

KAIST Business School

WORKING PAPER SERIES

Are There Too Many Superheroes? Analysis of the Social Distance in Massive Multiplayer Online Role Playing Game

Myunsoo Kim
Byungtae Lee

September, 2013
KCB-WP-2013-019



This paper can be downloaded without charge at:

KAIST Business School Working Paper Series Index:

http://www.business.kaist.ac.kr/main.asp?cate_code=20091008101934&gourl=/program/case_work.asp&resource=3&cate=2

and

<http://www.ssrn.com/link/KAIST-Business-School.html>

Social Science Research Network eLibrary:

<http://papers.ssrn.com/sol3/displayabstractsearch.cfm>

©2007 All works posted here are owned and copyrighted by the author(s).

Papers may be downloaded for personal use only.

Are There Too Many Superheroes? Analysis of the Social Distance in Massive Multiplayer Online Role Playing Game

Myunsoo Kim

College of Business

Korea Advanced Institute of Science and
Technology

85 Huegiro, Dongdaemoon-gu

Seoul, Korea 130-722

jamaica@business.kaist.ac.kr

Byungtae Lee

College of Business

Korea Advanced Institute of Science and
Technology

85 Huegiro, Dongdaemoon-gu

Seoul, Korea 130-722

btlee@business.kaist.ac.kr

Abstract

This paper suggests a computational model which investigates the sustainability of MMORPGs from the social distance perspective by considering the major differences of the virtual world in an MMORPG and the real world. The effects of social distance on the actual playtime are empirically tested. The analysis results suggest that social distance can initiate a positive feedback of abandonment, resulting in the rapid collapse of the number of players. Increasing uncertainty in rewarding players' effort may have better results for MMORPG managers in the long run, since the managers care about profits, not social welfare. Also, a fine-tuned retirement plan may be vital to MMORPG sustainability, because MMORPG players usually do not retire by natural causes such as growing old. This paper offers a relatively new approach by combining characteristics of MMORPG and social distance with both a computational model and empirical support.

Introduction

World of Warcraft (WOW) is a stellar example of a long-running and successful Massively Multiplayer Online Role Playing Game (MMORPG) that was drawing more than 10 million users as of 2011.¹ Its latest expansion pack “Mists of Pandaria” sold 2.7 million copies within the first week of its release². According to MMOData.net, there are about 22 million active subscriptions in major MMORPG services³, and total spending exceeds \$12 Billion⁴ as of 2012.

The big success of the MMORPG industry encouraged many researchers to investigate the motivations for playing the game. Reeves and Read (2009) suggested that MMORPGs provide combined fun from both personal interactions and social interactions, and the synergies are the reasons behind the commercial success of MMORPGs. Personal interactions in MMORPGs are further categorized into achievement, immersion and exploration. Social interactions include competition and socializing. Other researchers also suggested similar motivations from both personal and social interactions to explain why people enjoy MMORPGs so much (Choi and Kim 2006, 2009; Park, 2007).

Since MMORPGs provide “massive” online interactions, they often provide and maintain their own social structures and social status. People make groups and social hierarchies like guilds to achieve common goals, from virtual castle siege to real world marriage (Ducheneaut et al., 2007). Many researchers suggested that social interaction and achieving better social status are the major motivations

¹ http://en.wikipedia.org/wiki/World_of_Warcraft#cite_note-sub5-11

² http://en.wikipedia.org/wiki/World_of_Warcraft:_Mists_of_Pandaria#cite_note-36

³ <http://users.telenet.be/mmodata/Charts/TotalSubs.png>

⁴ <http://www.superdataresearch.com/global-mmo-games-spending-exceeds-12bn/>

for playing MMORPGs (Choi and Kim, 2009; Ducheneaut et al., 2007; Jakobsson and Taylor, 2003; Lazzaro 2004; Yee, 2002).

However, the existence of social interactions and social status in MMORPGs inevitably suggests that social distance also exists. In the real world social economics, social distance is defined as the difference between one's recognized efforts and average recognized efforts of all members in the society and social status is a form of social reward given by the society according to the member's social distance (Arrow, 1972; Akerlof, 1976). The same concept can be applied to MMORPGS, because it provides extrinsic rewards for the efforts of players, usually with stronger avatar (Bartle 2004b). In a role playing game, the avatar's relative strength is typically represented as the avatar's level (Baron 1999; Brown and Bell 2004; Jakobsson and Taylor 2003). A high level avatar can cast a stronger spell, wield a stronger sword, and in MMORPGs, it can help other players with such abilities. Therefore, a strong thus high level avatar is an extrinsic reward for the player's efforts given by the game system and it is recognized by other players. If one's recognized efforts are lower than the society's norm, which is usually modeled as average efforts of all the member of the society, social distance is negative and society penalizes her with low social status and if one's recognized efforts are higher thus social distance is positive, the society rewards her with high social status (Akerlof 1997; Freshman and Weiss 1998). In an MMORPG, such penalties and rewards can be given by other players since a relatively low level avatar (and its owner) may not be so welcomed in a hunting party, an army preparing castle siege and even as trading partners, while a relatively high level avatar is expected to be welcomed in almost all situations.

Some game magazines and players have identified social distance as a critical factor, since it can cause players to discontinue playing an MMORPG. According to the news article, "Why new players give up playing," from the Korean online MMORPG magazine Onlifezone,⁵ a typical complaint is that "there are too many high level (thus better than me) users so I don't think I can catch up." In an article from the

⁵ <http://www.onlifezone.com/4144011>

Korean online gaming news service Danawa, the social distance between new and old players was cited as a major reason for the industry's lack of new players.⁶ However, to the best of our knowledge, social distance and its effects on the sustainability of MMORPG has not been addressed properly in related academic fields. We argue that in the social distance perspective, MMORPGs are different to the real world in the following characteristics, and thus they can be academically challenging problems to analyze and can affect the sustainability of MMORPGs significantly.

First, the number of players endogenously fluctuates. In the real world, society members cannot easily drop out from a society or move to another society even if they do not satisfied with the current social status. Many real world social economic studies did not consider that the number of members can change (Akerlof 1997, 1980; Arrow, 1972; Freshman and Weiss 1998). Akerlof (1980)'s model allowed a member can choose unemployment if the expected social status is not worth the effort, however, the member still gets negative utility from low social status as they still remain in the society. However, in MMORPGs, a player can simply choose not to play the game if her current social status is low enough. This may significantly threaten the sustainability of MMORPGs, because if the player with the lowest social status drops out, the average recognized efforts increases, and some other the player becomes the one with the new lowest social status and her social distance widens. This may create positive feedback or chain reaction in abandonment, in conjunction with reduced fun from social interaction because of the smaller network size, thus may collapse the entire MMORPG.

The second major difference is that MMORPGs are private businesses and thus managers want to maximize the profit, not social welfare. In traditional social economics studies, implications are focused on maximizing social welfare, and managing social distance is important to set the right amount of incentives for members of the society to maximize their production (Arrow, 1972; Akerlof, 1976). However, in MMORPGs productions are virtual goods such as magic swords and cursed armor, and they

⁶ http://news.danawa.com/News_List_View.php?nSeq=1427239

cannot be directly converted into the game service provider's profit. Therefore to MMORPG managers maximizing the number of subscribers can be more important than the virtual productions. This clear difference in the objective functions of intended audiences with traditional real world social economics requires different models and may yield different implications.

The third is that the virtual world presented by MMORPGs are fully designed by game developers, including the law of physics (Simpson 1999). In the real world social distance perspective, accurately measuring personal efforts is important to improve incentives for the members although it may be costly. It is because in the real world there are so many ways to innovate and contribute to the society. In MMORPGs game developers designed what activities are available, how they should be recognized in the game system and how it should be rewarded, thus can perfectly measure players' effort and reward it without any errors. However, too much precision in recognizing the efforts under limited innovation opportunities can hurt the game's profitability because there are too few disturbances in social status and the new or less resourceful players may never catch up incumbent players with high social status and eventually give up playing the game.

The fourth difference is that MMORPGs are artificially created, thus less affected by the law of nature. In the real world, all the mightiest kings could not overcome their mortality, and dictators were overthrown by angry citizens. The real world mandatory retirements are usually based on age, based on the assumption that over-aged workers have less potential to contribute. Therefore, social distance can be controlled by natural causes to some extent. In MMORPGs, such real-world mortality has much less effect within the lifetime of the service and high level incumbent players may continue to build up their social status throughout the entire lifetime of the service. Thus it may be more difficult to manage social distance in MMORPGs and the managers may have to artificially emulate it.

We argue that these four major differences in the perspective of social distance are both academically challenging problems and can generate valuable implications for MMORPG managers. This paper aims to investigate the effects of players' social distance on the sustainability of MMORPGs.

In the following section, literature is reviewed and hypotheses are developed. Section 3 introduces the computational model and related analysis. Section 4 shows results from an empirical test on how social distance affects MMORPG players' behavior. The final section includes discussions and summaries regarding future research opportunities.

Literature Review and Hypotheses Development

MMORPG and Social Interactions

In MMORPGs, players use avatars to interact with other avatars and artificial environments (Jung and Lee, 2012). The virtual world in an MMORPG is "highly planned by the designers," and the players must follow their rules and systems to become successful and powerful avatars (Simpson 1999). Designers often provide avatar development systems that provide extrinsic rewards, such as levels and experiences that are linked to players' activities such as huntings and completing quests (Bartle 2004b). In traditional single player role playing games, those extrinsic rewards works as payoffs from personal interaction.

However, in MMORPGs, these extrinsic rewards can also be used by other players to measure individual players' efforts (Burgoyne and Lewis 1994; Walster et al. 1973). Accumulation of rewards results in the status as a high-level avatar with superior power. Since the avatar's potential power can be seen by other players as the avatar's level, a powerful avatar can attract positive reactions from other players that enhance his or her self-esteem (Baron 1999; Brown and Bell 2004; Jakobsson and Taylor 2003). In this case, becoming a powerful avatar may result in positive social payoffs as well as a personal payoff (Choi and Kim 2006).

Many studies found out some players regarded social interactions and social payoffs as equally important as personal interactions and considered the opportunity to interact with a large number of players as beneficial. Park (2007) suggested that traditional video games only have to provide personal interactions, while MMORPGs should provide quality social interactions to ensure that players enjoy the game.

Individuals can hunt together with greater efficiency, engage with more trading partners, and talk with a group (Ducheneaut et al. 2006, 2007). Choi and Kim (2009) surveyed MMORPG players and found out that they play the game because within the game they are important and likeable to others. Ducheneaut et al. (2007) examined the sustainability of guilds within an MMORPG, and they discovered that these successful guilds have higher density in social interactions. Jakobsson and Taylor (2003) discovered that some players play the game to be admitted to a high-level guild. One player stated, “It’s the people that are addictive, not the game” (Lazzaro 2004). Yee (2002) observed that avatars that are decorated with items that depict power broadcast their elevated social status and are rewarded with a sense of achievement. Ducheneaut et al. (2006) found out that the players in MMORPG interact as friends and spectators. They laugh with each other and laugh at each other. Such “laughing at together” clearly suggests that the players consider the social status in an MMORPG may result in positive or negative social payoffs for certain players.

Previous studies indicate that MMORPG players are motivated by social status. Thus, designers of games have been encouraged to enhance features associated with social payoffs. However, managing social distance may not be so easy because for each player’s perceived social status is relatively rewarded according to the social distance between one’s recognized efforts and average efforts (Akerlof 1997; Freshman and Weiss 1998) and the average efforts of all players change in the real time.

Economic Perspective of Social Distance

Marx (1852) identified social distance as a critical factor for maintaining social stability, and the subject is that continues to be discussed by social and political economists. Arrow (1972) first suggested that social norms serve as a mechanism for resolving inefficiencies arising from externalities. Akerlof (1976) explained that social decisions have social consequences therefore they require different models because the social distance may harm efficient income distribution and resource allocation. He also argued that the costs associated with social distance and reputation could lead to unemployment (Akerlof 1980). Becker

et al. (1977) empirically showed that differences in social status can break up marriages. He also explained that some restaurants and businesses maintain their social status by raising prices (Becker 1991) and it can be economically reasonable. Fershtman and Weiss (1993) suggested that social distance may motivate potential workers to obtain desired educational goals in spite of short-term monetary loss. They also investigated the socially optimal amount of social rewards according to players' preferences. If players are pursuing a better social status, a certain level of social rewards may increase a player's output however it cannot reduce the output once social status is set.

Akerlof (1997), Fershtman and Weiss (1998) defined three broad types of incentives that govern the behavior of individuals in society: (i) private rewards, such as wages and profits; (ii) social rewards, such as prestige and status; and (iii) rules and laws that enforce certain types of behavior and penalize deviations. Social distance is defined as the difference between one's recognized efforts and average efforts of all members in the society, thus can have both positive and negative effects on a person's utility. If one's performance is better than average, social distance is positive and society rewards the individual with a higher social status. If one's performance is lower than average, social distance is negative society punishes the individual with a lower social status.

In an MMORPG, an avatar's level can reflect the amount of effort invested in the game by the avatar's owner. The game system rewards greater effort with a stronger avatar with higher level (Bartle 2004b). Avatar's level works as a social status indicator, since a strong avatar can contribute more to other players than a weak avatar can (Taylor 2006). However, one of the critical differences in MMORPGs is that the number of the players in an MMORPG is not fixed. Many traditional real world social distance studies considered that the members of a society cannot enter or leave the society easily (Akerlof 1997; Fershtman and Weiss 1998). In MMORPGs, players usually have better things to do than playing a specific game if it does not produce enough fun and changing virtual worlds generally requires only a few mouse clicks. Therefore, in MMORPG the number of players can either increase or decrease in real time.

Without an adequate number of players, dissatisfaction may result for gamers who expect “massive” interactions with others (Taylor 2006).

Therefore, if one player is being laughed at by others because of her low social status represented by her powerless avatar, the player may discontinue the game due to negative social payoffs. As players with lower social status abandon today, average level thus average efforts rises and it may force the players with the new lowest social status to give up playing tomorrow. In addition, network size decreases as players with low social status give up, and consequently fun from social interaction decreases. Hence we suggest the following hypothesis:

H1: Social status initiates a positive feedback in players' abandonment of an MMORPG, resulting in rapid collapse.

Another deviation from the real world is that an MMORPG is fully designed by the game developers. Previous studies about the real world addressed the uncertainty in detecting and distributing social rewards for personal efforts to maximize social welfare by providing incentives for the members of the society (Akerlof 1976; Fershtman and Weiss 1993). Improving accuracy of detection of the efforts and allocation of social reward is important in the real world however it can incur significant costs, because there are so many ways to innovatively contribute to the society. In an MMORPG, the whole game system is designed therefore the ways to put efforts are predetermined and limited, and they are perfectly monitored and measured. Perfect measurement can be a good news, however, since there are limited possible actions available for players, it may put too little disturbance in social status, leaving less chance of catching up social distance for those who start the game later. At this point the manager may have to consider inserting deliberate uncertainty in recognizing the effort. In the real world, uncertainty in recognizing personal efforts can only hurt the social welfare because highly resourceful members may give up exerting efforts to produce social welfare (Akerlof, 1980). However, yet another critical deviation from the real world is that an MMORPG manager may not care about in-game virtual productions such as enchanted swords, since they cannot be directly converted into profit. If a manager only cares about the

number of subscriptions to maximize the profit (Jung and Lee, 2012), inserting deliberate uncertainty in recognizing personal efforts can help managing social distance because it can put disturbances in social status. Highly resourceful users will not like uncertainty and it may reduce the initial build up of the network size, however, uncertainty also improves the chance of catching up social status, thus can slow down crash. We suggest the following hypotheses.

H2a: When uncertainty in recognizing personal efforts is low, more players join in the game initially, but later less players remain.

H2b: When uncertainty in recognizing personal efforts is high, fewer players join in the game initially, but later more players remain.

The last major deviation from the real world is that the MMORPG players do not age enough to naturally retire from the game within the service lifetime. An MMORPG manager may try to emulate the real world and retire high-level players to manage social distance. We expect that a proper retirement plan, which removes players if they reach a certain level, can promote the sustainability of an MMORPG by managing social distance. If the retirement level is too high, social distance may widen to an undesirable level and too many players may drop out. However, if the designated retirement level is too low, players cannot play long enough to sustain a network size suitable for attracting new users. Therefore, we suggest the following hypotheses.

H3a: When the retirement level is set low, social distance and network size decrease.

H3b: When the retirement level is set high, social distance and network size increase.

Computational Model and Analysis

An MMORPG service provider launches the game at period zero ($i=0$). There are a few users who join the game at the time of launch (n_0) and such users represent the initial endowments of the service. The service provider operates the game for indefinite periods and each period is denoted as i . During each

period, potential users can join the game if they consider it to be attractive.⁷ The number of potential users for each period is denoted as $n_{p,MAX}$. Since the potential users are interested in massively multiplayer online games, those potential users are attracted to the number of users playing the game at the given period i (n_i). We assume that an MMORPG is a typical experience good and the number of players is the best visible and objective quality indicator for potential users. The number of users who join the game at the period i ($n_{p,i}$) is defined as:

$$n_{p,i} = \min(n_i, n_{p,MAX})$$

Each user plays the game for at least one period before deciding whether to quit or stay in the game. A user's utility consists of three components. The first component is that an MMORPG as a video game gives personal satisfaction. When a player kills a fearsome monster, the action may earn the experience points required to advance to the next level (Dibbell 2007). Experience and advanced levels can serve as extrinsic rewards that secure personal satisfaction (Brown and Bell 2004; Cast and Burke 2002). In addition, it is assumed that users have heterogeneous resources invested in the game. Resources can be interpreted as abilities that facilitate advances to the next level efficiently, such as quick thinking, reflexes, available time, and opportunity cost. Investment of resources increases the chance to level up during a given period. However, it is assumed that users do not know about how their resources are being converted for advancing avatar's levels beforehand. The next component is that massively interacting with other users while playing an MMORPG gives social satisfaction. For example, a user can chat, trade, or hunt with other users and enjoy various social activities. Lastly, a user can enjoy positive payoffs or

⁷ We did not consider the price of the MMORPG service, for we wanted to focus on the dynamics of social distance within the game, not on users' pricing sensitivities. Also, since there are many free-to-play MMORPGs available that rely on two-sided market business models that include in-game advertisements, we argue that disregarding price does not deviate too much from reality.

suffer from negative payoffs associated with social distance (Akerlof 1976; Fershtman and Weiss 1993).

User j 's utility during the period i is defined as:

$$u_{i,j} = G_P(V_{i,j}(p_j) - r_j) + G_S n_i + n_i(L_{i,j} - \text{avg}(L_i))$$

The notation G_P indicates personal satisfaction from advancing a level as designed by game developers. Although some role playing game may have a better personal extrinsic reward at early player level, while others may have it on later player level, in order to focus on social distance, it is assumed that G_P is constant throughout the game, regardless of the player's level. $V_{i,j}$ is zero if user j failed to achieve a level up in the period i , and it is 1 if the user is successful in advancing. Each user put different amount of resources in the game, denoted as r_j , which is normalized to a standard uniform distribution⁸. For now it is assumed that the probability of advancing a level up during each period for user j (p_j) is an increasing function of the user j 's resource (r_j , $p_j=r_j$). The game perfectly recognizes the player's effort (r_j) and reward accordingly. A user who gains a level has positive payoffs from personal interaction, while the user who fails to advance has negative payoffs. It is assumed that the users do not know p_j , therefore they try the game for at least one period and decide to leave the game if total utility goes below zero. G_S indicates marginal social satisfaction from networking. The user j 's level at period i is noted as $L_{i,j}$, and the average level of total users playing the game at period i is represented by $\text{avg}(L_{i,j})$. Social distance is expressed as the difference between a player's level and average level, multiplied by network size, because if there are more people who laugh at the player, the player may get more negative payoffs from

⁸ It is assumed that a user does not adjust the amount of resources, because not all the resources are adjustable since resources include natural abilities like reflexes, tactical maneuvers and generating ideas, and the model allows that a user can always drop out for there can be a better use of her resources than slacking off in the game.

social distance. At the end of each period, each user evaluates her utility. If perceived utility is negative, the user quits playing the game.

The payoffs from social distance may not be significant at the early stage since the average level may not be high enough. However, as the game continues and users advance levels, the social distance may be significant for new users and they may decide to drop out quickly. A problem occurs when low level users drop out because the average level increases. Eventually, positive feedback may be initiated and even users who gained some levels may drop out because the social distance widens as lower level users drop out. The first experiment shows that feedback regarding dropouts may be initiated, and it can affect the game's sustainability. Table 1 lists parameter values used by simulations.

Table 1. Default Parameter Values and Settings		
Parameter/Settings	Description	Default value
G_P	Satisfaction from level up	3000
G_S	Satisfaction from networking	1
$N_{p,MAX}$	Maximum potential number of players for each period	100
N_0	Initial number of players	10
The number of simulation runs	The number of simulations performed to obtain an average value for each setting	100

Positive Feedback of Abandonment due to Social Distance

To show clearly how positive feedback of abandonment due to social distance can destroy the entire game, the number of players during each period has been plotted (Figure 1), along with the ratio of number of

dropped out new players (who joined the game first time at the given period) to total new players (Figure 2). The simulation ran 100 times under default parameter settings and values are averaged.

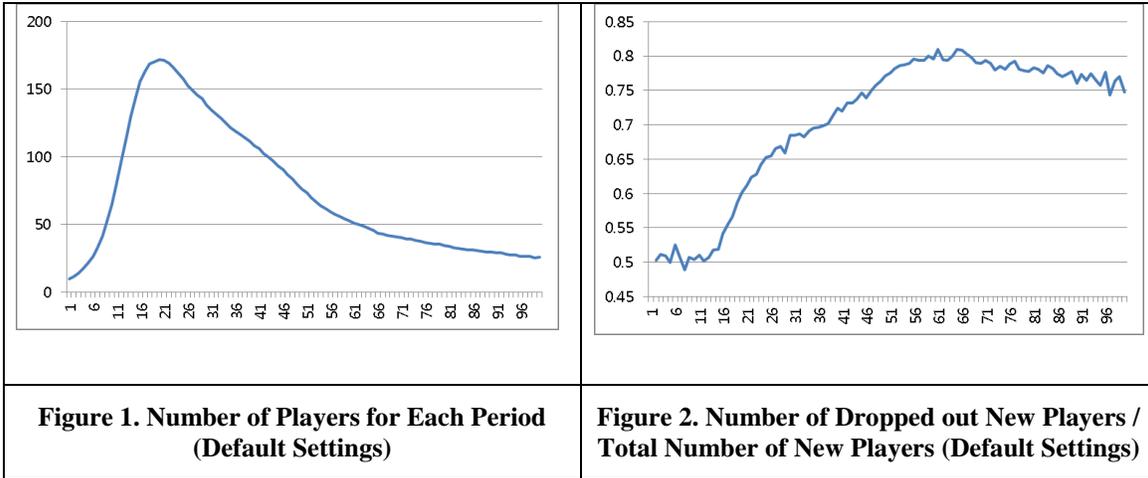
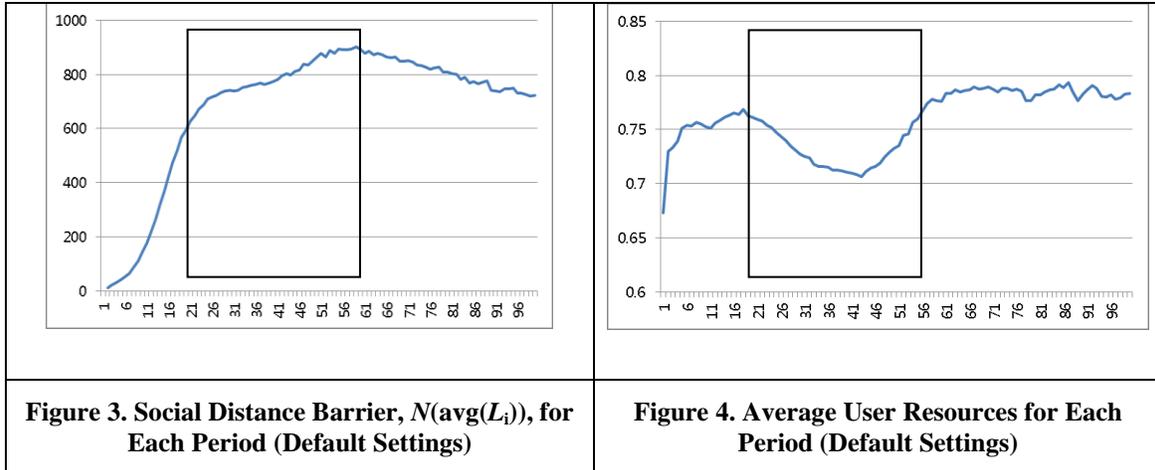


Figure 1 shows that at the early stages, the game attracts a growing number of users. As more users play the game, it becomes more attractive and results in positive feedback of participation. In Figure 2, during early periods only about half of new players drop out since their resources are uniformly distributed and network size is very small. However, the social distance between existing users and new users widens as time passes, and since it is multiplied by network size, after the tipping point (in this case around the period 21), more new players start to drop out and the system starts to crash from positive feedback of abandonment.

The new users, who have zero avatar level, immediately face negative payoffs from social distance, $-N(0 - \text{avg}(L_i))$ as they enter the game. Figures 3 shows the scalar value of it, termed as “social distance barrier,” expressed as $N(\text{avg}(L_i))$. Figure 4 shows the average user resources during each period.

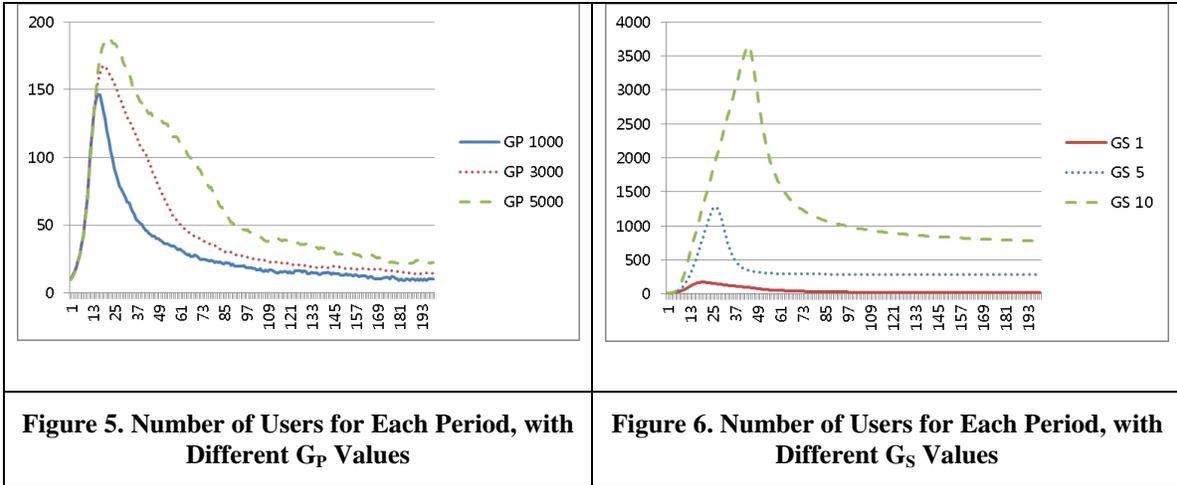


Social distance barrier in Figure 3 shows very similar pattern with drop out ratio in Figure 2, which suggests that the new players are suffering from social distance. In Figure 3, in the early stages, social distance barrier rapidly increases since players are building up levels and the network size also increases. Soon social distance barrier prevents maintaining adequate amount of new and low level users (Figure 2), who give other players positive social payoffs with their relatively low social status, thus the number of users start to decline. As network size starts to collapse (period 21 to 56), the speed of social distance barrier increase reduced, and finally social barrier starts to decrease as too many users have dropped out.

Average player resources represented in Figure 4 shows the value of around 0.75 during the early stages, because when n_i is small thus only personal interaction matters and users with resources smaller than 0.5 drops out. However, during the collapsing periods (periods highlighted with black box in Figure 4) indicates that even resourceful users drop out of the game because they do not have fun anymore due to the loss of social status and decreasing network size, suggesting that positive feedback of abandonment from social distance is working against the game system. Once enough users drop out of the game, eventually only users with enough resources and high levels will remain in the game (Figure 3 and 4), and the game becomes “the league of dedicated elites.” From these analysis, we suggest that the results support hypothesis H1, since social distance initiated positive feedback of abandonment by increasing the social barrier and decreasing the network size.

These findings may be alarming for an MMORPG manager. In a role-playing game, personal extrinsic rewards, such as advancing a level up, is tightly integrated with the game system, as Reeves and Read (2009) suggested. However, combining massive online multiplayer feature introduces social interactions along with social distance to the game system, whether the service provider wants it or not. Combining the two primary attractions—the role-playing element and the massive multiplayer element—into one service has greatly increased the game’s value, which is shown as rapid increase of the number of users in the early stages. However, the dark side of social interactions, social distance, may eventually cause the system to crash in the long run. The exponential increase of users in the early stages and the dramatic collapse caused by the social distance in the later stages are, characteristically, due to the combination of those two different elements. If the game does not provide extrinsic rewards for personal activities (e.g., experience points and levels up), the content of the game deviates from the critical element of role playing. Similarly, a substantial number of target customers may be lost since if the game does not provide social interaction, it simply becomes a traditional computer role-playing game. Therefore, the MMORPG service provider should consider that the combination of role play and massive multiplayers may induce early growth as well as a later crash because of social distance.

One can expect that increased fun from personal interaction with a well-designed game system can prevent collapse caused by the social distance or at least delay the crash. The following figures show how increasing the parameter G_p and G_s can affect system behavior.



Increasing parameter G_P and G_S clearly gathers more users; however, it can only delay the crash and cannot prevent the crash.

Uncertain Extrinsic Rewards from Personal Interaction

One can expect that in any video game, including MMORPG, it is easier to gain social rewards (i.e., levels) than it is to gain social rewards in the real world. We investigated the role of uncertainty in gaining levels on the game's sustainability. In previous experiments, we learned that if extrinsic social rewards are given in accordance with the user's resources without any uncertainty, the game ends up with a few high-level, resourceful users. If there is uncertainty regarding advancement of an avatar's level, incumbent players may not retain their social status easily.

To incorporate uncertainty, p_j is fixed to $1/2$ for all users. That is, the probability of advancing a level up does not depend on a user's resources. Highly resourceful users are likely to develop negative utility from personal interaction because of uncertain extrinsic rewards. However, users with low resources are likely to gain positive utility from personal interaction. Therefore, highly resourceful users are more likely to leave the game early, while users with fewer resources may stay in the game longer. Experiments were performed for low, medium, and high values of G_P . Initially, G_P value was at the benchmark default (3000) and the experiment results are presented in Figure 7.

Figure 7 shows that when uncertainty is incorporated ($p_j = 1/2$), the game system gains users more slowly than in the case of certainty ($p_j = r_j$), but in the later stages it can sustain more users. Because highly resourceful users do not gain enough levels relative to their resources therefore they drop out early, slowing the initial buildup of network size and reducing the total number of new users. However, uncertainty slows down the crash of network size by disrupting the social status of incumbent users, hence even after the peak value a relatively larger number of users are maintained even in the later periods.

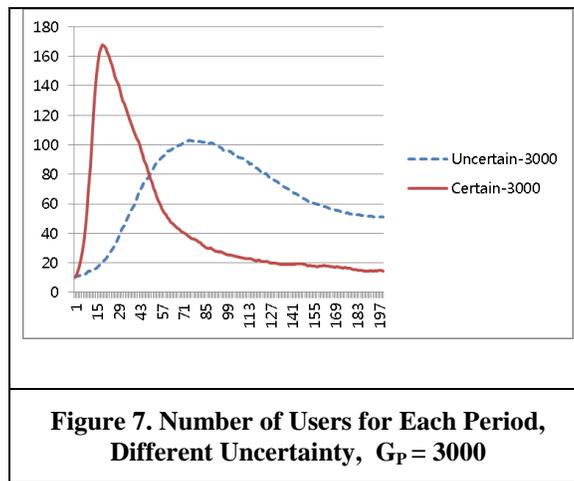
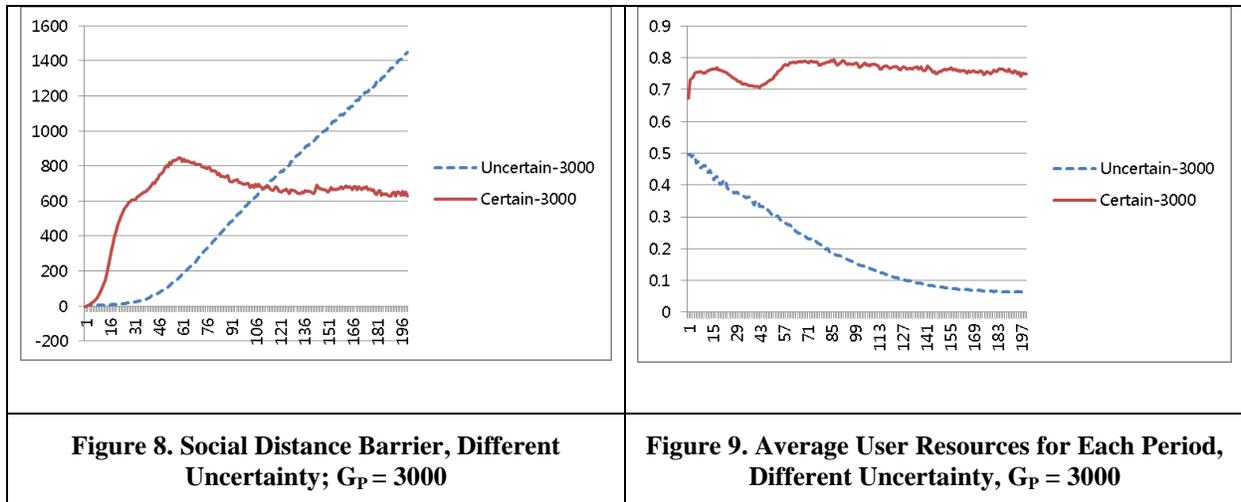
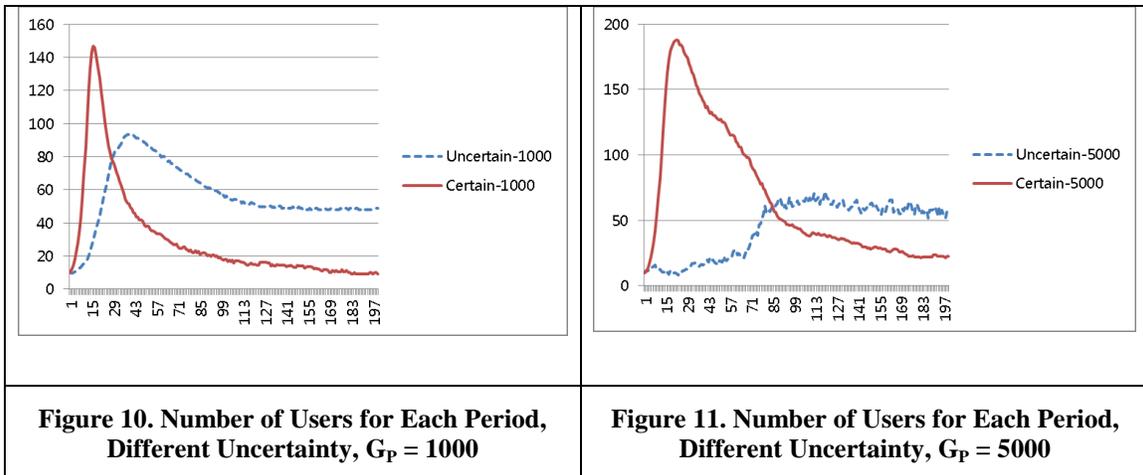


Figure 8 shows the social distance barrier from each different uncertainty settings. Under the case of uncertainty, during the early stages, the social barrier increases rather slowly, however it continues to grow even in the later stages, because relatively more users are remained in the game, even without there are no more new users are supplied. Figure 9 shows the average user resources and under the case of certainty, a league of elites remained and under uncertain conditions, however, in this case, a “league of opportunists,” who desire extrinsic social rewards from personal interaction and little investment of resources, remain.



Since uncertainty is incorporated with personal interaction, the amount of extrinsic rewards for personal interaction G_p can change the system's behavior. When the level of extrinsic rewards is low, uncertainty may have little effect. Therefore, imposing uncertainty when the game does not place much value on personal interactions should not change the system's behavior to a noticeable extent. However, when the game provides substantial utilities from personal interactions, such as well-designed quests and challenges, imposing uncertainty may change the system's behavior a great deal. Subsequent experiments were conducted for different values of G_p . For the lower value, $G_p = 1000$ was selected; for the higher value, $G_p = 5000$ was selected. The results match intuitive expectations and shown in Figure 10 and 11.

When extrinsic rewards from personal interaction are low, users exhibit similar behavior under uncertain and certain cases. However, under uncertainty the number of users increases at a slower pace and a larger number of users can be expected at the later stages. With higher personal extrinsic rewards, incorporating uncertainty makes the system build up users even slower, and it shows a more random like movements in number of users during each stage because of the gap between those who have succeeded in advancing to the next level up and those who have failed is larger.

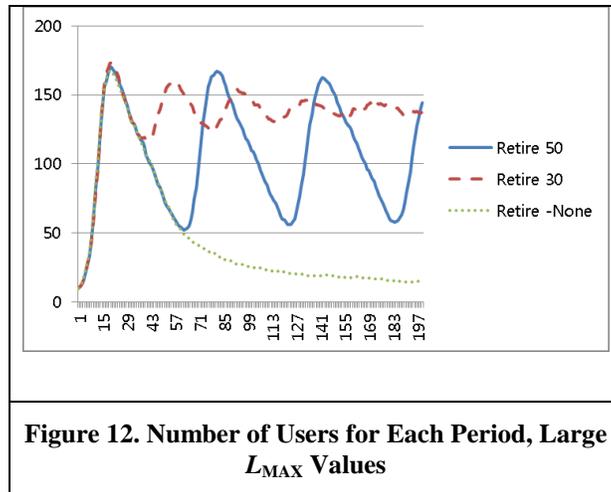


For all of the cases in this section, uncertainty clearly delays building up the number of users in early stage because it deters users who want to invest large amounts of resources. However, if without uncertainty, in the perspective of long-term sustainability, recognizing and rewarding personal efforts may be “too perfect” for the world of MMORPG. If there is no uncertainty in measuring and rewarding personal efforts under limited possibilities of innovations, users who join the game in the later stages do not have many options to catch up with incumbents who have achieved high levels and who have better resources. In the real world, uncertainty in social rewards for personal efforts may discourage individuals from extending personal efforts, leading to underutilization of personal abilities or even unemployment, thus, social welfare diminishes (Akerlof 1980). However, usually the objective of MMORPG service is to secure many users to maximize revenue, not to maximize users’ levels or virtual production. Therefore, it may be beneficial for a game manager in the long run to create a virtual world in which everybody has roughly the same chance of being rewarded regardless of personal resources, although it can be a “lemon market” from the perspective of production. We suggest that the results of the experiments support hypothesis H2a and H2b, as increasing uncertainty lost the initial buildup however delayed the crash and retained relatively more players in the later periods.

Retirement Policy

In the real world, mortality forcefully retires people of the highest social status eventually. Thus, at least a part of social distance can be controlled by the nature. In an MMORPG, however, forced retirement by natural or external causes rarely happens in the service lifetime. So far, it is assumed implicitly that there are no external interventions for retiring high-level players. Therefore, users can play the game indefinitely, and users at higher levels with more resources can enjoy elevated social status forever and the social distance barrier increases continuously. Hence, an artificial retirement policy may be a viable solution to contain social distance since the artificial world of MMORPG does not follow nature's law. Although feasibility of such policies is questionable, because restricting total playing time or maximum allowed levels may not be welcomed by users. We assume that only substantial external rewards can make a user who is enjoying a high social status leave the system willingly. Such changes may be costly however the strategy itself may be important to managers if providing retirement can delay significantly or eliminate system crashes due to social distance.

In the next set of experiments, it was assumed that users who achieved a certain level voluntarily left the game system. We are focusing on the benefits, rather than the costs, of a retirement policy to save the game system from a crash. We introduce another parameter—the maximum allowed level (L_{MAX}). If a user reaches this level, automatic retirement occurs and the user never returns. First, relatively large values of L_{MAX} were used in the experiments, because in experiments so far are the special cases that L_{MAX} is set to infinite. The following figure shows how the system behaves when L_{MAX} is established as infinite, 50, and 30.



We observed that when there was no retirement policy, the system crashed and never recovered. However, if the retirement level was set to 50, the system periodically recovers from crashes. At $L_{MAX} = 30$, oscillation existed but the scale of fluctuation is reduced as time goes. The social distance barrier and average amounts of resources are shown in Figures 13 and 14. Both the social distance barrier and average amount of resources oscillate on some scale although it is contained at a certain scale. Since highly resourceful players are retired as time goes on, the average amount of players' resources decreases, meaning that the system may escape the crash and the league of elites. Additionally, when retiring level is high, more time is required to recover from the crash since some users with elevated social status linger in the system. Thus, new users are discouraged from joining the game; network size is reduced; and attractiveness of the system is diminished. However, once the last high-level user finally retires, the subsequent surge in new users builds up network size, and the process repeats itself. Thus, there is chance for a better sustainability when applying a retirement policy however if the retirement level is set to too large a value, the periodic reboot might come too late.

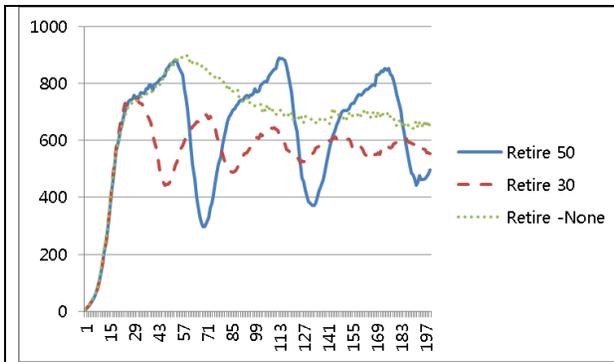


Figure 13. Social Distance Barrier for Each Period ,Large L_{MAX} Values

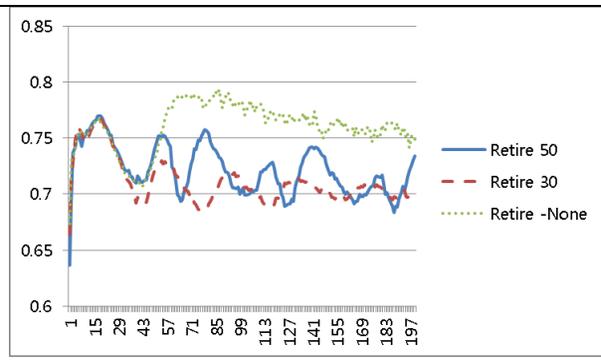


Figure 14. Average User Resources for Each Period, Large L_{MAX} Values

Therefore, it may be advantageous to lower the retirement level to prevent even the initial crash. For mid-ranged values of L_{MAX} (10 and 20), the results are shown in the Figure 15. In this case, there were no significant signs of impending crashes. A proper setting for retirement level may ensure that social distance remains at a desirable level and that stability of the system remains intact. Although the graph shows random fluctuations in the number of users, the scale of fluctuation is relatively small and clearly effective for preventing even an initial crash. Also, Figure 16 and show that the average user resource level remains stable, indicating no sign of positive feedback of abandonment. The social distance barrier in mid-range L_{MAX} values showed very stable values, and did not produce any visible patterns.

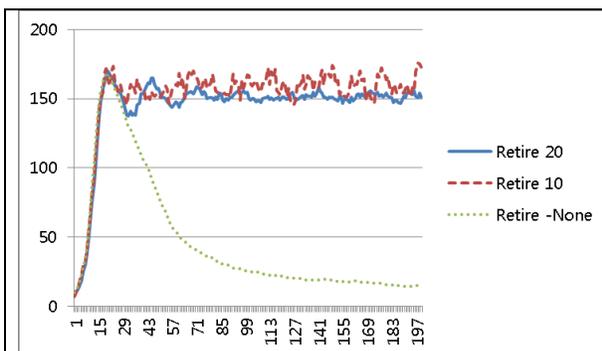


Figure 15. Number of Users for Each Period, Mid-range L_{MAX} Values

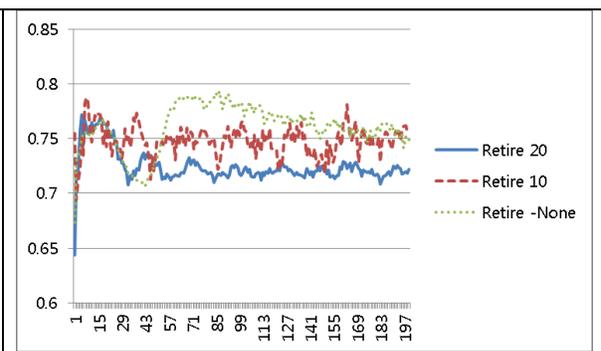
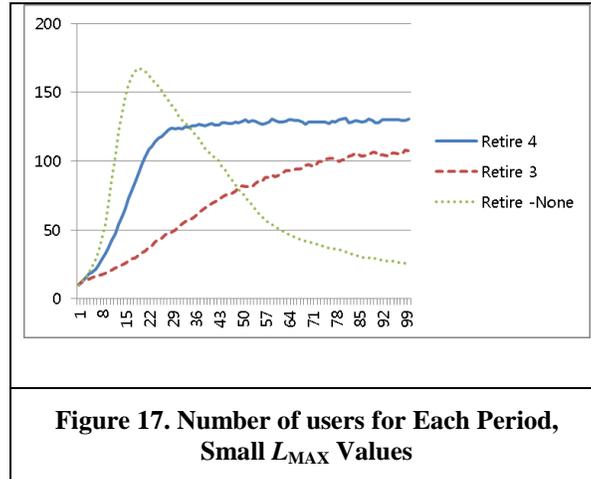


Figure 16. Averaged Users Resources for Each Period, Mid-range L_{MAX} Values

If the retirement level is set to very low values ($L_{MAX}=3, 4$), the system behaves differently. Figure 17 shows that if the retirement level is set to too low, users will retire too quickly and the network size will not be large enough to attract potential users, although it shows much stable number of users once reached a certain network size.



Therefore, we suggest that H3a and H3b are supported since too large value of the retirement level induces crashes and too small value restricts initial network build up. The experiments described in this section suggest that a well-balanced retirement policy may attract a sufficient number of new users while successfully preventing a crash due to social distance, although this fine balance is hard to pinpoint and costly to impose. In the real world, experimental projects such as levelless MMO⁹ do not rely on extrinsic social rewards, such as levels. Level caps incorporated in certain existing MMORPGs represent a form of retirement associated with social distance. Although users who have advanced to high levels do not completely leave the system, they do not gain additional levels, thus the social distance can be controlled. When launching a sequel to the previous game, there is usually a large reward for relocation to encourage high-level players to leave the previous system and join the new one. Those external rewards can be interpreted as retirement policy associated with social distance.

⁹ <http://au.gamespot.com/age-of-wushu/videos/gamespot-reports-levelless-mmos-6392294/>

Empirical Analysis of Social Distance in an MMORPG

Computational Analysis so far is based on the assumption that the MMORPG players are actually affected by perceived social distance. To validate this fundamental assumption with an empirical test, we gathered actual play data from EverPlanet, a Korean MMORPG service provided by Nexon¹⁰. The data contain detailed activity logs of about 270,000 players from the first day of the launch, February 9, 2010 to August 8, 2010. Since the data contains more than a few billion records, 10,000 players are randomly sampled and tested. The variables used in the empirical model are shown in the following table:

Table 2. Variables Used in Empirical Model		
Variable	Description	Note
$P_{i,j}$	Dependent variable, Total played time for player j during day i	$(1 < i < 188)$ $(1 < j < 10,000)$
$AP_{i,j}$	Accumulated played time of player j from day 1 to day $i-1$	$AP_{i,j} = \sum_{k=1}^{i-1} P_{k,j}$
$SD_{i,j}$	Social distance, difference between player j 's level during day i and average level during day i	$SD_{i,j} = L_{i,j} - \text{Avg}(L_i)$
N_i	Number of players played in day i	
CD_i	Control, number of days passed (i)	
CW_i	Control, weekday (Monday=1, Sunday=7)	
CS_i	Control, during semester (=0), summer vacation (=1)	

¹⁰ <http://everplanet.nexon.com>

Descriptive statistics are in the appendix. Since the utility cannot be directly measured, we proxy played time for how much a player enjoyed the game at a given day. Accumulated played time is selected to capture the consumption of content provided by the game. In the computational model, the effect of social distance is the level difference multiplied by network size. In empirical model it can be interpreted as the interaction term between social distance and network size. Other time-variant variables such as number of days passed, weekday, vacation for students are considered. The data also include each player's gender and age however instead using them we imposed fixed effects for players to absorb players' heterogeneity more clearly. The final empirical model is expressed as:

$$P_{i,j} = \alpha_j + b_0 + b_1 AP_{i,j} + b_2 SD_{i,j} + b_3 N_i + b_4 (SD_{i,j} \times N_i) + b_x CX_i$$

Where α_j indicates fixed effects. Simple linear regression shows:

Table 3. Regression Results			
Observation	35966	R-squared	0.4709
Prob > F	0.0000	Adj. R-squared	0.3162
Variable		Coeff	p-value
$AP_{i,j}$		-0.0053807	0.000
$SD_{i,j}$		-29.66567	0.209
N_i		8.112353	0.000
$SD_{i,j} \times N_i$		0.2573368	0.001
CD_i		-11.57766	0.000
CW_i		-13.41284	0.590
CS_i		272.1008	0.128
<i>Constant</i>		6187.539	0.000

<i>Fixed Effects, absorbed</i> F(8126, 27832)	0.000
---	-------

Interaction term between social distance and network size is positive and significant. It suggests that higher than average level users may enjoy positive utility by “laughing at” lower level users, while lower than average level users suffers from “being laughed at”. Network size alone is also positive and significant, suggesting that the game provides positive networking value even when social distance is zero. Social distance alone is not significant and is expected because if there are no people around, social distance should not matter. The test result suggests that the players of an MMORPG are actually considering social distance, supporting the fundamental assumptions used in the simulation.

Conclusion

In this study, we described a computational model that identifies social distance as an important variable regarding players’ decisions and the sustainability of MMORPG services, and empirical test which shows significant impact of social distance on the time spent by the real game players. Unlike the real world, MMORPG players experience more freedom to join or leave the virtual world. MMORPG managers seek to maximize the number of players, rather than the production of the participants. In an MMORPG, everything can be designed including uncertainty in measuring personal efforts. Finally, retirement plans may be important considerations since players rarely retire from the virtual world due to natural causes. By considering such characteristics of MMORPG in our model, we argue that this study can offer new perspectives and insights for understanding economic and social phenomena in the virtual world.

If the social distance is not managed, the system may collapse rapidly because of positive feedback of abandonments from social distance. As negative payoffs from social distance for the new players reaches a certain level, the new players give up playing thus the network size decreases, and other players may lose both her social status and the benefits from larger network size, and eventually give up playing the game. To manage social distance, managers may have to consider incorporating deliberate uncertainty in

measuring and rewarding personal efforts. In the real world, policy makers seek to maximize social production and social welfare, therefore uncertainty hinders the awarding of incentives and social welfare. However, deliberately imposing uncertainty in the MMORPG virtual world can be a viable strategy because uncertainty may slow down both the initial build up and crash. Although it deters highly resourceful players, the system may gain more opportunistic players. Social distance in MMORPG can be well managed if a proper retirement plan is imposed. If the manager can retire players who have achieved high levels precisely at the point that social distance overwhelms the social benefits for players, the service may maintain satisfied players for a long time. Managers may have to perform cost-benefit analyses regarding sustainability of game systems before imposing retirement plans.

This study has several limitations, as well as possibilities regarding future research opportunities. The model assumed that there is always satisfaction when a player advances a level up during every period. Although MMORPG service providers usually add new contents and system updates throughout the lifetime of their services, it may not be easy to keep the players satisfied for a long time. Players compare rewards from personal and social interactions however the relative scale is forced by values set for G_p and G_s . A more subtle approach to scaling these two variables may elaborate more design issues and implications.

References

- Akerlof, G. A. 1976. "The Economics of Caste and of the Rat Race and Other Woeful Tales," *Quarterly Journal of Economics* (90), pp. 599-617.
- Akerlof, G. A. 1980. "A Theory of Social Custom, of Which Unemployment May Be One Consequence," *Quarterly Journal of Economics* (94), pp. 749-775.
- Akerlof, G. A. 1985. "Discriminatory, Status-Based Wages among Tradition-oriented Stochastically Trading Coconut Producers," *Journal of Political Economy* (93) pp. 265-276.

- Arrow, K. J. 1972. "Models of Job Discrimination," in A. H. Pascal, ed. *Racial Discrimination in Economic Life*, Lexington, Mass.: D. C. Heath, pp. 83-102.
- Baron J. 1999, "Glory and Shame: Powerful Psychology in Multiplayer Online Games," in *Proceedings of 1999 Game Developers Conference*, available at: http://www.gamasutra.com/view/feature/3395/glory_and_shame_powerful_.php
- Bartle, R. A. 2004a. *Pitfalls of Virtual Property*, Themis Group.
- Bartle, R. A. 2004b. *Designing Virtual Worlds*, New Riders Pub.
- Becker, G. S., Landes, E. M., and Michael, R. T. 1977. "An Economic Analysis of Marital Instability," *Journal of Political Economy* (85), pp. 1141-1187.
- Becker, G. S. 1991. "A Note on Restaurant Pricing and Other Examples of Social Influences on Price," *Journal of Political Economy* (99), pp. 1109-1116.
- Brown, B., and Bell, M. 2004. "Social Interaction in 'There'," in *Conference on Human Factors in Computing Systems CHI '04 Extended Abstracts on Human Factors in Computing Systems*, pp. 1446-1468.
- Burgoyne, B. C., and Lewis, A. 1994. Distributive Justice in Marriage: Equality or Equity?" *Journal of Community & Applied Social Psychology* (4), pp. 101-114.
- Calder, B. J., and Staw, B. M. 1975. "Self-perception of intrinsic and extrinsic motivation," *Journal of Personality and Social Psychology* (31:4), pp. 599-605.
- Cast, D. A., and Burke J. P. 2002. "A Theory of Self-Esteem," *Social Forces* (80:3), pp. 1041-1068.
- Castronova, E. 2002. "On Virtual Economies." CESifo Working Paper Series No. 752.
- Choi, D. S., and Kim, J. W. 2006. "What Makes Players to Get Experienced Enjoyment during the Playing [of] Online Games?" *Journal of Game Industry and Culture* (13:3), pp. 66-88.
- Choi, D. S., and Kim, J. W. 2009. "A Study on the Effect of Self-Efficacy on the Flow Experience of the Game Playing," *Journal of Korean Game Society* (9:3), pp. 87-96.
- Csikszentmihalyi, M. 1990. *Flow: The Psychology of Optimal Experience*, New York, NY: Harper & Row.

- Dibbell, J. 2007. *The Life of the Chinese Gold Farmer*. Life.
- Ducheneaut, N., Yee, N., Nickell, E. and Moore, R. J. 2006. "Alone together?' Exploring the Social Dynamics of Massively Multiplayer Online Games," in *ACM Conference on Human Factors in Computing Systems (CHI 2006)*, pp. 407-416.
- Ducheneaut, N., Yee, N., Nickell, E., and Moore, R. J. 2007. "The Life and Death of Online Gaming Communities: A Look at Guilds in World of Warcraft," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '07)*. ACM, New York, NY, USA, pp. 839-848.
- Fershtman C., and Weiss Y. 1993. "Social Status, Culture and Economic Performance," *The Economic Journal* (103:419), pp. 946-959.
- Fershtman C., and Weiss Y. 1998. "Social Rewards, Externalities and Stable Preferences," *Journal of Public Economics* (70), pp. 53-73.
- Jakobsson, M., and Taylor, T. L. 2003. "The Sopranos Meet EverQuest: Social Networking in Massively Multiplayer Online Games," in *Proceedings of the 2003 Digital Arts and Culture (DAC) Conference*, Melbourne, Australia, pp. 81-90.
- Jung, G. J., and Lee, B. T. 2012. Koster, R. 2005. *A Theory of Fun for Game Design*. Scottsdale, Arizona: Paraglyph Press.
- Lazzaro, N. 2004. "Why We Play Games: Four Keys to Emotion without Story," in *2004 Game Developers Conference*.
- Marx, K. 2013. *Der achtzehnte Brumaire des Louis Bonaparte*. Jazzybee Verlag.
- Park, J. C. 2007. "What sustains gameplay?" *Journal of Game Industry* (18:1), pp. 40-56.
- Reeves, B. and Read, J.L. 2009. *Total Engagement: Using Games and Virtual Worlds to Change the Way People Work and Businesses Compete*, Harvard Business Press.
- Simpson, Z. B. 1999. "The In-game Economics of Ultima Online," in *2000 Computer Game Developer's Conference*, San Jose, CA.
- Taylor, T. L. 2006. *Play Between Worlds: Exploring Online Game Culture*, MIT Press.

- Walster, E., Berscheid, F., and Walster, G. W. 1973. "New Direction in Equity Research," *Journal of Personality and Social Psychology* (25), pp. 151-176.
- Williams, D., Ducheneaut, N., Xiong, L., Zhang, Y., Yee, N., and Nickell, E. 2006. "From Tree House to Barracks: The Social Life of Guilds in World of Warcraft," *Games and Culture* (1:4), pp. 338-361.
- Yamaguchi, H. 2004. "An Analysis of Virtual Currencies in Online Games," Working Paper, available at SSRN 544422.
- Yee, N. 2002. "Facets: 5 Motivation Factors for Why People Play MMORPGs," Working Paper, available at <http://www.nickyee.com/facets/home.html>

Appendix

Descriptive Statistics (Observation : 35966)					Correlation						
Variable	Mean	Std. Dev.	Min	Max		AP_{ij}	SD_{ij}	N_i	CD_i	CW_i	CS_i
P_{ij}	6183.2	9452.2	1	126964	AP_{ij}	1.00					
AP_{ij}	162050.3	402301.3	1	4378635	SD_{ij}	0.72	1.00				
SD_{ij}	0.6	16.5	-25	53	N_i	-0.12	0.00	1.00			
N_i	216.9	67.7	118	464	CD_i	0.15	-0.00	-0.31	1.00		
CD_i	90.8	56.2	1	188	CW_i	-0.00	0.00	-0.05	0.00	1.00	
CW_i	4.0	2.1	1	7	CS_i	-0.00	-0.00	-0.18	-0.25	0.02	1.00
CS_i	0.7	0.4	0	1							

KAIST Business School Working Paper Series

Category	Serial #	Author	Title
Working Paper	2005-001	Jeho Lee Jaeyong Song	Incompatible Entry in Small-World Networks
Working Paper	2005-002	Woochan Kim Taeyoon Sung	What Makes Group-Affiliated Firms Go Public?
Working Paper	2005-003	Xavier Martin Namgyoo K. Park	Bounded Momentum in the Formation of Strategies : The Case of Alliances
Working Paper	2005-004	Kwangwoo Park George Pennacchi	Harming Depositors and Helping Borrowers : The Disparate Impact of Bank Consolidation
Working Paper	2006-001	Se-Bum Park	Content- Versus Retrieval Ease-Based Judgments: The Role of Cognitive Resources
Working Paper	2006-002	Jungsuk Oh	Profit-Sharing in the Closed Content Market
Working Paper	2006-003	Yoon-Suk Baik	An Empirical Study of Patent Disclosure
Working Paper	2006-004	Seung-Yoon Rhee Theresa M. Welbourne	Employee Behavioral Change Under Gainsharing : The Effects of Gainsharing Satisfaction
Working Paper	2007-001	Christina Fang,, Jeho Lee, Melissa A. Schilling	Exploration and Exploitation: The Influence of Or -ganizational Structure on Organizational Learning
Working Paper	2007-002	Mooweon Rhee Ji-Hwan Lee	The Signal Outside Directors Send to Foreign Investors
Working Paper	2007-003	Bobae Choi Kooyul Jung	Analyst Following, Institutional Investors and Pricing of Future Earnings:
Working Paper	2007-004	Kooyul Jung,, Boyoung Kim Byungmo Kim	Tax Motivated Income Shifting and Korean Business Groups (Chaebol)
Working Paper	2007-005	Do-Hyung Park Se-Bum Park	The Multiple Source Effect of Online Consumer Reviews on Brand Evaluations: Test of the Risk Diversification Hypothesis
Working Paper	2007-006	Boyoung Kim Kooyul Jung	The Influence of Tax Costs on Accounting Conservatism

*The above papers are available at KAIST Business School Working Papers Website

<http://www.business.kaist.ac.kr/main.asp?cate_code=20091008101934&gourl=/program/case_work.asp&resource=3&cate=2>

You may get additional copy of the documents by downloading it using the Acrobat Reader.

at The Social Science Research Network eLibrary < <http://papers.ssrn.com/sol3/displayabstractsearch.cfm>>.

KAIST Business School Working Paper Series

Category	Serial #	Author	Title
Working Paper	2007-007	Hoon Cho Brian A. Ciochetti James D. Shilling	Are Commercial Mortgage Defaults Affected by Tax Considerations?
Working Paper	2007-008	Yoon-Suk Baik Jaywon Lee	Earnings Management Dynamics and Deregulation: Case of the U.S. Airline Industry
Working Paper	2007-009	In Joon Kim Geun Hyuk Chang Suk Joon Byun	New Bonds on American Option Prices
Working Paper	2007-010	Seigyoung Auh Eric Shih Yeosun Yoon	Aligning Benefits with Payments in a Consumer Financing Context: A Test of the Pattern Alignment Hypothesis
Working Paper	2007-011	Dae Ryun Chang Se-Bum Park	Market Pioneering Advantage in the Successive-Generation of the Mobile Telecommunication Market
Working Paper	2007-012	Seoung-Yoon Rhee	Shared Positive Emotions and Group Effectiveness : The Role Broadning-and-Building Interactions
Working Paper	2008-001	Sangwoo Lee Kwangwoo Park Hyun-Han Shin	Disappearing Internal Capital Markets: Evidence from Diversified Business Groups in Korea
Working Paper	2008-002	Jae-Cheol Kim Byungtae Lee Se Hak Chun	The Optimal Allocation of Burden of Proof and Its Effect on Precaution Behavior
Working Paper	2008-003	S. Hun Seog Jangkoo Kang	Indexing Catastrophe Securities
Working Paper	2008-004	S. Hun Seog	On the Competition between Insurers with Superior Information
Working Paper	2008-005	Sang-Pil Han Jae-Hyeon Ahn	Evaluating the Impact of the Acquisition Channel on Customer-Firm Relationship
Working Paper	2008-006	Byungjin Kwak Byung T. Ro Inho Suk	Corporate In-House Legal Counsel as Voluntary Governance Mechanism and Quality of Voluntary Disclosure: The Case of Management Earnings Forecast
Working Paper	2008-007	Jihyun Lee Tong Suk Kim Hoe Kyung Lee	Risk-Return Relationship in High Frequency Data: Multiscale Analysis and Long Memory Effect
Working Paper	2008-008	Duk Bin Jun Jungil Kim	A choice-based multi-brand diffusion model incorporating replacement demand

*The above papers are available at KAIST Business School Working Papers Website

<http://www.business.kaist.ac.kr/main.asp?cate_code=20091008101934&gourl=/program/case_work.asp&resou rce=3&cate=2>

You may get additional copy of the documents by downloading it using the Acrobat Reader.

at The Social Science Research Network eLibrary < <http://papers.ssrn.com/sol3/displayabstractsearch.cfm>>.

KAIST Business School Working Paper Series

Category	Serial #	Author	Title
Working Paper	2008-009	Duk Bin Jun Dae Keun Park	A Simultaneous Test of Unit Root and Level Change
Working Paper	2008-010	Won Hyeok Choi Duk Bin Jun, Dong Soo Kim, & Jaesun Noh	Spurious Mean-Reversion of Stock Prices in the State-Space Model
Working Paper	2008-011	Changki Lee Soung Hie Kim	A Method to Reflect Corporate Business Strategy On Information System Assessment Using the Quality Function Deployment and Analytic Hierarchy Process
Working Paper	2008-012	Richard D. MacMinn S. Hun Seog	Distribution of Price and Quality under Information Asymmetry
Working Paper	2008-013	Jaesun Noh	Long Run Probability of Default and BASEL II Capital Allocation
Working Paper	2008-014	Mark J. Eppli Hoon Cho James D. Shilling	Agglomeration Risk in Retail Shopping Centers
Working Paper	2008-015	Kyung-Hwan Kim Young-Joon Park, James D. Shilling, Hoon Cho	Do Higher Land Values Cause Higher House Prices, or Vice Versa?
Working Paper	2008-016	Jae-Cheol Kim Byungtae Lee Nirup Menon	The Role of the Uncertainty of the Performance of Knowledge in Knowledge Management
Working Paper	2009-001	Young Ae Kim Hee Seok Song Soung Hie Kim	A New Marketing Strategy Map for Direct Marketing
Working Paper	2009-002	Young Ae Kim, Muhammad A. Ahmad, Jaideep Srivastava, Soung Hie Kim	Role of Computational Trust Models in Service Science
Working Paper	2009-003	Jangkoo Kang, Tong Suk Kim, Changjun Lee, Byoungkyu Min	Macroeconomic Risk and the Cross-Section of Stock Returns
Working Paper	2009-004	Suk Joon Byun Sol Kim Dong Woo Rhee	Forecasting Future Volatility from Option Prices Under the Stochastic Volatility Model
Working paper	2009-005	Jae-Cheol Kim Min-Young Kim Se-Hak Chun	Property Tax and Its Effects on Strategic Behavior of Leasing and Selling for a Durable-good Monopolist
Working paper	2010-001	Duk Bin Jun, Jungki Kim Myoung Hwan Park Kyoung Cheon Cha	Managing Store Market Share in the Face of Growing Competition

*The above papers are available at KAIST Business School Working Papers Website

<http://www.business.kaist.ac.kr/main.asp?cate_code=20091008101934&gourl=/program/case_work.asp&resouce=3&cate=2>

You may get additional copy of the documents by downloading it using the Acrobat Reader.

at The Social Science Research Network eLibrary < <http://papers.ssrn.com/sol3/displayabstractsearch.cfm>>.

KAIST Business School Working Paper Series

Category	Serial #	Author	Title
Working Paper	2010-002	Duk Bin Jun, Dong Soo Kim, Sungho Park, Myoung Hwan Park	Parameter Space Restrictions In State Space Models
Working Paper	2010-003	Duk Bin Jun, Yongjin Kim, Jaesun Noh	Long Term Mean Reversion of Stock Prices based on Fractional Integration
Working Paper	2010-004	Suk joon Byun, Byungsun Min	Conditional Volatility and the GARCH Option Pricing Model with Non-normal Innovation
Working Paper	2010-005	JoongHo Han, Kwangwoo Park, George Pennacchi	Corporate Taxes and Securitization
Working Paper	2010-006	Jinyong Kim	Evaluating Time-Series Restrictions for Cross-Sections of Expected Returns: Multifactor CCAPMs
Working Paper	2010-007	Ji-Hwan Lee, Soo Wook Kim, Chi Hoon Song	The EFFECTS OF TRUST AND PERCEIVED RISK ON USERS' ACCEPTANCE OF ICT SERVICES
Working Paper	2010-008	Jaeho Lee, Ji-Hwan Lee, Baeho Choi	Impact of Internationalization on Innovation in the Service Industry
Working Paper	2010-009	Eunkyung Lee, Yeosun Yoon	The Effects of Regulatory Focus and Past Performance Information on Temporal Bias of Future Optimism
Working Paper	2010-010	Hyungsuk Choi, Yeosun Yoon	Fluently Processed Offers Must Have Greater Value: How Metacognitive Experience of Fluency Affects Deal Evaluations
Working Paper	2010-011	JaeCheol Kim, SeHak Chun	Retailer.s Market Power and the Optimal Channel Strategies of a Manufacturer in Electronic Commerce
Working Paper	2010-012	SeHak Chun, JaeCheol Kim, WooJe Cho	The Burden of Proof in Electronic Commerce Security Breaches and the Optimal Security Investment of Firms
Working Paper	2010-013	Jae min Jung	A clash of ownership and Journalism : CNN's movie coverage
Working paper	2010-014	Konan Chan, David Ikenberry, Inmoo Lee, Yanzhi(Andrew) Wang	Informed Traders: Linking legal insider trading and share repurchases
Working paper	2011-001	Youngbae Kim, Hyunho Kim	User innovation in Korean manufacturing firm: Incidence and Protection

*The above papers are available at KAIST Business School Working Papers Website
 <http://www.business.kaist.ac.kr/main.asp?cate_code=20091008101934&gourl=/program/case_work.asp&resouce=3&cate=2>

You may get additional copy of the documents by downloading it using the Acrobat Reader.

at The Social Science Research Network eLibrary < <http://papers.ssrn.com/sol3/displayabstractsearch.cfm> >.

KAIST Business School Working Paper Series

Category	Serial #	Author	Title
Working Paper	2011-002	Inmoo Lee, Michael Lemmon, Yan Li, John M. Sequeira	The Effects of Regulation on the Volume, Timing, and Profitability of Insider Trading
Working Paper	2011-003	Duk bin Jun, Dong soo Kim, Jae hwan Kim	A Bayesian DYMIMIC Model for Forecasting Movie Viewers
Working Paper	2011-004	Duk bin Jun Dong soo Kim	Recovering the Actual Impact of Word-of-Mouth and Biases in Suppliers' Expectations Based on Extreme Behaviors and Information Symmetry
Working Paper	2011-005	Duk bin Jun Chul Kim	Copula-based Simultaneous Approach to Multivariate Alternative Choice and Quantity Choice
Working Paper	2011-006	Duk bin Jun Seung hyun Kim	Structural Change Detection in Multivariate Dynamic Linear Model with Application to Business cycle
Working Paper	2011-007	Duk bin Jun Ji hwan Moon	Comprehensive Disaggregation Framework with Information Loss Function
Working Paper	2012-001	Eun-Suk Lee Yonjeong Paik	VARIATION OF ORGANIZATIONAL IDENTIFICATION IN A STRONG CULTURE: AN OCCUPATIONAL PERSPECTIVE
Working Paper	2012-002	Kooyul Jung, Boyoung Kim, Kyoungwon Mo	Firms' strategic management disclosure policy before debt offerings
Working Paper	2012-003	Jinyong Kim Yong-Cheol Kim	Financial Crisis and a Transmission Mechanism of External Shocks: The Signaling Role of Korean Monetary Stabilization Bond
Working Paper	2012-004	Chan-gu Kim Kooyul Jung	Underwriting Relationships and Analyst Herding Behavior around Equity Offerings
Working Paper	2012-005	Stephen P. Ferris, Sulgi Koo, Kwangwoo Park, David T. Yi	Gold, Silver, Bronze or Tin? The Short and Long Term Effects of Mega Sporting Events
Working Paper	2012-006	Khishigjargal Jambal, Bong-soo Lee, Sang Whi Lee, Kwangwoo Park	Reverse Takeover and Firm Survivability
Working paper	2012-007	Bowon Kim, Chaiho Kim	Defining and Measuring Value System Sustainability : Initial Concepts and Blueprints
Working paper	2012-008	Ji-Hyun Shon, Young-Gul Kim, Sang-Jin Yim	Dissecting Movie Genres from an Audience Perspective: MTI Movie Classification Method

*The above papers are available at KAIST Business School Working Papers Website

<http://www.business.kaist.ac.kr/main.asp?cate_code=20091008101934&gourl=/program/case_work.asp&resource=3&cate=2>

You may get additional copy of the documents by downloading it using the Acrobat Reader.

at The Social Science Research Network eLibrary < <http://papers.ssrn.com/sol3/displayabstractsearch.cfm>>.

KAIST Business School Working Paper Series

Category	Serial #	Author	Title
Working Paper	2012-009	Jin Ho Park Kwangwoo Park Ronald A. Ratti	Investment Propensity of Controlling Shareholders and Financial Constraints: Evidence Around the World
Working Paper	2012-010	Younghwan In Julian Wright	Signaling private choices
Working Paper	2012-011	Duk Bin Jun Chul Kim	The Role of Sticker Shock on Quantity and Variety
Working Paper	2012-012	Duk Bin Jun Chul Kim	A Copula-based Direct Utility Approach with Various Correlations
Working Paper	2012-013	Duk Bin Jun, Dae Keun Park, Jung Il Kim	Distribution Based Level Change Detection in a Random Level Forecasting Model
Working Paper	2012-014	Kun Soo Park Ward Whitt	CONTINUOUS-TIME MARKOV CHAIN MODELS TO ESTIMATE THE PREMIUM FOR EXTENDED HEDGE FUND LOCKUPS
Working Paper	2012-015	D. J. Cho, H. T. Kim, J. Lee, S. H. Park	Cost-Benefit Analysis for Controversial Industry
Working Paper	2012-016	Younghwan In	A fictitious-play interpretation of the Nash solution
Working Paper	2012-017	Younghwan In Julian Wright	Loss-leader pricing and upgrades
Working Paper	2013-001	Taehee Choi Jinhan Pae Choong-yuel Yoo	Demand for Fair Value Accounting: The Case of Asset Revaluations in Private versus Public Firms
Working Paper	2013-002	Moon Young Kang	Exploring the Connection between Purchasing and Donation
Working Paper	2013-003	Byungho Park Moon Young Kang Jiwon Lee	Linguistic Formality and Interactivity in Political Marketing: Effects of Structural Features in Plain Text Messages
Working paper	2013-004	Moon Young Kang Byungho Park	Corporate Size Matters: How Message Attributes in Corporate Social Media Affect Customers Perception
Working paper	2013-005	Yuri Jo Chang-Yang Lee	SAVE THE COMPANION: WHY TECHNOLOGICAL LEADERS SHARE THEIR RESEARCH OUTPUT WITH COMPETITORS

*The above papers are available at KAIST Business School Working Papers Website

<http://www.business.kaist.ac.kr/main.asp?cate_code=20091008101934&gourl=/program/case_work.asp&resou rce=3&cate=2>

You may get additional copy of the documents by downloading it using the Acrobat Reader.

at The Social Science Research Network eLibrary < <http://papers.ssrn.com/sol3/displayabstractsearch.cfm>>.

KAIST Business School Working Paper Series

Category	Serial #	Author	Title
Working Paper	2013-006	Frederick Dongchuhl Oh Kyung Suh Park	Corporate Governance Structure and Product Market Competition
Working Paper	2013-007	오동철 임현준	통화·금융위기의 발생 메커니즘과 전염현상
Working Paper	2013-008	오동철 임현준	금융시장 충격의 전파에 관한 이론적 고찰
Working Paper	2013-009	Lee-Seok Hwang Hakkon Kim Kwangwoo Park Rae Soo Park	Corporate Governance and Payout Policy: Evidence from Korean Business Groups
Working Paper	2013-010	Hongbok Lee Sekyung Oh Kwangwoo Park	How do capital structure policies of emerging Markets differ from those of developed Economies? Survey evidence from Korea
Working Paper	2013-011	Seul Ah Oh, Chae Woo Nam, Tong Suk Kim,Hoe Kyung Lee	Assessing the Proportionality Assumption in Default Rate Forecasting Using the Proportional Hazard Model
Working Paper	2013-012	Yong J. Hyun, Jeong-Eui Kim James W. Gentry Sunkyu Jun	The Effect of Time Pressure on Choice and Postpurchase Process
Working Paper	2013-013	Hee-Chan Song Tae-Hyun Kim	An Evolutionary Perspective on Corporate Ethical Behavior: "Ethics follows strategy"
Working Paper	2013-014	HEEJUNG BYUN TAE-HYUN KIM	PRINCIPAL-PRINCIPAL AGENCY PROBLEM AND SHAREHOLDER ACTIVISM: THE RISE OF MINORITY SHAREHOLDER MOVEMENT IN KOREA 2001-2008
Working Paper	2013-015	SEUNG-HYUN RHEE WILLIAM OCASIO TAE-HYUN KIM	Attention to Member Firm Performance in Hierarchical Business Groups: The Effects of Relevance
Working Paper	2013-016	HEEJUNG BYUN TAE-HYUN KIM	Identity Claims and Diffusion of Sustainability Report
Working Paper	2013-017	Hoje Jo, Hakkon Kim Bong-Soo Lee, Kwangwoo Park	Corporate Environmental Responsibility and Financial Performance
Working paper	2013-018	Myunsoo Kim Byungtae Lee	An Economic Analysis of Two-sided Market Strategy under the Threat of Advertisement De-embedding Service by a Third Party
Working paper	2013-019	Myunsoo Kim Byungtae Lee	Are There Too Many Superheroes? Analysis of the Social Distance in Massive Multiplayer Online Role Playing Game

*The above papers are available at KAIST Business School Working Papers Website

<http://www.business.kaist.ac.kr/main.asp?cate_code=20091008101934&gourl=/program/case_work.asp&resouce=3&cate=2>

You may get additional copy of the documents by downloading it using the Acrobat Reader.

at The Social Science Research Network eLibrary < <http://papers.ssrn.com/sol3/displayabstractsearch.cfm> >.