behavior during a given period.	Supported
H6. Those without access to ICT devices offering portability and download ability will engage in less piracy behavior during a given period.	Supported

as a competitive good for piracy behavior. We detect that people who have a device equipped with both functions are more likely to pirate movies, which is the unique finding of this study. In the previous research, researchers set the independent variable as demographic or psychological characteristics, as we previously mentioned (Kwong and Lee, 2002; Chiang and Assane, 2008; Dilmperi et al., 2011; Bounie et al., 2006; Kim et al., 2011). However, to the best of our knowledge, they did not set the independent variable as ownership of a media player. Based on the theoretical limitations of previous studies, we research ownership of a media player in order to identify unique findings. To the best of our knowledge, this is the first study to analyze ICT devices in relation to the degree of piracy behavior using a quantitative approach based on a well-balanced sample data with a broad age spectrum.

Additionally, this study analyzed the effect of piracy behavior of consumers by ICT device ownership in the digital era. At this time, the movie industrial estate tries to help consumers induce proper consumption behavior through campaigns prohibiting illegal downloads. For example, the Good-downloader campaign is a variety of the above campaign that prohibits illegal downloads and lets consumers pay a proper price for buying movie files in Korea. However, many consumers still try to consume movie files through piracy behavior. In this sense, we consider the subject matter of this paper to be vital and well-timed.

Since it is difficult to engage in piracy behavior without ICT devices, some may find our results to be stating the obvious. The significance of this study lies in the fact that we empirically prove that users are more inclined to engage in illegal movie piracy when they can conveniently watch pirated movies on ICT devices while on the move. We have conducted a meaningful analysis of how piracy behavior is affected by the possession of ICT devices. Meanwhile, we might want to ask why those who have ICT devices engage in more movie piracy behavior. It is because owners of ICT devices have greater perceived ease of use for movie piracy than those who do not, causing more instances of ICT device being used to watch pirated movies (Chang, 2013).

This study, however, has several limitations. First, movie genre, which we could not access in the sample, could be a determinant driving heterogeneity in digital piracy behavior. For instance, some individuals might always go to theaters to see action or suspense movies, even if they have ICT devices, to appreciate the huge scale of these movies, but they might always pirate romantic movies or comedies in order to save money. Redondo (2013) showed the differences in movie and music piracy habits across individual characteristics of piracy behavior. However, this study only tells us that those who have ICT devices pirate all kinds of movies; it does not reveal any tendency in the genres being pirated. Future studies could

segment all genres and analyze the effect of having an ICT device on piracy behavior for specific genres. The second limitation is related to the national origin of the movie. Baughn and Yaprak (1996) suggest that patriotism exists at the individual level. If a specific person has strong patriotism and thinks he or she should only see his or her own nation's movies in the theater, then the results for whether that individual has an ICT device and engages in piracy or goes to a movie theater could differ from the results of this study. This study does not capture these characteristics, so future studies could address these issues. Third, there are other variables not covered in this study, such as religion. If a specific religion teaches that sin can be easily washed away by praying to god, those who follow this religion could be more inclined to commit the crime of piracy behavior using an ICT device. Moreover, the literature shows that spirituality is a predictor of hereditary crime (Chui, 2013). However, we do not know the religions of the individuals in our study. Fourth, this study had a sample period of one year, so it only captured the static characteristics of having an ICT device and engaging in movie piracy. However, if we had panel data for owning an ICT device and engaging in piracy, we could investigate dynamic changes in piracy. Fifth, a higher amount of piracy may be associated with a greater likelihood of engaging in piracy for users of ICT devices compared to non-users, or with a specific group's tendency to be involved in piracy. This is an endogeneity problem because there is a correlation between the ICT device variable and the error term (Greene, 2007). This problem could be a limitation. The sixth limitation is related to the characteristics of the Internet environment in Korea. In Korea, the Internet penetration rate and Internet speed are among the best in the world, so we can see the results of piracy with ICT devices in a good environment. However, Internet penetration and Internet speed worldwide are generally not as good as in Korea. Thus, there could be bias in this study. Lastly, this study's analyses are based on the survey method. The survey method is based on the memory of respondents, so it cannot be completely accurate. If respondents have partial memory loss, the results of study could be also influenced.

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심현보(Sim, Hyeonbo)

중앙대학교 경제학과에서 학사학위를 취득하였으며 금융공학을 융합전공하였다. KAIST(한국과학기술원) 경영과학과에서 석사학위를 취득하였고, 현재 고려대학교 경제학과 박사과정에 재학 중이다. 주요 연구 관심분야는 산업조직론, 게임이론, 공정거래이다.

김민기(Kim, Minki)

서울대학교 경제학부를 졸업하고 미국 시카고 대학교에서 경제학 석사 학위와 박사 학위를 취득하였다. 현재 KAIST(한국과학기술원) 경영대학에서 마케팅 분야 조교수로 재직 중이며, Journal of Marketing Research, Quantitative Marketing & Economics, International Journal of Research in Marketing, Applied Economics, Energy Policy, PLoS ONE 등의 국내외 학술지에 논문을 게재하였다. 경제학 모형에 기반한 계량 마케팅 방법론을 개발하고 있으며, 최근엔 소셜 미디어 빅데이터를 활용한 최적 바이럴 마케팅 전략 연구에 초점을 맞추고 있다. 이를 위해 전산학, 전자공학 등 타 분야 연구자들과의 융합 연구도 활발히 수행하고 있다.

문정훈(Moon, Junghoon)

문정훈 교수는 서울대학교 농경제사회학부 지역정보학과의 부교수이다. 문정훈 교수는 버팔로 소재 뉴욕 주립대의 경영과학과에서 2006년에 박사학위를 취득하였다. 2006년에서 2010년까지 KAIST 경영과학과에서 교수생활을 하였으며, 2010년부터는 서울대학교에서 근무하고 있다. 주 연구분야는 식품 분야 정보경영 및 마케팅이다.

Appendix A. Correlation matrix (Note that * : p < 0.05, ** : p < 0.01 , *** p : <0.001)

	numdown	video player	DVD player	Blu-ray player	PlayStation	Xbox	PMP	DivX player	HDTV	smartphone	tablet PC
numdown	1										
video player	-0.055*	1									
DVD player	-0.035	0.307***	1								
Blu-ray player	0.048*	0.062**	0.137***	1							
PlayStation	0.044*	0.039	0.121***	0.175***	1						
Xbox	0.053*	0.055*	0.113***	0.151***	0.175***	1					
PMP	0.042	0.107***	0.123***	0.107***	0.101***	0.093***	1				
DivX player	0.039	0.066**	0.158***	0.210***	0.089***	0.204***	0.117***	1			
HDTV	0.048*	0.012	0.172***	0.114***	0.131***	0.149***	0.135***	0.146***	1		
smartphone	0.054*	0.021	0.061**	0.059**	0.057*	0.065**	0.083***	0.045*	0.113***	1	
tablet PC	0.042	0.069**	0.143***	0.174***	0.157***	0.105***	0.159***	0.133***	0.121***	0.103***	1

Appendix B. ZINB Results (Note that * : p < 0.05, ** : p < 0.01 , *** p : <0.001.)

Appendix B. ZINB Results (Note that * : p < 0.05, ** : p < 0.01 , *** p : <0.001.)

	numdown		numdown		numdown		numdown		numdown		numdown		numdown		numdown		numdown		numdown	
	Count	Inflate	Count	Inflate	Count	Inflate	Count	Inflate	Count	Inflate	Count	Inflate	Count	Inflate	Count	Inflate	Count	Inflate	Count	Inflate
video player	-0.323**	12.12																		
	(-3.12)	(0.00)																		
DVD player			-0.205*	7.542																
			(-1.97)	(0.00)																
Blu-ray					0.558*	16.58														
player					(2.17)	(0.01)														
PlayStation							0.444*	17.73												
							(2.56)	(0.00)												
Xbox									0.451*	-1.951										
									(2.48)	(-0.00)										
PMP											0.256*	-12.70								
											(2.22)	(-0.00)								
DivX player													0.365	-2.858						
													(1.85)	(-0.00)						
HDTV															0.250*	-17.63				
															(2.24)	(-0.00)				
smartphone																	0.288	-18.13		
																	(1.90)	(-0.01)		
tablet PC																			0.272*	0.215
																			(2.19)	(0.00)
constant	2.967***	-26.50	2.931***	-23.28	2.790***	-19.42	2.774***	-19.96	2.774***	-20.19	2.744***	-13.69	2.791***	-19.57	2.722***	-3.523*	2.608***	-1.617	2.755***	-20.30
	(41.10)	(-0.00)	(37.88)	(-0.00)	(52.50)	(-0.01)	(50.53)	(-0.01)	(51.01)	(-0.00)	(44.75)	(-0.03)	(51.68)	(-0.00)	(34.77)	(-2.49)	(18.58)	(-4.31)	(46.71)	(-0.00)
lnalpha	1.671***		1.674***		1.668***		1.652***		1.672***		1.673***		1.674***		1.646***		1.623***		1.673***	
constant	(47.93)		(48.06)		(46.69)		(44.65)		(47.99)		(48.03)		(48.06)		(33.24)		(43.08)		(48.03)	
N	2000		2000		2000		2000		2000		2000		2000		2000		2000		2000	

Appendix C. Correlation matrix (Note that * : p < 0.05, ** : p < 0.01 , *** : p < 0.001.)

	numdown	male	age	univ_over	metropolitan	income1	income2	smartphone	tabletPC	house_ICT	port_down	nonport_down	Nonport_downx
numdown	1												
male	0.053*	1											
age	-0.135***	-0.019	1										
univ_over	-0.010	0.142***	0.069**	1									
metropolitan	0.012	-0.012	-0.008	0.057*	1								
income1	0.045*	-0.020	0.076***	0.067**	0.013	1							
income2	-0.038	0.017	0.171***	0.162***	0.063**	-0.442***	1						
smartphone	0.054*	-0.005	-0.101***	0.080***	0.046*	0.011	0.071**	1					
tablet PC	0.042	0.053*	0.095***	0.082***	0.0407	0.017	0.144***	0.103***	1				
house_ICT	0.011	0.084***	0.112***	0.167***	0.022	0.057*	0.163***	0.094***	0.125***	1			
port_down	0.025	0.001	-0.061**	0.091***	0.069**	0.054*	0.073**	0.803***	0.208***	0.098***	1		
nonport_down	0.025	0.086***	0.102***	0.146***	0.021	0.066**	0.156***	0.081***	0.116**	0.938***	0.089***	1	
nonport_downx	-0.055*	0.007	0.197***	0.056*	0.030	0.046*	0.099***	0.021	0.069**	0.200***	0.033	0.195***	1

Appendix D. VIF tables

(1) For ZINB1 model

Variable	VIF	1/VIF
income_2	1.44	0.693
income_1	1.34	0.747
univ_over	1.1	0.912
age	1.09	0.917
house_ICT	1.09	0.919
tablet PC	1.05	0.949
smartphone	1.04	0.957
male	1.03	0.970
metropolitan	1.01	0.990
Mean VIF	1.13	

(2) For ZINB2 model

Variable	VIF	1/VIF
income_2	1.43	0.698
income_1	1.35	0.742
age	1.11	0.904
nonport_down	1.1	0.907
univ_over	1.09	0.917
nonport_downx	1.08	0.926
port_down	1.04	0.965
male	1.03	0.972
metropolitan	1.01	0.988
Mean VIF	1.14	

<Abstract>

Effects of ICT Device Ownership on Consumers' Digital Piracy Behavior

Sim, Hyeonbo · Kim, Minki · Moon, Junghoon

This study investigates how information and communication technology (ICT) can damage intellectual property rights (IPR) in the movie industry. Utilizing a survey questionnaire to gather information about the extensive use of ICT devices, including tablet PCs and smartphones, we demonstrate how digital piracy behavior is associated with various socio-demographic characteristics. Econometrically, since a large number of people do not engage in piracy activities, we adopt a zero-inflated negative binomial model. We find that people with tablet PCs are more likely to engage in the piracy of movies from peer-to-peer (P2P) sites. In particular, when we categorize ICT devices based on whether they are portable and allow downloads, we find that people with devices equipped with both functions are most likely to engage in movie piracy.

Keywords: Digital piracy behavior, ICT device, zero-inflated negative binomial model, movie industry.

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