경영관리연구
(제6권 제1호)

The Effect of the Shutdown System on Social Games

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The Korean government enforced the shutdown systemfor children aged under 16, starting from November 20th, 2011. Based on data from a Korean social game company, we found the structural change of play time of user and the difference of network effects among two different groups. The results show that the enforcement of the shutdown system makes the structural change for play time of users. There is negative network effect on play time for users and when the policy is implemented, network effect gets worse as more people are online, users play the game less. This study shows some interesting implications for the characteristics of users on social game.

Key words : Network effect, social game, policy change

논문투고일: 2013. 4. 28. 논문수정일: 2013. 5. 19. 게재확정일: 2013. 6. 17.

1. Introduction

Since the advent of the Internet, the online game marketshave been growing dramatically. Especially, according to DFC Intelligence Forecasts, the global market for social games is expected to reach $7.5 billion by 2016.[1] Therefore, a lot of companies jump into the social game industry and many new social games are coming out.

Being that the game companies earn revenues from selling items to users, the game companies try to increase the duration of playing times through various designs and strategies. However, online games are embroiled in controversy as cause of the Internet addiction. When a lot of social problems were turned out to be caused by online game addictions, Korean government put the shutdown system on children aged under 16. According to the act of the shutdown system, the adolescences cannot play online games from 12am to 6am. This act was passed on May 19th, 2011, and its enforcement started on November 20th, 2011. The goal of the policy is to reduce the number of children who are addicted to online games and decrease social problems.

There are many literature focusing on the Internet addiction (Young 1998) and the motivations of online game (Choi and Kim 2004; Yee 2006). Some literature are related to online game policy but they only cover information issues(Chung and Grimes 2005) However, few literature covers the effect of shutdown system in an online gamebecause the policy was enforced very recently and it was first started in Korea.

This paper studies the effect of shutdown system on online game. The result of this study shows that the enforcement of shutdown system makes the structural change for play time of users. There is negative network effect on play time for users and when the policy is implemented, network effect gets worse - as more people are online, users play the game less. This study shows some interesting implications for the characteristics of users on social game.

1) See DFC Intelligence Report www.dfcint.com

2. Theoretical Backgrounds and Hypotheses Development

As shown in the figure 1, primary interest is on the association between network effect/ marginal network effect and play time of social game, and how this relation changes when the shutdown system is implemented.

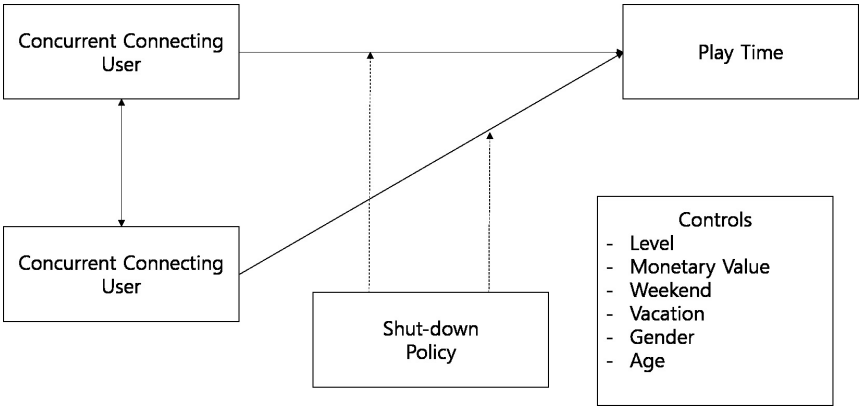

Figure 1 Conceptual Framework

A social game is defined as a game played and distributed on social networks. Since social game is based on social networks, the attributes of social networks affects the social game.

There are a lot of studies on the network effect of social network. According to Metcalfe's law, the value of a network is related to the square of network size(Metcalfe 1995). Reed's lawclaims that the value of a network is proportional to the exponential of the network size (Reed 1999). A social game, as a part of social network, can also has network effect. In a social game, the network size can be represented as the number of concurrent connecting users.

Hypothesis 1A (H1A): *Play time of a user is positively related to concurrent connecting users*.

Hypothesis 1B (H1B): *The concurrent connecting users generates networkeffect, and also affect the play time*.

As shutdown system is enforced, the number of users is decreased. This is because children under 16 are not available to play online games after midnight. As most social games are farming garden or raising animals, users have to be online frequently. Since the

policy keeps adolescent users from playing the game continuously, the active users of adolescence will be decreased. As the number of concurrent connecting users decreased, this will weaken the network effect.

Hypothesis 2A (H2A): *The association between concurrent connecting users and play time is weaker when the shutdown system is enforced.*

Hypothesis 2B (H2B): *The marginal network effect is weaker when the shutdown system is enforced.*

3. Data

The data was collected from the Korean social game company. They provide service log files of a social game. This game is based on simulation, which users are growing their gardens. It is similar to the "Farm Ville", serviced by Zynga on the Facebook. Data was collected for 8 months, from July 20th, 2011 to march 20th, 2012. The effect of the shutdown system can be observed for 4 months and compare it with data of 4 months before the enforcement. Among 131,925 users, 182 users were randomly chosen during the data collecting period, as shown in Table 1. The total number of observation is 3,907.

Table 1 Description of users

Age	Group 1				Group 2			
	~19	20~29	30~39	40~	~19	20~29	30~39	40~
Gender								
Man	6	13	7	5	0	4	4	1
Woman	43	54	14	17	18	23	11	6
Total	49	67	21	22	18	27	15	7

Group 1 is when the shutdown system is not enforced, and Group 2 is after November 20th, 2011, when the shutdown system started.

Table 2 Descriptive Statistics

Variables	Mean	Std. dev.	Min	Max
P_Time	1535.011	3513.871	0	33831
CCU	7536.049	3287.886	1922	14248
Level	31.84233	18.24915	1	102
XP	342259.3	703775.2	0	4781146
Gold	733868.4	1212360	6	11800000
WeekDay	.5879191	.4922725	0(N=105)	1(N=137)
Vac	.3091886	.4622182	0(N=180)	1(N=62)
Gen	.8715127	.3346745	0(N=34)	1(N=152)

Table 2 show the labels and descriptive statistics for each variable. *P_Time* is the total play time for each user for each day, which is measured in seconds. *CCU* are cumulative concurrent connecting users for each day. We measure the number of users who were online measured every hour and they were totaled for data collecting period. *Level* is the level for each user on specific day. *XP* is another variable that indicates how far the user achieved some goals or how much the user has experienced the game so far. *Gold* is monetary value on the game and the user can buy some items with this. *WeekDay* is a dummy variable indicating whether the day of user playing the game is weekend or not. It is 0 if the day of user played the game is weekend, and it is 1 if the day is weekday. *Vac* is a dummy variable, defined as 1 if the month the user playing the game is August or January which is vacation month, and 0 otherwise. *Gen* is a dummy variable, defined as 1 if a user is female, and 0 if a user is male.

Table 3 Correlation matrix

	P_Time	CCU	Level	Gold	WeekDay	Vac	Gen
P_Time	1						
CCU	-0.081***	1					
Level	0.297***	-0.329***	1				
Gold	0.052***	-0.345***	0.680***	1			
WeekDay	0.014	0.147***	-0.020	-0.013	1		
Vac	-0.034**	0.249***	-0.087***	-0.066***	0.065***	1	
Gen	0.123***	-0.069***	0.307***	0.168***	0.006	-0.016	1

***, **, and * Denote significance at 1%, 5%, and 10%, respectively.

Table 3 and Table 4 show correlation and multicollinearity of each variable respectively. Since the maximum VIF (variance inflation factor) is 2.86, we judged that there is no multicollinearity problem for this model.

Table 4 Multicollinearity Test

	VIF	SQRT VIF	Tolerance	R-Squared
CCU	1.27	1.13	0.7848	0.2152
Level	2.63	1.62	0.3800	0.6200
Gold	1.98	1.41	0.5046	0.4954
WeekDay	1.03	1.01	0.9735	0.0265
Vac	1.07	1.03	0.9344	0.0656
Gen	1.26	1.12	0.7956	0.2044
Age2	2.41	1.55	0.4141	0.5859
Age3	2.86	1.69	0.3493	0.6507
Age4	1.52	1.23	0.5690	0.3410
Mean VIF	1.78			

4. Empirical Analysis

4.1 Empirical Specification

We are primarily interested in understanding the effect of shutdown system on network effect. Thus, dependent variable is P_Time, and the key explanatory variables are concurrent connecting user CCU, and its network effect CCU_sq. The model to be estimated is

$$P\_Time_{it} = \beta_0 + \beta_1 CCU_{it} + \beta_2 CCU\_sq_{it} + \beta_3 Level_{it} + \beta_4 Gold_{it} + \beta_5 WeekDay_{it} + \beta_6 Vac_{it} + \beta_7 Gen_{it} + \sum_{l=1}^{L} \delta_l Age_{itl} + \varepsilon_{it}, \quad (1)$$

, where Age_{itl} , for l=1, …, L, are dummy variables so that $Age_{itl} = 1$ if the user i's age is in group l and 0 otherwise. We divide the age group into 4 - if the user is in age below 20, she is in group 1; if the user is in age between 20 and 29, she is in group 2; if the user is in age between 30 and 39, she is in group 3; if the user is in age more than 40, she is in group 4.

We conducted the Hausman test for each group in order to choose better estimation method, comparing ordinary least squares (OLS) with two-stage least squares (2SLS) estimation. Table 5 is the result from the Hausman test. It is shown that 2SLS is preferred to OLS. The instrumental variable XP is used to control the endogeneity problem of the $Level$ variable.

Table 5 the Hausman test

		Group 1		Group 2	
Efficient under Ho	Consistent under H1	Statistic	p-Value	Statistic	p-Value
OLS	2SLS	74.79	〈0.000	94.95	〈0.000

Finally, the test to check if there is any significant structural change among group 1 and group 2 was conducted. For OLS and 2SLS, the Chow test was conducted for each OLS and 2SLS model. As shown in Table 6, there exists structural change between group 1 and group 2, and the result of modeling two different groups separately is better than the result of the pooled regression.

Table 6 the Chow test

H0: no structural change	OLS		2SLS	
	Statistic	p-Value	Statistic	p-value
	9.9182	〈0.000	10.9642	〈0.000

4.2 Hypotheses test

Table 7 presents the results for both OLS and 2SLS estimation methods.Because the Hausman test shows that 2SLS estimation is better than OLS estimation, this study analyzes the results using 2SLS only. On the contrary to our expectation, the coefficients of the number of concurrent connecting users are insignificant for group 1 and negative for group 2.It means that users were playing this game independently based on little interactions with other users before the shutdown system enforced. But after the shutdownsystem enforcement, the users are aware of other users would be decreased. Based on this expectation, the users are stopped their playing. It turns out the negative coefficient in Group 2.Since the marginal network effects, which is

represented here as the square of the number of concurrent connecting users, is small but positively related to play time and it is significant for group 1, it could be generate positive network effects in the future.For group 1, marginal network effect is notalso significant. In short, H1A and H1B are not supported.

Table 7 Estimation Results

	OLS		2SLS	
	Group 1	Group 2	Group 1	Group 2
Intercept	685.5821 (940.9360)	2519.001 (1678.9500)	408.5601 (944.8525)	3884.25** (1713.866)
CCU	-0.327 (.2071)	-2.633*** (0.9505)	-0.3140 (0.2078)	-3.2049*** (0.9686)
$(CCU)^2$	0.000 (0.0000)	0.000*** (0.0000)	0.0000 (0.0000)	0.0005*** (0.0001)
Level	107.260*** (6.1429)	77.860*** (7.5211)	141.8099*** (7.3819)	128.7602*** (9.4523)
Gold	-0.002*** (0.0001)	-0.000*** (0.0001)	-0.0022*** (0.0001)	-0.0009*** (0.0001)
WeekDay	226.539* (123.8509)	-133.102 (224.6334)	221.7925* (124.2938)	-114.4969 (228.4462)
Vac	75.129 (157.1683)	362.710 (271.6968)	98.05276 (157.7518)	340.4826 (276.3082)
Gen	270.4222 (189.3151)	252.692 (461.1369)	-134.5969 (195.862)	-846.9406* (484.0525)
Age2	-113.0328 (179.2011)	402.2328 (374.0321)	-349.2462* (181.9701)	-329.0434 (388.6452)
Age3	115.4574 (211.6477)	-161.8248 (438.8258)	-457.1599 (222.8083)**	-1493.86*** (469.3297)
Age4	-830.2334*** (250.9605)	244.664 (1035.4430)	-1210.382*** (255.7873)	7.0689 (1053.296)

Note: Dependent variable: P_Time. Estimates for dummy variables are omitted from results for 2SLS. ***, **, and * Denote significance at 1%, 5%, and 10%, respectively.

Comparing group 1 and group 2, group 1 doesn't seem to have network effect but group 2 has negative network effect. There are significant structural change between group 1 and group 2 but it cannot be sure that network effect is weakened. This concludes that H2A and H2B are not supported.

5. Discussion and Conclusions

In this paper, the effect of the shutdown system on a social game is studied. We proposed that the network/marginal network and play time are positively related, and the shutdown system will weaken network effects. But the results show that the hypotheses are not supported.

However, this result implies some interesting characteristics of social game users. As the number of concurrent connecting users increase, users' playing time is decreased because users have less chances to interact with other users. The game in this study has a service of watering other users' garden. If sufficient number of users are played at the same time, users might water their garden mutually beneficial way in a short period. Since social games are not based on real-time interactions, this feature might reduce playtime but we could not know the net network effects.

Also, the structural changeof play time on the number of concurrent connecting users due to shutdown system can be described as; users who actively participated the game moved out after the shutdown system enforcement. Among the rest of users who stay after the shutdown system enforcement, there may be some users whose purpose of playing the game is not just for fun. Because the users can connect each other through social games, there may be some users who have advertising purpose, or other impure purposes except playing. These users may irritate other users and this will result in negative network effects of the number of concurrent connecting users on play time. But also we have limitations on this explanation: this study is exploring social games in the early state and there are not enough clues about users. We can gather the users characteristics next time, and then we can show which users make positive/negative network effects exactly.

This study have some limitations, and overcoming these can lead to future research. First, the sample size is small. Though the original number of users is 131925, 182 of them are observed with this study and this would be the main reason of some insignificant results. However, we sample them randomly, so it could represent the population of the game. Second, it cannot be sure that the number of concurrent connecting users are decreased because of the enforcement of shutdown system. The game used for this study can be no longer popular as time goes by. If we cancel out

this effect, then we can show more robust and clear results. Finally, detecting the users who leave the game when shutdown system is enforced and move to another game,where the policy is not enforced, can help further explain the impact of the policy on online game.

References

Choi, D., and Kim, J. 2004. Why people continue to play online games: In search of critical design factors to increase customer loyalty to online contents. *CyberPsychology & Behavior7*(1) 11 - 24.

Chung, G., and Grimes, S. M. 2005. Data mining the kids: Surveillance and market research strategies in children's online games. *Canadian Journal of Communication30*(4) 527 - 548.

Metcalfe, R. 1995. Metcalfe's Law: A Network Becomes More Valuable as it Reaches More Users. *Infoworld* 53 - 54.

Reed, D. P. 1999. That Sneaky Exponential - Beyond Metcalfe's Law to the Power of Community Building. *Context Magazine*.

Yee, N. 2006. The Demographics, Motivations, and Derived Experiences of Users of Massively Multi-User Online Graphical Environments. *Presence: Teleoperators and Virtual Environments15*(3) 309 - 329.

Young, K. S. 1998. Internet addiction: The emergence of a new clinical disorder. *CyberPsychology & Behavior1*(3) 237 - 244.

Business Management Research
(Vol. 6, No. 1)

셧다운 시스템이 소셜 게임에 미치는 영향

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2011년 11월 20일,대한민국 정부는 16세 미만의 청소년을 대상으로 셧다운 제도를 실시하였다. 한국 소셜 게임 회사의 데이터를 바탕으로, 셧다운 시스템으로 인한 두 그룹의 플레이 시간과 네트워크 영향의 차이를 분석하였다. 그 결과, 셧다운 시스템이 게임 사용자의 플레이 시간에 구조변화가 있는 것으로 나타났다. 또, 셧다운 제도가 실시된 이후,많은 사람들이 접속을 할수록,플레이 시간이 줄어드는 음의 관계가 나타남을 알 수 있었다.이 연구는 소셜 게임의 사용자들이 몇 가지 재미있는 특성을 지니고 있음을 보여준다.

키워드 : 네트워크 효과, 소셜 게임, 규제에 따른 변화ㄴ

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