

# CAN GOVERNMENT REGULATE AN EVIL ONLINE GAME?: AN EMPIRICAL ANALYSIS OF REGULATION POLICY EFFECTS USING VECTOR AUTOREGRESSION

Moonkyoung Jang, College of Business Administration, Seoul National University, Seoul, Korea, moonk@snu.ac.kr

Seongmin Jeon, Business School, Gachon University, Seongnam, Korea, smjeon@gachon.ac.kr

Jongil Kim, School of Law, Seoul National University, Seoul, Korea, thisishim@snu.ac.kr

Byungjoon Yoo, College of Business Administration, Seoul National University, Seoul, Korea, byoo@snu.ac.kr

## Abstract

*The objective of this study is to examine the effects of regulation policy on online gambling, an increasingly popular type of entertainment in the online game industry. Prior information systems (IS) studies on online game focus primarily on user behavior. However, there is a growing need to investigate the effects of regulation policy on dynamic changes of games or service providers instead of ad hoc heuristic approaches on individual behavior. Going beyond the approaches of previous studies, this study empirically tests the regulation policy effect with three theoretical perspectives: social influence, prior experience and perceived switching cost. A vector autoregression (VAR) methodology is used to forecast game usage and to model several patterns of the co-movement of online games. Evidence is also provided of strong Granger-causal interdependencies within games and service providers. This study provides one of the first empirical evidences that examine the effects of regulation policies on online game. In research methodology aspect, this study also introduces an exposition of VAR methodology in IS research. Therefore, it provides advanced knowledge on gambling behavior and helps develop suitable regulation policy to protect users of online gambling as well as to satisfy policy makers.*

*Keywords: online game, online gambling, regulation policy, policy effect, time series analysis, vector autoregression.*

# 1 INTRODUCTION

Can government defeat the evils of online game with a great policy? The objective of this study is to answer this question by revealing the true effects of regulation policy on online game. Online game is a fast-growing market that contains many categories such as arcade games, role-playing games (RPGs) and real-time strategy games (RTGs). Among these, one of the fastest growing categories is that of online gambling games. According to a report issued by the American Gaming Association (AGA), there are about 3,000 online gambling sites that offer various gambling games and these sites generate almost USD 30 billion in annual revenue (Stewart and Gray 2011). Although the online gambling industry has a huge economic volume, it is often considered a controversial one because some people think online game is a main cause in creating pathological gamblers, due to more easy access than traditional casino gambling (Cotte and Latour 2009). Therefore, many governments have enacted regulation policies to effectively control online gambling (Eadington 2004; Ma et al. 2014). However, the enactment of regulation policies is frequently a challenging task to policy makers because it is sometimes contradictory to public protection and personal freedom (Siemens and Kopp 2011). In this vein, numerous studies have been published to help make effective regulation policies in online gambling (Auer and Griffiths 2013; Gainsbury et al. 2013; Gainsbury et al. 2012; Gainsbury et al. 2014; Ma et al. 2014; Monaghan 2009; Siemens and Kopp 2011). However, most previous studies in this area have been focused on online gamblers' behavior with user-level data, while few attempts have been made to investigate the effects of regulation policies on online gambling with game- or company-level data. Moreover, those attempts are generally made through case study research and quantitative evidence is limited. In response to this limitation, this study empirically examines the effect of regulation policy on the dynamic changes of online gambling. In addition, it analyzes whether such regulation efforts effectively prevent addiction as is the legislative purpose of the government. It also checks for any side effects of the regulation policy. Therefore, the research questions are as follows:

- Does regulation policy effectively control online game? If so, what is the size of the effects?
- Does regulation policy have a similar influence on every game or player?
- Does regulation policy make dynamic changes in the online gambling industry?

To search for explanations to these research questions, this study employs vector autoregression (VAR) analysis. Many studies have utilized VAR to investigate policy effects in various areas such as monetary policy and freeway traffic policy (Awokuse and Bessler 2003; Bagliano and Favero 1998; Bernanke et al. 2005; Chandra and Al-Deek 2009; Heckman 2000; Sims 1986). In the context of online gambling, this study compares correlations and a ripple effect on each playtime trend of the top five online gambling games by using VAR at time points both before and after the policy regulation announcement.

The rest of this research article is organized as follows. Section 2 provides related literature to build the theoretical hypotheses. Section 3 presents a brief overview of the research context, the empirical data and the methodology that is adopted to validate the hypotheses. Section 4 shows the VAR test results and analysis. Finally, section 5 discusses the theoretical and practical implications of the results and conclusions.

## 2 LITERATURE REVIEW AND RESEARCH HYPOTHESES

This section discusses several factors from relevant literature such as social influence, objective of involvement and perceived switching cost. Based on this discussion, it develops the study hypotheses of the regulation policy effects on online gambling.

### 2.1 Social Influence

There are mixed views of acceptance and refusal of gambling. Most people perceive gambling as a relatively harmless entertainment within time and money limits, and play gambling sometimes with friends and families as an occasional leisure activity. On the other hand, other people think that social

responsibility and public health are important issues in gambling so the government should control gambling activities to prevent increasing the number of addictive gamblers (Watson et al. 2004; Grohman 2006). In this context, there is a rising interest in studying the effects of regulation policy. The important points are the regulation policy not only adjusts gambling activities but also changes public attitudes toward gambling. This is because the authority of the government has a huge power in public opinion and its rules enactment expresses a negative opinion of the government toward online gambling. Therefore, the regulation policy discourages people from gambling by reinforcing the negative perspective on gambling. This social influence has a big impact on actual gambling behavior and became social pressure to quit even though gambling is just one of many pastimes. For example, after Korean government announced gambling is one of the major addictive elements including drugs, alcohol and gambling, online gambling is considered as one of the important social problems (Business Korea 2013).

This view of social pressure is consistent with results in the unified theory of acceptance and use of technology (UTAUT) literature indicating that social influence is a significant factor that affects the behavioral intention to use information technology (Venkatesh et al. 2003). Hsu and Lu (2004) find that social influence is essential to users' online game usage behavior by explaining two factors of social influence, informational and normative influences. Informational influence happens when a user accepts information gained from other users. Normative influence happens when a user conforms to the expectations of others to acquire an incentive or avoid a penalty. One expects that online gambling can be explained by this view because online gambling is one with information technology and regulation policy is highly related to social influence. In addition, the total playing time of online gambling can be a proxy of actual online gambling behavior. Therefore, this leads to the first hypothesis:

*Hypothesis 1: From the perspective of social influence, regulation policy negatively impact on the total playing time of online gambling.*

## **2.2 Prior Experience**

It is generally known in information systems (IS) research that information technology (IT) usage behaviors can be different based on users' prior experience. For example, Castañeda et al. (2007) explain users' prior experience has the moderating effect on their intention to use a website by analyzing the levels of website and Internet experience. They find that experienced users think perceived usefulness is important but inexperienced users consider perceived ease of use as a more important factor. Taylor and Todd (1995) also find that there is a strong relationship between behavioral intention and actual behavior, and the degree of relationship is the difference based on users' experience. Experienced users have a stronger link between behavioral intention and actual behavior than do inexperienced users. In addition, inexperienced users easily overlook behavioral control in the formation of perceived intention, preferably depending on perceived usefulness. In the online gambling context, regulation policy can be a behavioral control that can have an impact on actual online gambling behavior and it can be different impact on online gambling behavior depending on users' prior experience. In addition, we can assume that more experienced users tend to play the higher level of online gambling. In fact, the instructions of online poker games usually recommend playing high level poker after playing proficiently on basic poker games. Therefore, this leads to the second hypothesis:

*Hypothesis 2: From the perspective of users' prior experience, regulation policy more impact on the total online gambling playing time of high-level games than that of low-level games.*

## **2.3 Switching Cost**

Switching cost is a well-known concept in diverse disciplines such as economics, marketing, etc. In the IS field, perceived switching cost is used for explaining loyalty or lock-in effect of an online-service platform and is known as having a big impact on imposing loyalty (Chen & Hitt 2002; Kim & Son 2009; Deng et al. 2010; Wang et al. 2011). In addition, there are many factors to strengthen or

weaken the switching cost such as past investment, economic value, and technical self-efficiency (Ray et al. 2012). The regulation policy can be a factor to change perceived switching costs of users. It would be especially plausible in this context because Korean government only bans access to gambling games of a certain website for 48 hours if users lose their game money more than KRW 100,000 within a day. Thus, the game players can simply avoid the prohibition by changing the gambling website if users want to play more online gambling games after they lose their game money limit in a certain website. Therefore, the regulation policy can decrease perceived switching cost of users and at the same time encourage changing gambling websites to avoid the prohibition. We assume that the switching behavior of users can be presented as the fluctuation of total playing of time per each company between before and after policy announcement. Thus, this leads to the third hypothesis:

*Hypothesis 3: From the perspective of switching cost, regulation policy has different impact on the total online gambling playing time of platforms.*

### 3 DATA AND METHOD

This section introduces the research context and presents a brief overview of the empirical data and VAR methodology that is applied to verify our hypotheses.

#### 3.1 Research Context

Korea has become a big player in the online game industry based on a high ratio of broadband Internet penetration, many Internet cafes and political factors to encourage online game development (Huhh 2008). According to a report of the Korea Creative Content Agency (KOCCA), the domestic online game market had a 28.6% market share of the world market, and experts are forecasting that it will keep its second place for the time being. Thus, the volume of online game exports is USD 2.4 billion, which is over 90% of the total game exports in 2012. Despite its industrial importance, Korean government declares that online game is the fourth major addictive element adding to drugs, alcohol and gambling (Business Korea 2013). In addition, the government has highly regulated online gambling after announcing detailed regulation criteria on November 29, 2012, since the government considers online gambling as a main cause of generating gambling addicts. The details of the regulation policy include that online gambling games should permit users:

- to authenticate their IDs whenever they access the game;
- not to buy game money more than KRW 300,000 (about USD 300) in a month;
- not to wager game money more than KRW 100,000 (about USD 10) in a game;
- not to access the game for 48 hours if they lose more than KRW 100,000 game money within a day;
- not to choose their opponents by themselves;
- not to run the game automatically.

#### 3.2 Data

The data set used for this study is obtained from Gametrics (<http://www.gametrics.com>), one of the major research data providers especially about the online game industry in Korea. The main object of this company is to provide various analyses based on users' behavior data related to many computer games for game business participants such as game company owners, game developers, marketers, etc. As shown in Table 1, this study focuses on the data from the top-five poker games in terms of the hours of game usage to find out the effect of regulation policy. The merit of using the game-level data set is that it is not necessary to conduct an extra survey or experiment for this study only and this game-level data set is obtained with comparative ease. Given the significant difference between each game in terms of its structure (speed of play, reward structure, role of skill, importance of strategy), the analysis based on each playing time can be insightful and warranted. The five poker games have almost a 75% share of the Korean poker game industry in November 2014. The remaining 25% is shared with seven companies and each company has less than a 5% share. To avoid potential selection

bias, we first use a dataset of twelve companies to check our hypotheses and find that there is no significant result difference between the dataset of all companies and that of top-five companies. Therefore, we decide to use the dataset of top-five poker games since the influence of the other seven companies on the Korean online gambling industry is too small to investigate. There are many similarities among the poker games in terms of rules, so the share of game users participating in each poker game can be changeable depending on the attractive features. Therefore, the online gambling game providers compete with each other to acquire more of the total online gambling players.

Name	Company	Release date	Market share
<i>Hangame lowbaduki</i>	<i>NHN</i>	2003-01-21	31.91%
<i>Netmarble poker</i>	<i>CJ E&amp;M</i>	2010-12-15	14.14%
<i>Hangame highlow</i>	<i>NHN</i>	2002-10-18	11.45%
<i>Hangame seven-poker</i>	<i>NHN</i>	2002-10-18	8.78%
<i>Pimang lowbaduki</i>	<i>Neowizgames</i>	2003-08-13	7.78%

Table 1. Top-five poker games

In addition, the original data set is daily playing time per each poker game, and we aggregate into weekly data. The reason why a week is chosen as the time unit of data analysis is because people tend to perform online poker games on a weekly basis. People often play online poker games after office hours or on weekends when they have extra time to rest. These behavior patterns are similar to other types of entertainment such as participating in hobbies such as hiking or watching movies. If the data set is analyzed on a daily basis, it is possible to miss meaningful results (Ma et al. 2014).

As illustrated in Figure 1, the trends of playing time move together in a similar pattern from December 19, 2010 to November 15, 2014. It seems that the five poker games have high correlations. Especially, four games (except *Hangame lowbaduki*) show high similarity of playing time trends.

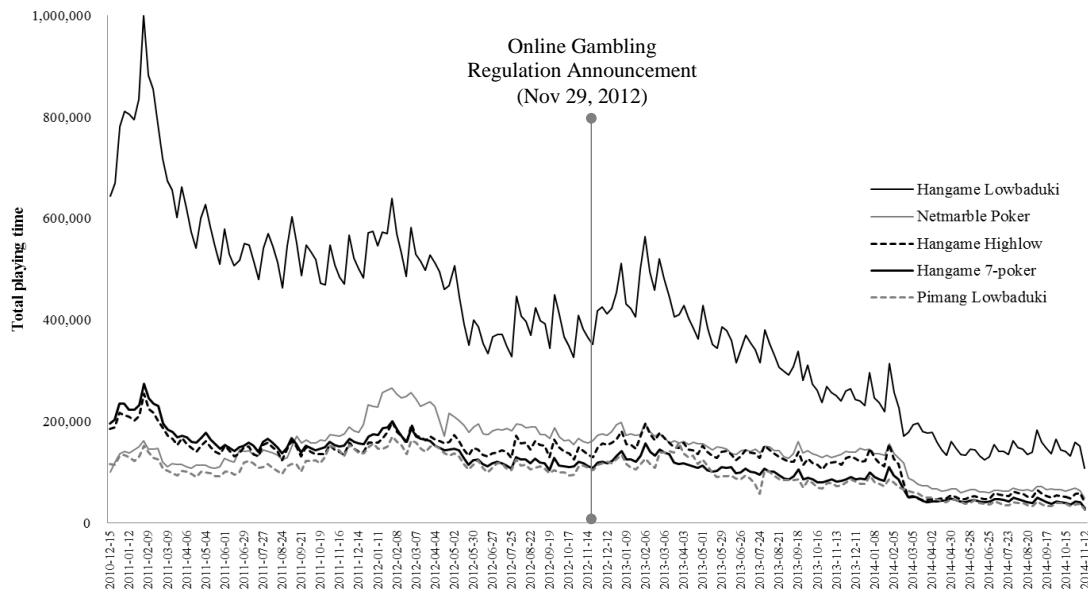


Figure 1. Weekly game playing time of each poker game

### 3.3 Model Specification

To develop the model for the hypotheses, VAR is applied, which is a rigorous empirical research method for analyzing the dynamic relationships among variables without strict economic theory restrictions, such as the assumption of exogenous variables (Cooley & Dwyer 1998). VAR represents a relationship among variables such as correlation and a ripple effect that can be inspected by evaluating impact volume when one variable affects the other valuables in the model. It is also good

to show the relationship that can change over time and is relatively easy to interpret (Enders 2008). In the case of the online gambling industry, many game providers are trying to have a greater proportion of total game players with a similar online gambling game style. Therefore, this study expects that VAR can successfully show the dynamic changes among the online gambling service providers.

Even though VAR does not have many strict theoretical restrictions, one needs to check the general property of the least squares estimator in a regression for time-series data. It is the assumption of a stationary stochastic process (Hamilton 1994). Therefore, the study conducts a unit root test to measure the stationarity of the five poker games' playing time by using the augmented Dickey-Fuller (ADF) test in E-views software. The test results shows that every level data set of each game is not stationary, while the first difference data set is stationary as illustrated in Table 2. The analysis using non-stationary data set may be spurious because non-stationary data set has unstable means, variances and co-variances. Thus, we choose the first difference data set of each game for this study.

	<i>Hangame lowbaduki</i>	<i>Netmarble poker</i>	<i>Hangame highlow</i>	<i>Hangame seven-poker</i>	<i>Pimang lowbaduki</i>
Level	Non-stationary	Non-stationary	Non-stationary	Non-stationary	Non-stationary
1st difference	Stationary	stationary	stationary	Stationary	stationary

*Table 2. ADF test results*

For the specification of the lag term, diagnostic checking is performed, selecting lag three (i.e. three weeks) among the several candidates based on the lowest Final Prediction Error (FPE) and Akaike Information Criterion (AIC) as shown in Table 3. Additionally, to check whether the data set needs a more sophisticated multiple time series analysis such as a vector error correlation model (VECM), a Johansen cointegration test is also conducted and the data set presents no significant cointegration. This result suggests that the VAR analysis is appropriate for this case.

Lag	FPE	AIC	SC	HQ
0	1.38E+39	104.3115	104.3954*	104.3455
1	1.09E+39	104.0761	104.5796	104.2800*
2	1.03E+39	104.0167	104.9399	104.3905
3	8.13E+39*	103.7818*	105.1245	104.3254
4	9.11E+39	103.8925	105.6549	104.6062

*Table 3. Lag selection*

## 4 EMPIRICAL ANALYSIS AND RESULTS

This section investigates the impact of the regulation policy with various perspectives. The study conducts dynamic forecasting and demonstrates interrelationship change by using VAR analysis. In detail, Granger causality analysis and impulse response function (IRF) analysis are reported as standard practices for VAR analysis (Stock & Watson 2001).

### 4.1 Social Influence Perspective

This study performs dynamic forecasting for the data after regulation policy announcements based on the data before regulation policy announcements. As shown in Figure 2, the model's predicted value is lower than the observed one until the second week of February 2014, while the predicted value is higher than the observed one around that point. The decreasing trends of predicted and observed values are similar, and particularly, the actual playing time drops sharply around the second week of February 2014. Around that time, the regulation policy is systemically applied to the *NHN* games that have the largest market share, so the total playing time drops sharply.

In addition, this study expects that the regulation policy will affect not only the total playing time by decreasing, but dynamics changes among online gambling games. Therefore, this study uses VAR analysis, specifically Granger causality analysis and IRF analysis, to investigate the interrelationship changes among five games.

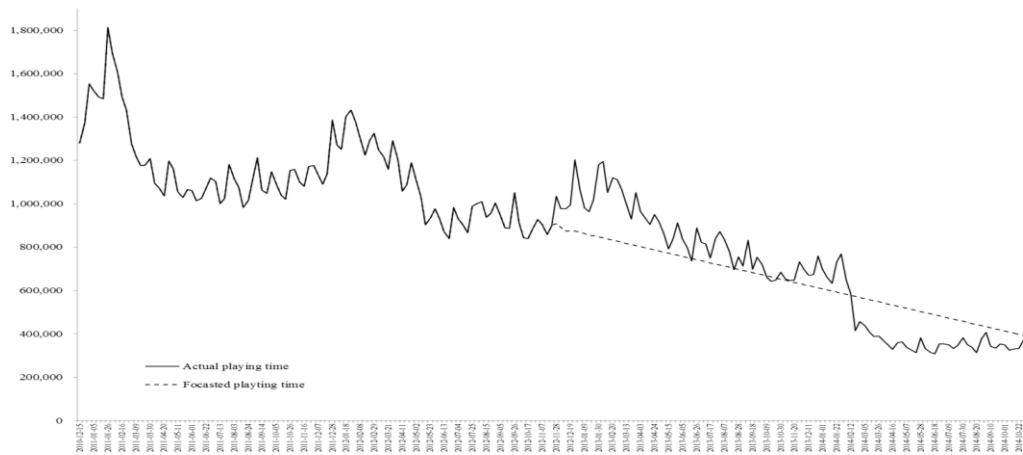


Figure 2. Forecast of total playing time

Granger causality test statistics indicates that the lagged variables of one variable affect the values of other variables in the VAR model (Granger 1969). The empirical data set is divided based on the day of the regulation policy announcement, and a Granger causality test is conducted for each data set to compare relationship changes among five games. Table 4 shows  $p$ -values of Granger causality tests, and each column of the table reveals that the effects of a particular game on all games. Before the announcement of regulation policy, it is evident that *Hangame highlow* and *Hangame seven-poker* are influential games in the online gambling industry. After the announcement of regulation policy, *Hangame lowbaduki* and *Netmarble poker* had slightly lower impact on other games. Furthermore, based on  $p$ -values of Granger causality tests, we draw a reduced form model of interactions among five poker games as shown in Figure 3. It shows that the interrelationship became much simpler after the announcement of the regulation policy. For example, before the announcement, *Hangame lowbaduki*, *Hangame seven-poker* and *Hangame highlow* have Granger causality to each other. However, after the announcement, only *Hangame lowbaduki*, *Hangame seven-poker* and *Netmarble poker* are related.

	Affected Games	Affecting Games				
		$\Delta$ ( <i>Hangame lowbaduki</i> )	$\Delta$ ( <i>Netmarble poker</i> )	$\Delta$ ( <i>Hangame highlow</i> )	$\Delta$ ( <i>Hangame seven-poker</i> )	$\Delta$ ( <i>Pimang lowbaduki</i> )
Before	$\Delta$ ( <i>Hangame lowbaduki</i> )		0.1566	0.0003*	0.0042*	0.0361*
	$\Delta$ ( <i>Netmarble poker</i> )	0.5659		0.275	0.1965	0.7462
	$\Delta$ ( <i>Hangame highlow</i> )	0.2313	0.0949		0.0164*	0.0296*
	$\Delta$ ( <i>Hangame seven-poker</i> )	0.0484*	0.0514	0.0014*		0.5498
	$\Delta$ ( <i>Pimang lowbaduki</i> )	0.2008	0.0865	0.0033*	0.0058*	
After	$\Delta$ ( <i>Hangame lowbaduki</i> )		0.0295*	0.2717	0.9025	0.0684
	$\Delta$ ( <i>Netmarble poker</i> )	0.2496		0.2839	0.4398	0.6215
	$\Delta$ ( <i>Hangame highlow</i> )	0.2522	0.0632		0.9497	0.2622
	$\Delta$ ( <i>Hangame seven-poker</i> )	0.5176	0.5081	0.797		0.1888
	$\Delta$ ( <i>Pimang lowbaduki</i> )	0.0177*	0.3973	0.5619	0.4942	

Notes.  $H_0$ : Column variables do not Granger-cause row variables (or sets). \* indicates  $p < 0.05$ .

Table 4. Granger causality test for five games

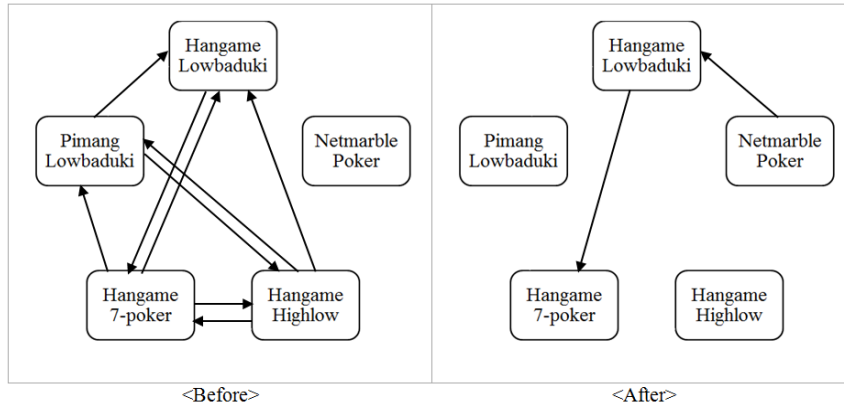
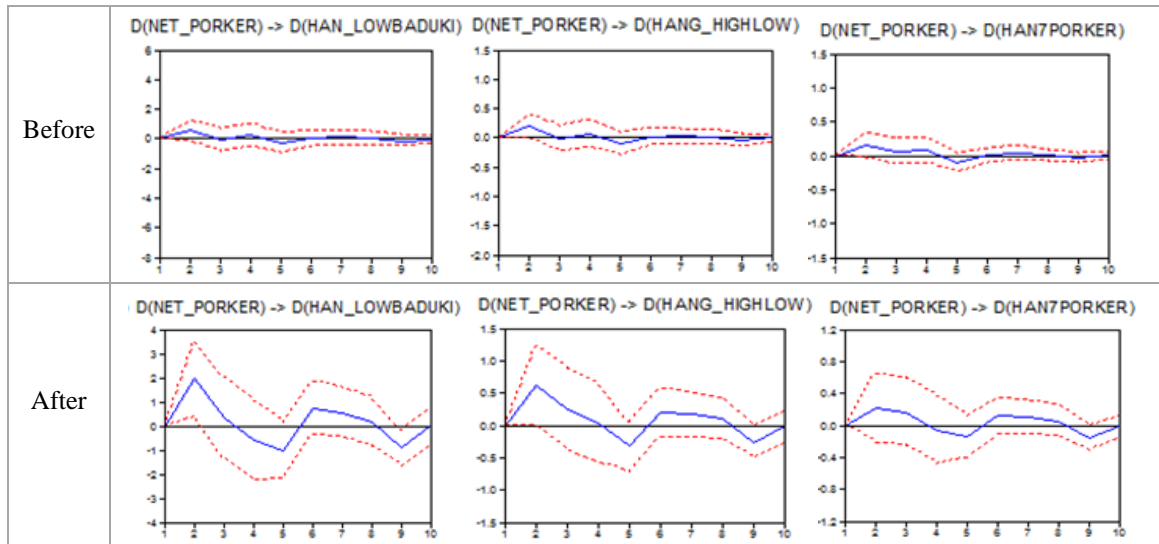


Figure 3. Reduced form model of interactions among poker games

Additionally, this study conducts IRF analysis that illustrates the response of current and future values of variables to one unit increase in the current value of one of the error terms in the VAR model, assuming that the error term returns to zero in following periods and all other errors are zero (Stock & Watson 2001). This analysis is an alternative way to measure the influence of one variable on another variable in the VAR model. Each IRF plot can be interpreted as showing the corresponding response of a variable over time, given one unit increase of a responded variable at time zero. Overall, the effects magnitude of one game to another tended to increase after the regulation policy announcement. All possible IRFs are provided in Appendix. For example, as shown in Figure 4, before the announcement, the impact of *Netmarble poker* on *Hangame poker*-games is about 0.3 at the two week horizon. This implied one unit increase in the first difference of *Netmarble poker* at time zero results on average and about 0.3 unit increase in that of *Hangame poker* games two weeks later. On the other hand, after the announcement, the impact of *Netmarble poker* on *Hangame poker*-games is a value of more than 0.5. One unit increase in the first difference of *Netmarble poker* at time zero results on average and about two units increase in that of *Hangame lowbaduki* two weeks later.



Notes. X-axis it the forecast horizon (in weeks), and y-axis is the forecasted response of the dependent variable to a unit shock in the corresponding error term. Plots include bootstrapped 95% confidence intervals.

Figure 4. Forecast error impulse responses of Netmarble poker (impulse → response)

Based on the comparison between the data of before and after the regulation policy announcement using VAR analysis, this study discovers that the total time of online gambling decreases gradually and the interaction among the top five poker games is going to be small and simple. However, it is



hard to simply say that these results show the regulation policy is successfully controlling and preventing an increase in the number of addictive gamblers. It can arouse a balloon effect (Mora 1996; Friesendorf 2005). For instance, the repression of legal online gambling can increase the number of illegal online gambling sites. People who are influenced by negative perspectives on online gambling can more easily tend to use illegal online gambling sites secretly because they are conscious of the way other people are looking at them. Indeed, Korea Communications Standards Commission (KCSC) reports that the number of deliberately illegal online gambling sites increase from 36,282 to 46,321 during last year (Etnews, 2015).

## 4.2 Prior Experience Perspective

The regulators have frequently considered online gamblers as a homogeneous group. However, many researchers in IS have revealed different demographics, personality traits and psychological dimensions of online gamblers based on their online gambling activities (Ma et al. 2014). Therefore, this study investigates the differences of the regulation effects by users' prior experience as described in hypothesis 2.

First, the data set is divided into two groups based on game level to investigate the effect of user experience on regulation policy. It is assumed that more experienced users tend to participate in the higher level of poker games. The five poker games are categorized into two groups: basic and advanced games. The basic poker games are Seven-poker, so-called Seven-card stud, while the advanced games are *Lowbaduki* and *Highlow*, which require very high level of skills. Many online poker instructions commonly recommend to play *Lowbaduki* or *Highlow* poker after playing skillfully on basic poker games such as Seven-poker (Online Poker 2011; Teaching poker 2002). Thus, this study categorizes *Netmarble poker* and *Hangame seven-poker* as basic games and *Hangame lowbaduki*, *Hangame highlow* and *Pimang lowbaduki* as advanced games.

Then, dynamic forecasting is performed for the playing time after regulation policy announcement based on the data before regulation policy announcement. Figure 5 shows the model for the basic games forecasted higher than observed value. The model for the advanced games predicts lower than observed value, and interestingly it shows a negative predicted value after April 2014.

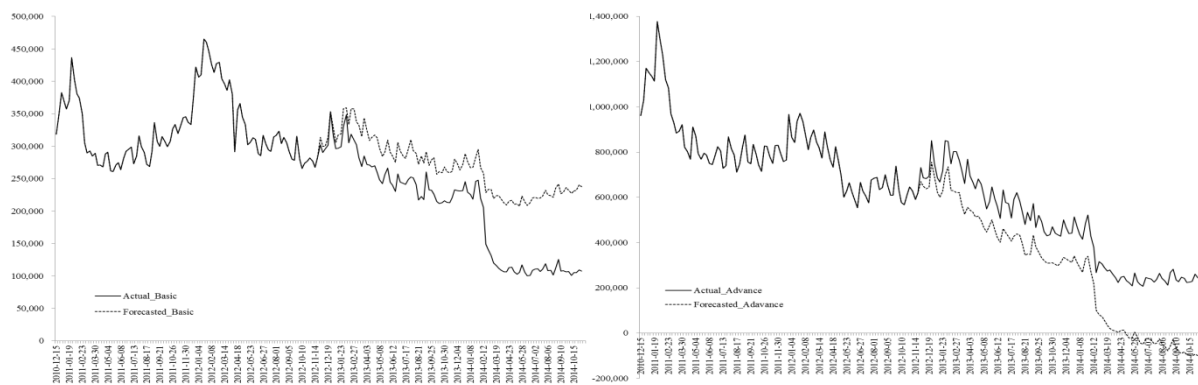


Figure 5. Forecast of total playing time for basic and advanced games

Furthermore, dynamics changes are examined between these two categories after the announcement of regulation policy using Granger causality analysis and IRF analysis. The first difference data set of two groups is stationary and the proper lag of VAR model is three according to the lag selection criteria. Based on  $p$ -values of Granger causality tests, this study draws a reduced form model of interactions between two groups as in Figure 6. It presents the relationship change after the announcement of the regulation policy. Before the announcement, the playing time of the basic game is Granger cause of the advanced game one, whereas two becomes Granger causes each other after the announcement.

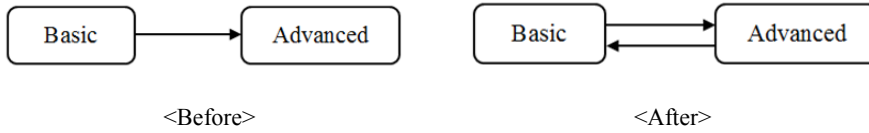


Figure 6. Reduced form model of interactions between groups

This study conducts IRF analysis as another way to check the influence of one variable on another variable. The impact of the basic game is maintained longer after the regulation policy as shown in Figure 7. For example, before the announcement, the impact of the basic game on itself is 0.9 unit at the one week horizon, which indicates one unit increase in the first difference of the basic game at time zero results on average in approximately 0.9 unit increase in that of the basic game one week later. All responses before the policy converge to zero over time within approximately two weeks, whereas all responses after the policy meet to zero over time in around four weeks.

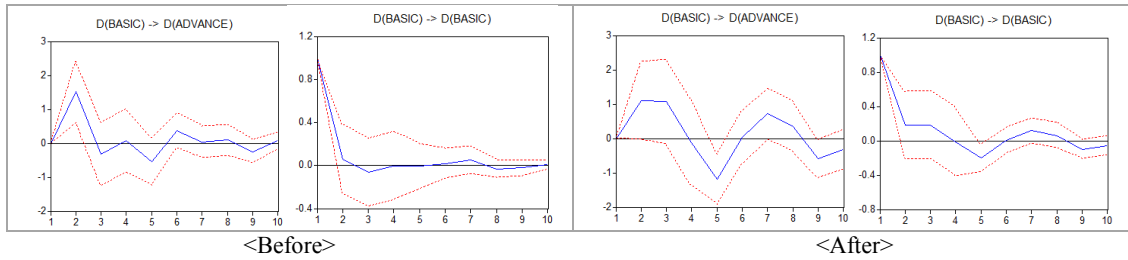


Figure 7. Forecast error impulse responses for basic and advanced games

### 4.3 Perspective of Switching Cost

For hypothesis 3, to analyze the regulation policy effect on users' behavior of changing gambling websites, this study categorizes five poker games into three groups according to online gambling platforms. Then dynamic forecasting is performed for the playing time as illustrated in Figure 8. The forecasted value of *NHN* is much lower than actual value, whereas the forecasted value of other companies is higher than actual value. It seems that the regulation policy had relatively low impact on games of the company with the largest market share. The forecasting value of *NHN* drops sharply while the actual value falls relatively gradually and this result can be a consequence of greater perceived switching cost of *NHN* game players than that of other games. The players who have greater perceived switching cost are comparatively hard to change game websites.

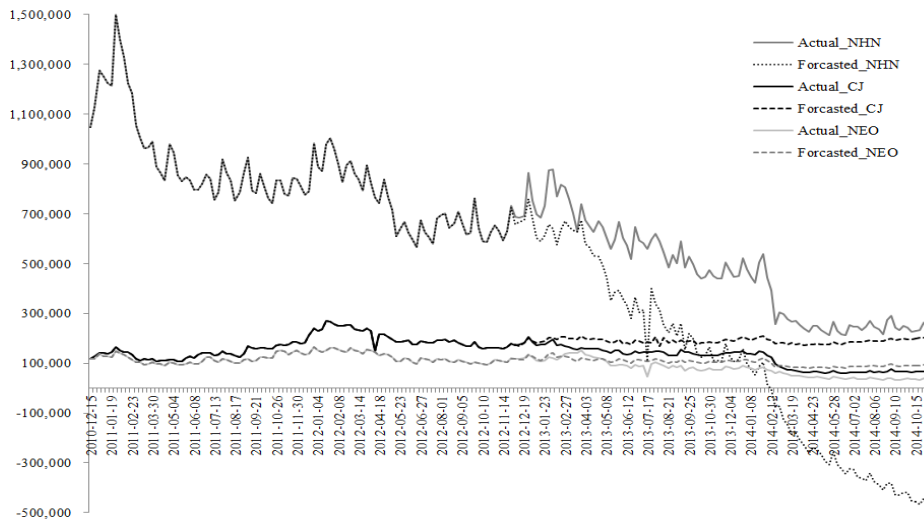


Figure 8. Forecast of total playing time for *NHN* game

Therefore, this study tries to check dynamics changes among three platforms after the announcement of regulation policy using Granger causality analysis and IRF analysis. As illustrated in Figure 9, a

reduced form model is drawn of interactions between three companies based on  $p$ -values of Granger causality tests. It presents the dynamic changes after the announcement of the regulation policy. Before the announcement, the playing time of *Neowizgames* is Granger cause of *NHN* games, whereas the playing time of *NHN* is Granger cause of *Neowizgames* and that of *CJ* is Granger cause of *NHN* and *Neowizgames* after the announcement.

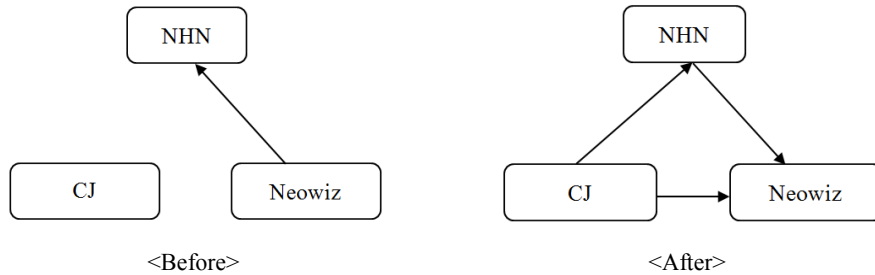


Figure 9. Reduced form model of interactions among service providers

Furthermore, IRF analysis is conducted to check the influence of one company on another company. Overall, the effects magnitude of one game to another tends to increase after the regulation policy announcement. For example as shown in Figure 10, before the announcement, the impact of *CJ* on *NHN* is about one at the two week horizon, which implies one unit increase in the first difference of *CJ* at time zero results on average of about one unit increase in that of *Neowizgames* two weeks later. On the other hand, after the announcement, the impact of *CJ* on *NHN* is a value of about two. One unit increase in the first difference of *CJ* at time zero results on average in about two units increase in that of *NHN* two weeks later. In addition, all responses before the policy converge to zero over time within approximately two weeks, whereas all responses after the policy meet to zero over time in around four weeks.

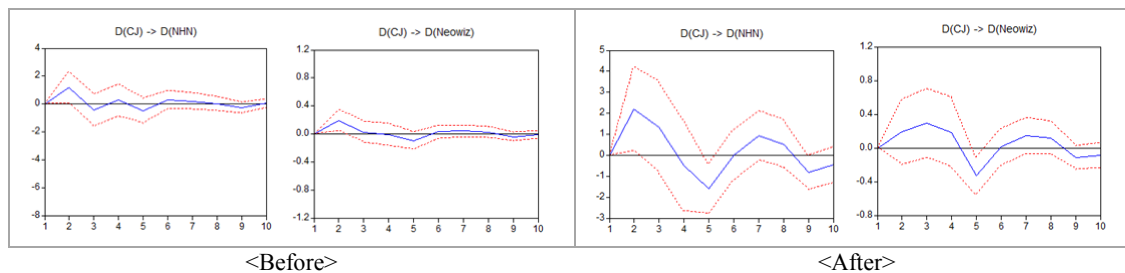


Figure 10. Forecast error impulse responses for service providers

## 5 CONCLUSIONS

This study provides an advanced understanding of gambling behavior and helps in developing appropriate regulation policy to protect online gamblers and to satisfy policy makers. This study specifically suggests three theoretical perspectives: social influence to investigate the regulation policy impact; prior experience to find the difference of the regulation effect by users' prior experience; and perceived switching cost to consider the regulation policy effect on users' behavior of changing gambling website.

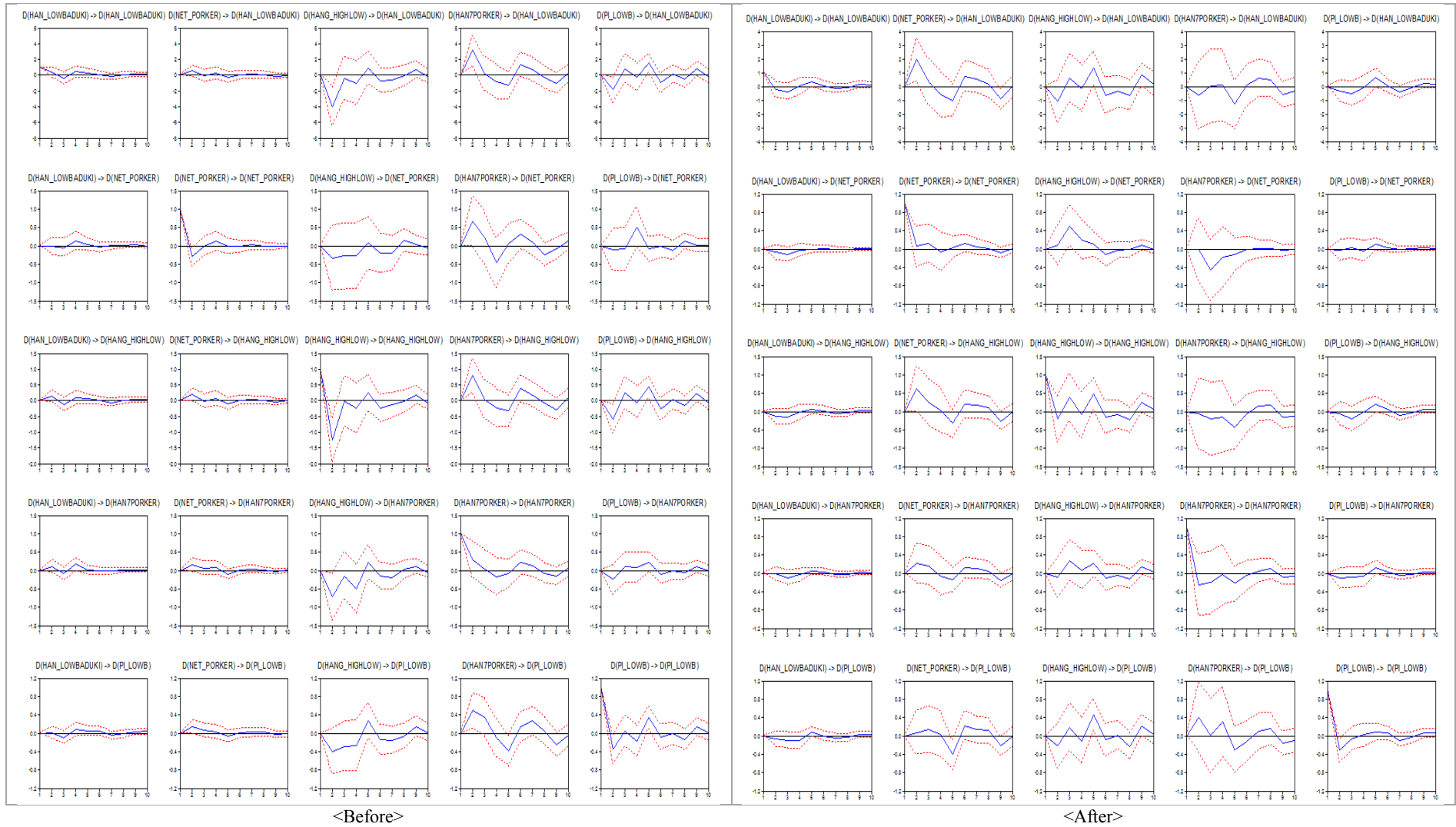
We empirically investigate the effect of the regulation policy using VAR methodology. The results of VAR indicate that the imposition of the regulation policy contributes in decreased playing time and significantly changes interrelationships among games. In addition, the policy impacts are different depending on user groups with different levels of prior experience. Furthermore, it significantly affects the users' behavior of changing platform. Therefore, the policy makers should consider online gamblers as a heterogeneous group to effectively prevent creating pathological gamblers as well as to successfully protect personal freedom.

However, this study does not come without limitations. First, it uses game-level data instead of user-level data. To check consistency, more study is planned to obtain individual level data of each game

with more investigation to strengthen the current results. Furthermore, although we form hypothesis 3 based on switching cost perspective for the parsimonious model, another point of views can be also interesting such as multi-homing (Rochet and Tirole, 2003). We are expecting that this point of view can answer how the company which has the largest market share has less impact than the other companies. More study is planned to investigate with this perspective after obtaining individual level data of each game. In addition, we investigate how the regulation policy affects the change of users' gambling behavior and the dynamic change of online gambling industry using VAR methodology. To check reliability, more study is needed such as Difference-in-Difference analysis for future research. Moreover, it uses the online game data from Korea only. It is possible to overlook cultural distinctive characteristics in different countries.

Despite these limitations, we believe that our study provides one of the first empirical evidences that examine the effects of regulation policies on online game. In research methodology aspect, our study also introduce an exposition of VAR methodology in IS research.

## Appendix. IRF (Impulse→Response) for Five Games



## REFERENCES

- Auer, M., and M. D. Griffiths. (2013). Voluntary limit setting and player choice in most intense online gamblers: An empirical study of gambling behaviour. *Journal of Gambling Studies* 29 (4):647-660.
- Awokuse, T. O., and D. A. Bessler. (2003). Vector autoregressions, policy analysis, and directed acyclic graphs: An application to the US economy. *Journal of Applied Economics* 6 (1):1-24.
- Bagliano, F. C., and C. A. Favero. (1998). Measuring monetary policy with VAR models: An evaluation. *European Economic Review* 42 (6):1069-1112.
- Bernanke, B. S., J. Boivin, and P. Elias. (2005). Measuring the effects of monetary policy: A factor-augmented vector autoregressive (FAVAR) approach. *Quarterly Journal of Economics* 120 (1):387-422.
- Business Korea. (2013). Online game addiction bill: Undergoing rapid legislation amid blowing-up opposition. Retrieved from <http://www.businesskorea.co.kr/article/2717/online-gaming-addiction-bill-undergoing-rapid-legislation-amid-blowing-opposition>
- Castañeda, J. A., F. Muñoz-Leiva, and T. Luque. (2007). Web acceptance model (WAM): Moderating effects of user experience. *Information & Management* 44 (4):384-396.
- Chandra, S. R., and H. Al-Deek. (2009). Predictions of freeway traffic speeds and volumes using vector autoregressive models. *Journal of Intelligent Transportation Systems* 13 (2):53-72.
- Chen, P.-Y., and L. M. Hitt. (2002). Measuring switching costs and the determinants of customer retention in Internet-enabled businesses: A study of the online brokerage industry. *Information Systems Research* 13 (3):255-274.
- Cooley, T. F., and M. Dwyer. (1998). Business cycle analysis without much theory: A look at structural VARs. *Journal of Econometrics* 83 (1):57-88.
- Cotte, J., and Kathryn A. Latour. (2009). Blackjack in the kitchen: Understanding online versus casino gambling. *Journal of Consumer Research* 35 (5):742-758.
- Deng, Z., Y. Lu, K. K. Wei, and J. Zhang. (2010). Understanding customer satisfaction and loyalty: An empirical study of mobile instant messages in China. *International Journal of Information Management* 30 (4):289-300.
- Eadington, W. R. (2004). The future of online gambling in the United States and elsewhere. *Journal of Public Policy and Marketing* 23 (2):214-219.
- Enders, W. (2008). *Applied Econometric Time Series*: John Wiley & Sons.
- Etnews. (2015). Need to change the regulation policy on online gambling (in Korean). Retrieved from <http://www.etnews.com/20150213000164>
- Friesendorf, C. 2005. Squeezing the balloon? Crime, law and social change 44 (1):35-78.
- Gainsbury, S., J. Parke, and N. Suhonen. (2013). Consumer attitudes towards Internet gambling: Perceptions of responsible gambling policies, consumer protection, and regulation of online gambling sites. *Computers in Human Behavior* 29 (1):235-245.
- Gainsbury, S., R. Wood, A. Russell, N. Hing, and A. Blaszczynski. (2012). A digital revolution: Comparison of demographic profiles, attitudes and gambling behavior of Internet and non-Internet gamblers. *Computers in Human Behavior* 28 (4):1388-1398.
- Gainsbury, S. M., N. Suhonen, and J. Saastamoinen. (2014). Chasing losses in online poker and casino games: Characteristics and game play of Internet gamblers at risk of disordered gambling. *Psychiatry Research* 217 (3):220-225.
- Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica: Journal of the Econometric Society*:424-438.
- Grohman, C. (2006). Reconsidering regulation: A historical view of the legality of Internet poker and discussion of the Internet gambling ban of 2006. *Journal of Legal Technology Risk Management*.
- Hamilton, J. D. (1994). *Time Series Analysis*. Vol. 2: Princeton University Press Princeton.
- Heckman, J. J. (2000). Causal parameters and policy analysis in Economics: a twentieth century retrospective. *Quarterly Journal of Economics* 115 (1):45-97.
- Hsu, C.-L., and H.-P. Lu. (2004). Why do people play on-line games? An extended TAM with social influences and flow experience. *Information & Management* 41 (7):853-868.
- Huhh, J.-S. (2008). Culture and business of PC bangs in Korea. *Games and Culture* 3 (1):26-37.

- Kim, S. S., and J.-Y. Son. (2009). Out of dedication or constraint? A dual model of post-adoption phenomena and its empirical test in the context of online services. *Management Information Systems Quarterly* 33 (1):5.
- KOCCA. (2013). 2013 White paper on Korean games: Guide to Korean games industry and culture. Korea Creative Content Agency.
- Ma, X., S.-H. Kim, and S.-S. Kim. (2014). Online gambling behavior: The impacts of cumulative outcomes, recent outcomes, and prior use. *Information Systems Research* 25 (3):511-527.
- Ministry of Culture, Sports and Tourism. (2012). Draft notice of web-board game regulation policy. Retrieved from [http://www.mcst.go.kr/web/s\\_data/ordinance/legislation/legislationView.jsp?pSeq=1063&pMenuCD=0405030000&pCurrentPage=1&pType=&pSearchType=01&pSearchWord=%EA%B2%8C%EC%9E%84](http://www.mcst.go.kr/web/s_data/ordinance/legislation/legislationView.jsp?pSeq=1063&pMenuCD=0405030000&pCurrentPage=1&pType=&pSearchType=01&pSearchWord=%EA%B2%8C%EC%9E%84)
- Monaghan, S. (2009). Responsible gambling strategies for Internet gambling: The theoretical and empirical base of using pop-up messages to encourage self-awareness. *Computers in Human Behavior* 25 (1):202-207.
- Mora, F. O. 1996. Victims of the balloon effect: Drug trafficking and US policy in Brazil and the Southern Cone of Latin America. *The Journal of Social, Political, and Economic Studies* 21 (2):115.
- Online Poker. (2011). Types of poker. Retrieved from <http://www.onlinepoker10.com/types-of-poker-games>
- Ray, S., S. S. Kim, and J. G. Morris. 2012. Research Note-Online Users' Switching Costs: Their Nature and Formation. *Information Systems Research* 23 (1):197-213.
- Rochet, J. C., and Tirole, J. (2003). Platform competition in two-sided markets. *Journal of the European Economic Association*, 1(4), 990-1029.
- Siemens, J. C., and S. W. Kopp. (2011). The influence of online gambling environments on self-control. *Journal of Public Policy & Marketing* 30 (2):279-293.
- Sims, C. A. 1986. Are forecasting models usable for policy analysis? *Federal Reserve Bank of Minneapolis Quarterly Review* 10 (1):2-16.
- Stewart, D. O., and L. Gray. (2011). Online gambling five years after UIGEA. Washington, DC: American Gaming Association.
- Stock, J. H., and M. W. Watson. (2001). Vector autoregressions. *Journal of Economic perspectives*:101-115.
- Taylor, S., and P. Todd. (1995). Assessing IT usage: The role of prior experience. *MIS Quarterly*:561-570.
- Teaching poker. (2002). Types of poker. Retrieved from <http://teachingpoker.com/Types.html>
- Venkatesh, V., M. G. Morris, G. B. Davis, and F. D. Davis. 2003. User acceptance of information technology: Toward a unified view. *MIS Quarterly*:425-478.
- Watson, S., P. Liddell Jr, R. S. Moore, and W. D. Eshee Jr. (2004). The legalization of Internet gambling: A Consumer Protection Perspective. *Journal of Public Policy & Marketing* 23 (2):209-213.