모바일 채널 수용이 고객의 동영상 소비에 미치는 영향에 관한 실증 연구

The Impact of Mobile Channel Adoption on Video Consumption: Are We Watching More and for Longer?

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요 약

모바일 기술의 진보는 미디어 산업에 혁신적인 변화를 가져왔다. 모바일 기기가 등장함에 따라 미디어 소비에서의 시공간적 제약이 사라졌다. 본 연구는 한국의 온디맨드 서비스 제공업체의 미디어 소비 데이터셋을 사용하여 모바일 채널의 도입이 개인의 영상 시청 행태에 미치는 영향을 분석하였다. 분석 결과 모바일 채널 채택이 TV 기반의 총 영상 시청 시간과 시청 콘텐츠 수를 유의하게 증가시킨다는 사실을 발견하였다. 본 연구 결과는 모바일 채널이 기존 TV 채널에 보완적인 역할을 한다는 것을 시사한다. 본 연구는 신흥 Over-the-Top(OTT) 시장에서 소비자 사용에 관한 이론 및 실무적 통찰력을 제공한다.

키워드 : 모바일 채널 채택, 영상 소비, 미디어 소비, 온디맨드 영상, Over-the-Top (OTT) 시장

Ⅰ. Introduction

The evolution of media technology has resulted in a multi-channel syndrome in media consumption. The increase in the number of smart devices capable of supporting digital media content has brought many changes to the traditional broadcasting industry. The introduction of new channels brought new types of video services such as over-the-top (OTT) services, resulting in fierce competition in video industry. To become the market leader, many market participants have employed a multi-channel strategy. For example, in the US, Comcast, a leading pay-for TV company, launched their mobile video streaming service "Xfinity-mobile" in 2017 and the OTT global giant Netflix has been establishing business partnerships with IPTV providers to target TV consumers outside of the mobile market. In the video streaming industry, a multi-channel strategy not only makes channels accessible through a second device but also makes them continuously available to watch between channels. <Figure 1> describes how video consumption has been

gaining popularity since 2017.

INCREASING TREND OF VIDEO CONSUMPTION
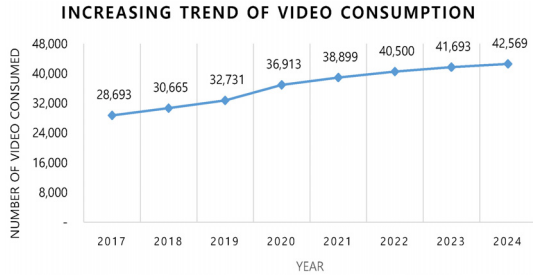
Referred from Statista: Increasing trend of video consumption (global).

〈Figure 1〉 The Trend of Video Consumption

The most critical change came that from the introduction of mobile video channels is that consumers become free to watch video content according to their schedule, which may attract many consumers to switch their main video consumption channel. With the emergence of smart devices, media consumption through multiple devices became common in recent years. Consumers can watch a movie or on-demand streamed video anytime at any place on their mobile phones or portable devices. In 2018, it was reported that 45% of US adults are using multiple devices to watch videos (Nielsen, 2018). In addition, in terms of video consumption with multiple devices, the role of mobile devices can be twofold. Mobile devices provide more convenient and diverse consumption environment to consumers (Lee *et al.*, 2005). On the one hand, such characteristics of mobile channel may attract individuals to alter their main video consumption channel. On the other hand, with such characteristics, mobile channel can work as an aid to let individuals consume more video content. Then, mobile channel can play a role as a complementary to the existing video consumption means. <Figure 2> shows the example of one source multi use pattern with regard to media channel.
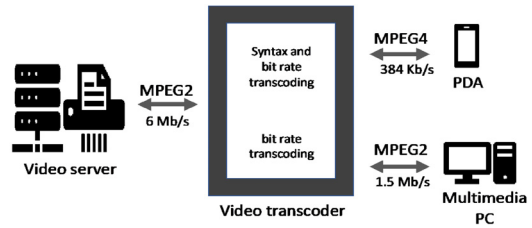
〈Figure 2〉 An Example of OSMU
(One Source Multi Use)

Drawing upon such phenomenon, the introduction of new channel may play either subsidiary or complementary role in terms of video consumption. Therefore, this study aims to show how the adoption of mobile channel affects video consumption. Although findings from prior studies show how mobile channels have changed media consumption, the effect of mobile channel adoption and VOD viewing is still unclear. Furthermore, prior studies were mostly conducted using surveys, interviews, and laboratory experiments, which may have missed unobservable factors in the measurement of results (Heckman, 1977). We deviated from these approaches by using empirical VOD utilization data obtained from one on-demand TV service provider, where consumers use a streaming service (e.g., an IPTV set-top box). We introduced a mobile channel to the existing TV contents and observed whether consumers increased their total consumption of the contents in terms of both viewing time and quantity. From such data, we identified changes in VOD usage following the adoption of the mobile channel. Consumers were able to pause content as they switched from one channel to another (called "seamless" or "continuous" watching" and also known as "n-screen") but were restricted to watching only one video on each channel at the same time. Employing a difference-in-differences (DID) approach with a real-world dataset of 12,118 VOD consumers, we found that the adoption of the mobile channel increased their total consumption time

and the quantity of content consumed. We further addressed how the effect differs according to the consumer's gender and video content's genre.

Our study contributes to the survival of traditional on-demand TV services in the digital video industry and supports the use of multi-channel strategies. By investigating whether a new channel displaces or cannibalizes existing utilization, we enhance the case for or against the acceleration of a multi-channel strategy. This study also sheds light on the increasing media consumption trend. We find that implementing multi-channel strategies, adopted by many on-demand TV service providers, not only provides ease of access but also increases utilization.

Ⅱ. Literature Review

2.1 The Relationship Across Various Media Channels

2.1.1 Displacement Effect in Media Channels

Channel adoption can have one of two effects: displacement or complement. To assess the impact of mobile channel adoption, we first studied papers examining how the two effects work in media consumption. There is still debate over how the adoption of a new channel (or mobile channel) affects existing channels. The effect can vary depending on the situation. For example, when considering a specific TV channel, it can sometimes have a complementary effect on existing media but can also act as a substitution. While Robinson (1981) claimed that TV is replacing other media channels, Dutta-Bergman (2004) demonstrated that consumers use TV as a complementary method of news media consumption.

Prior studies on the impact of new channel addition in media consumption compared the difference in time spent on the existing channel and the added channel. Scholars argue that total time spent on media content by users is limited by one's leisure time and is capped by other priorities－a school of thought typically described as "displacement theory" (Brown, 1974; Ha, 2012; Lazarsfeld, 1940). They found that when the added channel had a displacement effect, it added to consumer convenience but did not lead to increased viewing time. Several studies have also quoted the displacement theory to examine the impact of new channel adoption on the total usage of media. For one, people who consume more of one medium spend less time on another (Brown, 1974; Ha, 2012; Lazarsfeld, 1940). According to the study on whether increased TV viewing has reduced other media consumption, it was shown that time spent on reading fiction, listening to the radio, social activities and even public library use have decreased with the advent of TV (Coffin, 1955; Parker, 1963; Robinson, 1981; Weiss, 1969).

Therefore, the introduction of TV has had a displacement effect on consumer's media consumption. James (1995) verified that increased use of electronic bulletin boards reduces time spent on TV viewing, book reading, talking on the phone, and letter writing. Over time, the introduction of new media has, in turn, displaced the time spent on TV viewing. Kayany and Yelsma (2000) found that online media has displaced the information function of TV. Lee (2002) found that increased internet usage has led to a decrease in TV viewing among children in Singapore, showing that new media channels are replacing traditional media services. Furthermore, this displacement phenomenon has the same effect when it is limited to the contents of TV and video. The evolution of media technology means that consumers can access TV and video anytime and anywhere; the increased time spent on online streaming services has reduced the consumption of cable TV (Lee, 2015).

2.1.2 Complementary Effect in Media Channels

Although many scholars have found displacement effect of added channel on media consumption, the opposite phenomenon can also occur. That is, when the channel is added, the consumer can spend more time on the same content base thanks to the increased accessibility. Even if the length of time spent on media consumption does not increase, total media consumption can increase through the use of multiple channels simultaneously. This is another viewpoint often described as the "complementary theory", arguing that the introduction of a new channel causes a complementary relationship with original channel usage (Althaus, 2000; Dutta-Bergman, 2004; Wakshlag, 2010).

Prior studies have found the complementary role of the additory channel on diverse media consumption cases. With regard to information-seeking behavior through media, studies found that consumers prefer to access multiple channels rather than switching to the new type of channel. For example, individuals searching for health-related information have shown to refer to both existing media sources and mobile applications (Cho, 2015; Heckman, 1977; Lee *et al.*, 2018; Lewis *et al.*, 2016). The studies have found that individuals use mobile applications, the newly emerged searching channel for obtaining additory information that can't be found through traditional channel. The complementary role of new media channel is also found in terms of information sharing behavior. Neyazi *et al.* (2019) indicated that exposure to traditional media correlates with exposure to social media in terms of a non-western election context; that is people tend to listen to the radio or read newspapers to find election information and then move on to social media channels to share that information. Similarly, the introduction of a new mobile application is found to increase the number of news viewers on new websites

(Xu *et al.*, 2014). In terms of video consumption, several studies also investigated the complementary role of channel addition. Smith and Telang (2009) examined several variables that had a complementary effect on video consumption, such as movie broadcasts on DVD sales, and Gong *et al.* (2015) proved the positive effect of price discounts on digital video sales across channels.

Likewise, the findings regarding the impact of channel addition on media consumption are mixed. Also, not many studies have investigated how consumption pattern is changed as a result of consumption channel addition in the context of video consumption. Thus, this study examines how mobile channel, the newly emerged video consumption channel, have impact on video consumption.

2.2 Mobile Channel in Video Industry

Mobile channel has enabled consumers to easily watch videos at their convenience. The addition of mobile channels does not merely free up physical space restrictions (O'Hara, 2007). The adoption of mobile channels generates new data on media audience and many researchers have focused on studying the subject. For example, mobile TV preferences can be divided according to demographic characteristics or by user-interface design. In this respect,

some researchers also analyzed viewing behavior on mobile devices from the perspective of the audience. Lee *et al.* (2010) and See-To *et al.* (2012) examined mobile TV and video consumption from the consumer's perspective. Lee *et al.* (2010) perceived adoption by profiling demographic characteristics in college student populations of Korea, and See-To *et al.* (2012) studied users' mobile video appreciation. Moreover, Wong *et al.* (2016) developed a framework to determine why consumers use mobile TV. They found that performance expectancy is the most significant indicator to

behavioral intention to use mobile TV. In this regard, Phalen and Ducey (2012) suggest that the audience chose a mix of different media platforms to satisfy their own needs or availability. Kim (2016) found that mobile video consumption not only breaks the constraints of time and place of TV viewing but also enables the audience to manage viewing behavior in the context of other social activities in a convenient way. For example, it is possible to spend time with family while watching videos on their personal mobile devices. Mobile channel adoption is also found to change individual media consumption pattern. In terms of viewing on-demand services on multi-channels, continuous watching is available between channels. This consumption pattern is referred to as "multi-screen" (Chambers, 2019; Lin, 2019). With regard to media consumption, multi-screen behavior is found to affect consumer's content selection or media consumption volume (Phalen and Ducey, 2012).

As it is shown from prior studies, mobile channel addition has changed the way individuals consume video content. However, not many studies have investigated the causal impact of mobile channel adoption on video consumption behavior. Most of the studies are revolving around showing individual's change in perception or intention toward media consumption. Therefore, we empirically examine the impact of mobile channel adoption on video consumption using actual data. In doing so, drawing upon prior studies, we considered how the total time spent on video is changed after the introduction of mobile channel.

Ⅲ. Methodology

3.1 Research Setting and Data

We acquired access to an archival database of consumer-level log data on VOD viewing from a well-known VOD service provider in South Korea. The company launched VOD service since 2004 and is the leading VOD service provider, occupying 23.85% of Korean market share. The company launched a mobile service in 2014, which allows customers to watch videos via mobile phones in the same manner as they would watch videos on TV. Hereafter, we refer to this service as the "TV mobile" (TVM) and the company as the "VOD service provider" (VODER). A brief explanation of TVM is necessary. If a consumer of on-demand (TV) additionally subscribes to TVM, the on-demand service can be used on both TV and mobile devices. TVM is not only useful as a second method for watching VOD, but it also allows seamless watching, switching between the devices. For example, a consumer can start watching one video at home on TV, pause it, and then resume watching from the same point via a mobile phone; conversely, consumers can switch from a mobile phone to TV in the same way. But watching a video continuously is available only on one device at one time, which means that it is impossible to watch the same video on multiple devices together, since the nature of video contents has to be sequential in use. Please refer to <Figure 3> for more detail about TVM.
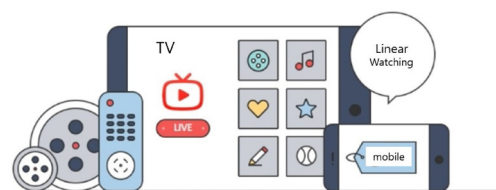
〈Figure 3〉 Description of TVM (TV-Mobile)

Three kinds of data sets were collected from the real-world on-demand platform: The first was "the video viewing log (TV only)" consisting of logs of consumers' viewing histories; the second was "the information of consumers," containing consumers' reg-

istration information; the third was "the information of contents" comprising of information on VOD content. First, the video viewing logs were accumulated to charge usage fees; therefore, these logs were well classified by each customer, including their unique ID. The video viewing log was collected from TV channels only, and the dataset consisted of the date of watching, total usage (such as time spent on viewing), the number of videos viewed, the content ID, and the unique consumer ID. We collected annual viewing logs between July 2018 and June 2019. The second data set included the month of registration for VOD (on TV) service, the month of TVM adoption, gender, age, and consumer ID. In July 2018, the number of new consumers joining the VOD service was 122,073. During the study period, a total of 18,372 consumers adopted TVM services at different times. Some joined immediately when they registered for VOD services, and the others joined later. Lastly, the content information dataset consisted of content name, ID, and category. A total of 157,414 unique VOD contents are categorized into 33 levels, which fall into three main categories: TV series, movies, and children's programs.

All three tables have been organized by unique consumer ID. To examine the changes in viewing behavior before and after the month of TVM registration, we summarized the data set as a monthly panel data set. The monthly summation of total viewing time and the quantity of content are used as a measure for media consumption per user. Note that not all consumers watched VOD every month during the study period.

To understand how the adoption of a mobile channel affected viewing behavior, we eliminated consumers who watched nothing or canceled the service during our study period. 12,118 samples remained, which capture more than 7 million viewing histories across 157,414 different VOD contents. Our sample consisted of two groups, a treatment group (5,051 consumers who have used TVM) and 7,067 of those who have not used TVM. The latter group is used for comparison as a control group. To normalize the promotion effect that is mostly given by month, the month of registration is aligned in all groups. Although the sample was from a single company, it is the longest-established service provider with the nation's greatest market share, which makes it ideal for testing our research question.

To isolate the effect of mobile channel addition, we identified other factors as control variables. Five control variables were defined. In the VOD business, the key driver of VOD consumption is leisure time, meaning that most revenue is generated during holidays. Thus, the number of holidays per month were counted as control variables. The total number of movies pro-

〈Table 1〉 Variable Description

Variable	Definition
$ViewTime_{it}$	Total time spent on video viewing (Unit: Second)
$ViewCount_{it}$	Total number of videos viewed
$Gender_i$	The gender of customer i (F:0, M:1)
Age_i	The age of customer i
$Holidays_t$	The number of holidays in month t (except weekends)
$Rainfalls_t$	Average rainfalls in month t (Unit: ml)
$Temperature_t$	Average temperature in month t (Unit: Celcius degree)
$NumContents$	The number of contents provided to consumers
$Megahits_t$	The number of mega-hit movies (more than 10million tickets sold at theater) in month t

vided by the platform and the monthly number of newly launched "mega-hit" movies are also counted as control variables, due to the heightened probability of viewing. Another factor that affects video consumption is the weather. Consumers will choose outdoor activities during fine weather therefore reducing VOD viewing. Thus, average temperature and rainfall were included to control the effect of the weather on viewing behavior. Of course, other variables can affect VOD consumption, but there are limits to the number of data that can be quantified. Therefore, we adopted five control variables that are considered to be the most influential in the industry. <Table 1> presents the detailed description of these variables.

3.2 Descriptive Statistics of Viewing Behavior

If VOD consumption increases in a timely manner, the effect of mobile channel acceptance could be moderated. Before conducting the analysis, we determined whether consumers were increasing or decreasing their VOD consumption over time after the registration for VOD services. As described in section 3.1, the data sets were summarized and organized as a monthly panel data set by unique consumer ID. The descriptive statistic of a monthly VOD consumption by all sample consumers is shown in <Table 2>. <Table 3> shows that VOD consumption varied month to month; consumers viewed most of VOD contents, in July 2018 and the least in June 2019, measured by both viewing time. The greatest quantity of content was watched in August 2018 and the least in February 2019. This variation simply describes how VOD is consumed depending on the month (or seasonality) but not linear changes in time.

⟨Table 3⟩ Monthly Total Consumption of Consumers

Time	Total number of contents viewed	Total view time (sec)
2018. July	1,266,971	34,599,728
2018. Aug	1,265,324	26,045,144
2018. Sept	1,275,200	31,541,712
2018. Oct	1,292,039	29,118,432
2018. Nov	1,248,135	31,567,136
2018. Dec	1,255,261	31,612,248
2019. Jan	1,260,668	33,609,120
2019. Feb	1,246,890	30,728,080
2019. Mar	1,263,792	32,567,568
2019. April	1,257,529	24,950,544
2019. May	1,261,164	27,930,248
2019. June	1,261,660	23,887,544

⟨Table 2⟩ Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
$ViewTime_{it}$	88,394.00	242,895.10	0.00	2,490,567.00
$ViewCount_{it}$	66.66	186.83	1.00	7,798.00
$Gender_i$	0.52	0.50	0.00	1.00
Age_i	37.61	12.28	10.00	90.00
$Holidays_t$	1.00	0.99	0.00	3.00
$Rainfall_{st}$	67.50	77.65	8.00	282.00
$Temperature_t$	12.50	9.25	0.00	27.00
$NumContents$	9,984.50	1,496.64	7,855.00	13,233.00
$Megahits_t$	**0.00**	**0.49**	**0.00**	**1.00**

To investigate the impact of mobile channel adoption, we looked at the statistics from the treatment group and control group and compared them with video transaction statistics to observe the changes in viewing behavior. Here, video transaction refers to whether an individual purchased video content for watching. To obtain the average viewing transaction per consumer, we divided the total viewing log by the sample number in each group. <Table 4> describes the transactions of consumers by treatment or control group. On average, consumers with TVM made more transactions than those without TVM. This comparison follows the result as the average time spent watching VOD in a group who has watched on TV only (control group) is smaller than that of treatment group and the average number of watched VOD in control group has also counted slightly smaller than the treatment group.

Although consumers with TVM have, on average, higher usage, this does not fully explain the impact of mobile channel adoption. Super consumers could exist in the treatment group who watched video via TV far more than the rest of the sample. It is also difficult to define whether consumption time increased before or after mobile channel adoption.
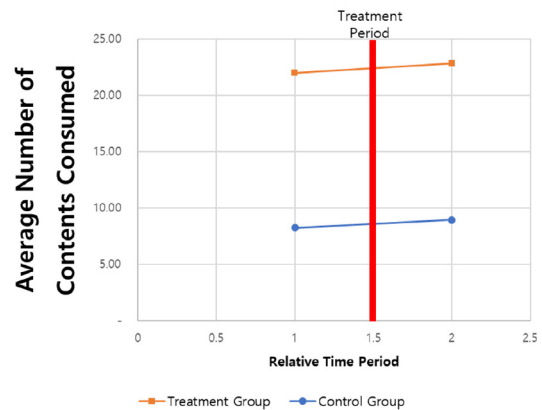
<Table 4> shows significant differences in VOD usage regarding the average transaction per consumer. Therefore, it was necessary to test that both the treatment and control groups are identically configured. We conducted a t-test to check the validity of randomization between the two groups in terms of demographical aspects such as age and gender. The age group is divided into two groups – people above and below average age. <Table 5> describes the result of the t-test and shows that there is no detectable variation across the demographics between the treatment and control groups.

〈Table 5〉 t-Test Result

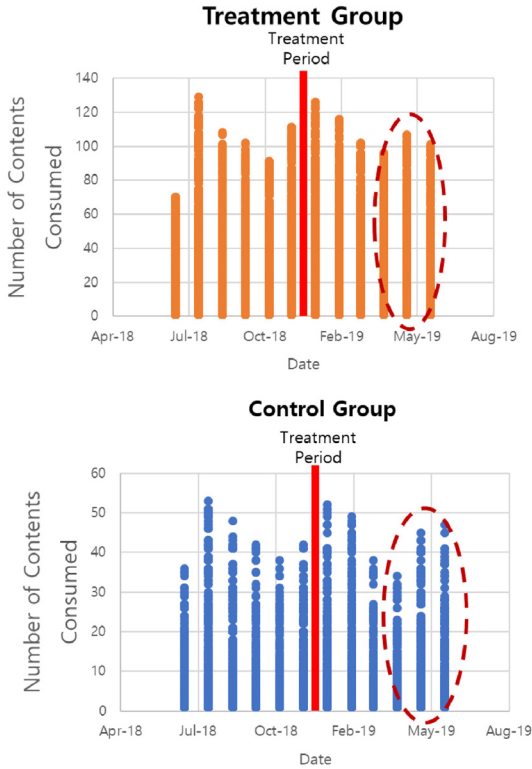|	t-stat	p-value
Gender	0.5362	0.5918
Age	1.6083	0.1078

Furthermore, in order to provide the validity of treatment effect in our model, we checked parallel trend assumption between control group and treatment group before and after the treatment. <Figure 4> and <Figure 5> describes such trend between two groups.

〈Figure 4〉 Comparison of Contents Consumption Mean between Control and Treatment Group

〈Table 4〉 Transactions of Consumers by Groups

	Total	Treatment Group	Control Group
Number of Consumers	12,118.00	5,051.00	7,067.00
Total transactions	7,196,148.00	3,346,573.00	3,849,575.00
Average transaction per consumer	593.84	662.56	544.73

〈Figure 5〉 Time Trend Comparison of Contents Consumption Magnitude between Control and Treatment Group

According to the two graphs, it is proved that the treatment made changes in the video consumption viewing amount growth between control group and treatment group. Also, <Figure 5> shows in more detail that there exists lagged treatment effect.

3.3 Econometric Model

We employed a DID approach to establish the effect of TVM on VOD viewing. The DID estimation has become an increasingly popular way to estimate causal relationships (Bertrand *et al.*, 2004; Lee and Bang, 2021). The advantage of the DID model is that it will not only measure the differences between the treat-

ment and control groups, but also the differences in the outcome variable changes that occur over time. *AfterTreatment* refers to the month of joining TVM and *Treated* denotes the binary variable indicating whether or not the consumer adopted a mobile channel.

Our primary target variable is viewing-behavior change. To identify the impact of mobile channel adoption on TV viewing, we examined how the usage of an existing TV channel changed. With the impact of an added mobile channel, the effect on existing media consumption can be divided into three: does not change, increases, or decreases. The hypothesis is that if existing channel consumption changes in the first two cases, the impact of a mobile channel on TV is complementary, whereas if it decreases, it is displacing. Therefore, we employed DID analysis to measure the difference before and after treatment.

We used two indicators to measure viewing behavior changes in our study. First, we traced the total time spent on watching VOD, and second, we counted the total number of VODs watched by consumers. The first dependent variable, *ln(Vtsum)*, is the natural log of the total amount of time in seconds that consumers spent watching VOD per month. The second dependent variable, *ln(ContentCount)*, is the natural log of the number of VOD contents that consumers watched per month. Logging the dependent variables is necessary to resolve normality concerns, as the data represents dramatic skewness.

We used the following model specification to estimate the treatment effect of mobile channel adoption on the first dependent variable:

$$\ln(Vtsum_{it}) = \alpha_{it} + \beta_1 \times AfterTreatment_t \quad (1)$$
$$+ \beta_2 \times Treated_i$$
$$\times AfterTreatment_t + \gamma_{it}\,\theta_i + \epsilon_{it}$$

Then, we adopted the following model specification

to estimate the treatment effect of mobile channel adoption on the second dependent variable:

$$\ln(ContentCount_{it}) = \alpha_{it} + \beta_1 \qquad (2)$$
$$\times AfterTreatment_t + \beta_2 Treated_i$$
$$\times AfterTreatment_t + \gamma_{it} + \theta_i + \epsilon_{it}$$

Treated is the created dummy variable that identifies the group exposed to the treatment, indicating whether the consumer has adopted TVM or not. Specifically, when *Treated* is 1, it refers to a group with TVM, and 0 refers to a control group without TVM. By scrutinizing our dataset, the all the consumers in our dataset registered and soon adopted TVM after TVM service has been launched. Therefore, we created the dummy variable *AfterTreatment* to indicate the treatment in a timely manner. Where a consumer adopted TVM in January 2019, viewing logs before January 2019 have a value of 0 for the *AfterTreatment* variable. To compare control group consumers with treated consumers, we systemically assigned them with the same proportion of *AfterTreatment* as treatment consumers.

Finally, to analyze the DID estimation, we created an interaction between the *AfterTreatment* and the *Treated* variables. This is the variable of our interest. γ_{it} refers to other time-variant control variables in <Table 5>, while θ_i denotes individual-fixed effect (unique consumer ID) and ϵ_{it} describes the error term.

Ⅳ. Results

4.1 Main Results

First, we analyze VOD usage changes with two dependent variables: total viewing time and the number of contents consumed. The main results of the DID analysis are summarized in <Table 6>. The first column presents the first model with the dependent variable

ln(Vtsum) referring to the log of total viewing time +1. As shown in <Table 6>, total time spent on VOD significantly increased in consumers with mobile channel adoption compared to the control group. Specifically, consumers who joined TVM spent 16.8% more time after adopting TVM, with ($p < 0.001^{***}$). We repeated the analysis by examining how the number of contents changed before and after TVM adoption. In column 2 of <Table 6>, the number of contents also increased by 2.4% after adopting TVM, with ($p < 0.05^{*}$). Time and consumer fixed effects were counted to analyze the monthly panel data set.

〈Table 6〉 The Main Estimation Results

	Model 1	Model 2
DV	*ln(Vtsum)*	*ln(ContentCount)*
Treated *AfterTreatment*	0.168^{***}	0.024^{*}
	(0.018)	(0.012)
AfterTreatment	0.082^{***}	0.077^{***}
	(0.018)	(0.011)
Consumer FE	Included	Included
Number of Obs.	111,867	112,009
Number of Groups	11,918	12,118
R-Squared	0.1174	0.5852

Robust standard errors in parentheses; $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$.

Second, we added five control variables to moderate other impacts to usage change, including seasonality and uneven content. We included the control variable throughout this study because its unchanging status allowed for a better understanding of the relationship between other variables. The results including control variables are reported in <Table 7>. Even after the inclusion of the control variables, the results are consistent. Both the time spent and the number of contents consumed increased significantly as described in <Table 7>. Similar to the main result, the total viewing time of the treatment group increased by 16.8%,

and the number of contents increased by 2% more than the control group.

〈Table 7〉 Full DID Estimation Result

	Model 1	Model 2
DV	ln(Vtsum)	ln(ContentCount)
Treated *AfterTreatment	0.168*** (0.018)	0.024* (0.012)
AfterTreatment	0.082*** (0.018)	0.077*** (0.011)
Control variables	Included	Included
Consumer FE	Included	Included
Number of Obs,	111,867	112,009
Number of Groups	11,918	12,118
R-squared	0.5075	0.5844

Robust standard errors in parentheses; *p<.05, **p< .01, ***p<.001.

<Table 6> and <Table 7>, which include the first dependent variable result (i.e., total viewing time) explain the complementarity between the additional mobile channel and existing TV channels. We found that TVM, the additional mobile channel, was effective in facilitating more time consumption on VOD through TV. Since our study examines on-demand VOD consumption, where simultaneous consumption is virtually impossible or not desirable because the nature of the contents is sequential, the increase from the result can be described as "additive consumption". Furthermore, as the increase shown by the second dependent variable result (i.e., the number of contents consumed) indicates, adding a mobile channel not only facilitates VOD consumption where users spend time on the contents via the existing TV channel but also gives rise to additional consumption on the VOD platform.

4.2 Additional Analyses

Next, we assess the heterogeneous effects of VOD usage by consumer segmentation (i.e., gender) and the genre of media content. According to (Constantiou and Mahnke, 2010), the degree of mobile TV adoption varies according to gender. They state that gender influences the individual's preference for mobile TV and revealed the different diffusion patterns between men and women. Therefore, we addressed this concern by analyzing the causal relationship between mobile channel adoption and VOD consumption in terms of gender, presented in <Table 8>.

〈Table 8〉 Additional Estimation Results by Gender

Gender	Male	Female	Male	Female
DV	ln(Vtsum)		ln(ContentCount)	
Treated*AfterTreatment	0.117*** (0.026)	0.066* (0.025)	0.062*** (0.016)	-0.008 (0.016)
AfterTreatment	0.068* (0.025)	0.126*** (0.025)	0.054*** (0.016)	0.097*** (0.016)
Consumer-FE	Included	Included	Included	Included
Controls	Included	Included	Included	Included
Number of Obs.	58,711	55,936	58,711	55,936
Number of Groups	6,343	5,774	6,343	5,774
R-squared	0.5318	0.539	0.6624	0.6601

Robust standard errors in parentheses; *p<.05, **p< .01, ***p<.001.

⟨Table 9⟩ Additional Estimation Results by Genre

DV	$ln(Vtsum)$			$ln(ContentCount)$		
Genre	Movie	Movie TV Series	Children's	Movie	Movie TV Series	Children's
Treated*AfterTreatment	-0.013 (0.028)	0.007 (0.020)	-0.057 (0.048)	-0.008 (0.028)	0.007 (0.013)	-0.068[*] (0.034)
AfterTreatment	0.090[***] (0.027)	0.063[***] (0.019)	0.024 (0.047)	0.045[***] (0.011)	0.040[**] (0.013)	0.031 (0.034)
Consumer-FE	Included	Included	Included	Included	Included	Included
Controls	Included	Included	Included	Included	Included	Included
Number of Obs.	77,239	81,275	23,570	77,239	81,275	23,570
Number of Groups	11,299	11,124	5,281	11,299	11,124	5,281
R-squared	0.2969	0.5293	0.5293	0.2969	0.5293	0.5293

Robust standard errors in parentheses; [*] $p<.05$, [**] $p< .01$, [***] $p<.001$.

The results in <Table 8> indicate that the total time spent on viewing VOD content increased for both males (12%) and females (6%). For the second dependent variable, males watched 6.2% more content after mobile channel adoption, whereas there were no significant changes for females. Therefore, the findings may reflect the difference in channel transition behavior of men and women. We assumed that females tend to use mobile devices for subsequent viewing between multi-devices, but mobile adoption has not affected their consumption. We also believe that males prefer to use TVM as a different device for watching additional videos.

Moreover, video consumption can be analyzed by content genre (Cha, 2013). Thus, we divided the table of contents data set into three categories: movies, TV series and, children's programs. Each content category had a different average length of video. For example, movies have a longer duration than a TV series episode, and children's programs are usually shorter than other genres. Within the data set, there were no significant changes in VOD usage for movies and TV series viewing following mobile channel adoption. However, con-sumers watched 6% fewer programs with children's content after mobile channel adoption. <Table 9> presents the additional estimation by content genre in detail. We assumed this result as children tend to repeatedly watch the same content, whereas adults prefer varied content. Although we expected the content genre to change VOD usage after mobile channel adoption, we found that content selection is more dependent on individual taste.

V. Conclusion

The increased capabilities of mobile devices have spurred the growth of media consumption. Our analysis revealed empirical evidence on the causal impact of mobile channel adoption on on-demand TV consumption. We found that the adoption of a mobile channel positively affects VOD usage including total time spent and the number of contents consumed. With more opportunity for media consumption, increased mobility and accessibility has led to higher media consumption. This study offers theoretical and practical implications on the impact of mobile channel adoption

on video consumption.

5.1 Implications

This study provides theoretical implications that may add to previous literature on media consumption and new channel adoption. Although prior studies focused on the difference in media consumption across different channels, those studies were limited in investigating the association between consumption magnitude in multiple channels. That is, prior studies related to channel adoption in media consumption are based on displacement theory, and most of them study media consumption across various channels. For example, TV viewing time diminished as computers appeared (Brown, 1974; Ha, 2012; Lazarsfeld, 1940). As consumers became able to access media content through various channels, researchers began to explore media consumption from the perspective of complementary theory (Althaus, 2000; Dutta-Bergman, 2004; Wakshlag, 2010). Scholars have hinted that consumers appear to be adding video consumption mediums rather than substituting them (Gibs, 2009; Wakshlag, 2010). Consumers can choose to watch a video on TV at home but are also free to watch videos on mobile devices away from home. Interestingly, the advent of mobile media has been found to decrease the usage of traditional media except for TV (Woo *et al.,* 2014). For TV consumption, the restriction on place for watching is the most inconvenient factor. The acceptance of a mobile channel, which negates that restriction, has a direct effect on TV consumption. Accordingly, Harris and Kim (2012) suggested that mobile TV provides more viewing opportunities and replaces other media such as radio, internet, or newspapers. However, there are few studies on new channel effects, particularly on video consumption. This study contributes to mobile IT literature by reexamining the comple-

mentary effect of media consumption. While prior studies are based on survey data with limited sample size, we used real-life consumer log data to enhance the validity of our findings. Furthermore, our results reveal that digital video content preference over multi-channels differs demographically and that video consumption behaviors differ depending on content genre.

In addition to the theoretical implications of these results, our study supports the use of multi-channel strategies in the VOD industry. The emergence of OTT services presents both opportunities and challenges to on-demand businesses. Our findings help decision-makers and digital marketers, particularly in VOD businesses, accelerate media consumption with expanded accessibility. This study's additional findings help marketers gain a better understanding of the impact of gender on VOD consumption, and to recognize the importance of genre-related promotions. Finally, consumption change from offline to online or from offline to other offline sources upon additional channel adoption are difficult to examine due to limited empirical data. However, this paper contributes to the study of consumption change related to online channels as empirical data sets are available.

5.2 Future Research

This study presents opportunities for further study. First, in light of the recent COVID-19 pandemic, 2020 data may provide insight into whether mobility is a significant driver of the causal relationship. If data during this time show little to no difference in the correlation, mobility may not be a significant driver when the majority of the population is confined. Second, while many mainstream scholars and the media praise the rise of new content providers such as Netflix, can be driven by increased accessibility rather than content improvement. Therefore, this study's results may be

strengthened by further analysis separating the impact of content from the impact of technology.

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The Impact of Mobile Channel Adoption on Video Consumption: Are We Watching More and for Longer?

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Abstract

The advancement in mobile technology brought disruptive innovation in media industry. The introduction of mobile devices broke spatial and temporal restrictions in media consumption. This study investigates the impact of mobile channel adoption on video viewing behavior, using real-world dataset obtained from a particular on-demand service provider in South Korea. We find that the adoption of a mobile channel significantly increases the total viewing time of video-on-demand via TV and the number of contents viewed. Our results suggest that the mobile channels act as a complement channel to conventional TV channels. We provide theoretical and practical insights on consumer usage in the emerging over-the-top market.

Keywords: *Mobile Channel Adoption, Video Consumption, Media Consumption, Video on Demand, and Over-the-top Market*
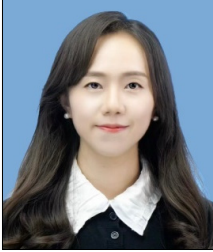
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SK Telecom에서 Marketing AI사업팀 매니저(데이터사이언티스트)로 재직 중이다. UCLA대학교에서 수학/경제학 학사 취득 후, KAIST 경영대학 석사과정을 졸업하였다. IPTV시청로그 분석을 통한 미디어 상품 개발 및 IPTV콘텐츠 추천로직을 개발하였으며, 현재 모바일 사용로그 분석기반의 AI빅데이터마케팅 사업기획 업무를 맡고 있다.

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KAIST 경영대학에서 박사학위를 취득하였으며, AI 기반 광고 최적화 및 수요예측 스타트업 임팩트에이아이를 공동 창업하였다. 주요 관심 분야는 광고 최적화, 디지털 마케팅, 디지털 콘텐츠, 공유 경제, 녹색 IT 등이다. 지금까지 Decision Support System 등 학술지에 논문을 발표하였다.

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KAIST 경영대학 교수로 재직 중이다. 아리조나대학 경영학 박사 취득 후 네브라스카 대학 교수를 역임하였다. 주요 관심분야는 IT Strategy와 Digital Innovation이다. MIS Quarterly, Journal of Management Information Systems, Information and Management 등 주요 학술지에 논문을 발표하였다.