What to Be Disclosed? Attributes of Online Games for the Market Transparency Policy

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Abstract. This paper identifies main features of online games to be disclosed to the market for policy makers. It tests the positive relationships between information disclosure for online games and stock returns using event analysis method. Based on data collected from online game companies between 2004 to 2009 in South Korea, the paper finds positive and significant correlation between game rating information and stock reactions. Specifically, the positive reactions are clear when a company introduces casual games, and a company has development capability. However, we do not find any significant relationships between stock reactions and voluntary information releases after the game rating information released. The findings support the feasibility of introduction of mandatory information disclosure scheme for online game industry.

Keywords: information disclosure, online game, information spillover, stock returns.

1 Introduction

Information disclosure is widely used by policy makers to protect public interests in many countries for protecting environment, ensuring health and preventing market failures in finance. FDA mandates drug companies to disclose the details of any new products to protect publics from any side effects. Mandatory disclosure of fuel mix percentages and pollution discharge statistics of electricity companies led to reduced use of fossil fuels and increased use of clean fuels in US (Delmas et al. 2010). It is reported that disclosure of financial information of companies leads to reduced liquidity, lower cost of capital, and more efficient market through reducing information asymmetry (Verrecchia 2004). Recently, scholars and policy makers are designing biodiversity index for companies to enforce companies disclose how their business activities making impact on the biodiversity in the ecosystem (Skouloudis et al. 2019).

As online games are forming an important industry over the world, policy makers are pressed to control the market in particular for transparency issues. The policy makers are in black on what information is required to be disclosed to provide right information for investors due to the new and unique nature of the service. Online games exploit the connectivity of the Internet, which appears to trigger rapid growth of the online game industry (OECD 2005). The online game industry is technology-intensive as well as the traditional video game industry and it depends on complementary technologies such as micro payments, broadband diffusions, and popularization of PCs (Lee et al. 2017). Traditional video games and online games are both experience goods, which means it is not easy to judge their value before use. Characteristics of experience goods make it difficult for managers and investors of game industries to allocate human and monetary resources.

This paper measures the impacts of the government enforcement to reveal the online game specification that can reduce information asymmetry by applying real option theory before the commercialization procedure. Online games are usually updated periodically, and the updates contain new features. So, we test information asymmetry for the beginning of commercialization and the updates that contain less information than the beginning period of the game. We adopt the event study methodology to discover reactions of stock markets during the online game development process.

Understanding information spillovers to the stock market during the product development cycle will provide a signal to investors and people who are interested in this product. By analyzing the information spillovers, the market may accordingly change the present value of undergoing products. So the related matters of information spillovers of online games (i.e. when they happen, what is included, which steps are important, or which steps are voluntary or forced by law) is critical to policy makers for the transparency of the online game industry.

2 Conceptual background and hypotheses

2.1 Online game characteristics

Network Effects of Games. Usually a massively multiplayer online games (MMOG) consists of two key components: a seamless vast virtual world and a large number of multiple users. The virtual world is evolved in real time through interactions of the users. Massive user connectivity, interactivity, and a continuing virtual world make it difficult to technically implement a MMOG game and require vast amounts of investments for development. On the contrary a conventional casual game creates disposable virtual spaces and a number of 2~32 clients participate in the game that is hosted in such spaces. At the end of a game session these virtual spaces are removed, and the results of the game are saved in the central databases.

Meagher and Teo (2005) modeled the existence of network externality in multi playable online games (MPOGs) using a two-part tariffs model. The model in this study is consistent with observed examples of online games pricing strategies.

Traditional video games are based on their dedicated platform, and their strategies contribute to the survival of indirect network externalities by increasing third parties to produce games for their platforms. But most online games do not have dedicated platforms. Online games generally make use of a personal computer and the Internet broadband. Choi and Kim (2004) showed that not only personal interactions and playing, but also anticipation of social interactions help players to reach flow. Steinkuehler and Williams (2006) said that "by providing spaces for social interactions and relationships. MMOs have the capacity to function as one form of a new 'third place' for informal sociability." Many people anticipate relationships when they choose to play an online game. A player will have more utility when s/he selects an online game in which more players participate. This feature may generate direct network effects: as more people participate in a game, a player will be bestowed with more utility.

The Korean Game Rating Board examines game contents, and rates it with one of the following 4 rates: "Everyone", "Above 12", "Above 15", and "Adults only (above 18)". "Everyone" graded games can be played by any players, including potential players of "Above 12", "Above 15", and "Adults only (above 18)" graded games. But "Adults only (above 18)" grade games are only playable by players who are older than eighteen. The difference of potential players between "Everyone" and "Adults only (above 18)" graded games reduces the pool of potential players from 100% to 67.8% (Korea Creative Contents Agency 2012). "Adults only (above 18)" online games contain generally prohibited activities in the reality such as violent, sexual, bleeding, or drug-use related actions; these contents may prevent potential players from playing the game, if they do not personally prefer some of these contents. Hence, the positive network externality in online game suggests that the direct network externality induces online games to gain more potential players which leads to a higher stock price reaction.

H1: If an online game has more potential players, then it promotes a higher stock price reaction of the firm which serves the game in the market.

Experience Goods. Many MMOGs offer trial opportunities for players in limited level or time, but basically MMOGs adopted subscription-based pricing strategies. Casual games use more aggressive strategies: they offer basic game functions for free and charge for optional game items (item-based pricing) such as beautiful hats, pets, or functional items: for example, strengthening their avatar for 5 minutes. If many games operate for free, subscription-based payments acts as an entry barrier for players. A game which does not charge for access is attractive. Traditional video games, including online games, are typical experience goods. Gaining information about quality of experience goods differs from getting information about the price of experience goods, and the latter is easy and inexpensive to obtain. It is also expected that the variance in the quality of the experience a player gets to be greater than the variance in the utility of price (Nelson 1970). It is easy to guess the quality of casual games because casual games are generally based on the real activities such as sports, racing, or dancing. On the other hand, an MMOG has its unique background, user interfaces, and its systems.

Usually casual games have much simpler structures and logics than MMOGs. The simplicity and aggressive pricing strategies of casual games makes it much easier for

potential players to discover their values in fewer sampling trials. So we can assume the following hypothesis:

H2: Introduction of casual games will have a larger impact on stock prices than MMOGs.

Longer Life Expectancy of Online Games. Lineage and Lineage 2, popular online games developed by NCSoft, have been running over 15 and 10 years respectively. A casual game, the "Crazy Arcade" developed and serviced by Nexon, is also enjoying a long life of 12 years. Many online games enjoy a longer lifespan than video games. Online games have average 50.8-month lifetime, but video games have only up to a 24-month lifetime, less than a half of an online game lifetime (Korea Creative Contents Agency 2012). It is well known that traditional video games follow the box office revenue models of Hollywood "blockbusters": 80% of the total revenues are made in the initial month, after which revenues quickly decline on a weekly basis. The average shelf-life of a video game is about six weeks. On the other hand, online game revenues increase over time: routine and urgent updates make its life time longer (Choi et al. 2007).

The major reason why online games usually have longer lifecycles is that they receive routine updates. A routine update generally adds new contents to the existing game and fixes its bugs. Major updates are usually applied one or two times a year; they add whole new story portions, tweak existing game systems, and eventually enhance the gaming experiences with improved game engine features and user interfaces. Minor updates are generally done between one or two weeks; they may add holiday events, minor story additions, and bug fixes.

So reacting to players' demands and to solve unintended situations such as bugs to hinder players' activities or system abuse is not only crucial to the success of an online game but also to sustaining a long life time of the game (Meagher and Teo 2005). According to the aforementioned logic, we can expect that a firm having game maintenance capability produces higher market reactions in the online game industry than a firm without it.

H3: A firm which has game maintenance and development capability can expect higher market reactions than a firm without it.

Business models in the online game industry. We focus on the "dis-intermediated" firms which are vertical integrated firms. These firms appeared in the beginning era of the online game industry. These firms have developmental organizations and service operation departments. They develop their own games, distribute them in their game portal, do marketing campaigns, and serve their games by themselves. It is platform providers that are similar to vertically integrated firms in the video game industry such as Sony, Microsoft, and Nintendo. In the traditional video game market, platform providers differentiate themselves by incompatible hardware systems (Aoyama and Izushi 2003) and the exclusive killer titles such as "Super Mario" which was only playable on

Nintendo platforms. Platform providers focus on gathering competent independent developers that do not own a platform. Gathering third-parties (competent independent developers) reinforces indirect network effects based on its platform (Zhu and Iansiti 2012). One more reason is "software licensing fees are the primary source of revenue for platform providers" of the video game industry. So platform providers prefer to gather more third-party developers. The online game firms, however, adopt vertical integration in order to operate their own games by themselves and to earn money directly through the service of these online games to reduce transaction costs.

Many online game projects are high risk projects with high returns. From this point of view, online games can be viewed the same way as high risk R&D projects. Online game firms may stop their projects if they predict that it will not yield the initially targeted profits. The publisher, developer, and vertical integrated model have differences in real options when the project outcome is uncertain.

A vertically integrated firm can enjoy various real options: they may either stop the project, simply delay it, or may acquire a firm which develops an online game or is able to develop new projects for their line-up. But for an independent publisher it is not easy to delay a project or develop a new one. Similarly, an independent developer has the options to stop, delay its projects or develop a new one, but the actions are limited by contracts with a publisher. They do not have the real options of acquiring new projects that are under development or developed by others. Independent publishers cannot take actions without help from the developer's side regarding problems such as bugs or unexpected events. Most independent online game publishers started without online game development teams, so they did not have sufficient experience to solve unexpected technical problems that occurred when online games were served to the public in the early stage. So it is predictable that a firm which adopts vertically integration receives higher stock returns from the market.

H4: Vertically integrated firms show higher stock returns than independent developers or independent publishers.

3 Data and Method

We collect data from Korean online game industry during 2002-2009. The history of the Korean online game industry is the longest in the world, and the Korean market is still a leading global market. By using data collected in the early stage of the industry life cycle, we can generalize the results to other countries who need to understand the policy implications before they introduce regulatory frameworks.

There were 12 firms listed on the Korean stock market in 2009. One firm, NCSoft is listed on KSE , the others on KOSDAQ. We selected firms which have an online game business as the major part in their portfolios. We gathered disclosures from the website of the Korean Financial Supervisory Service for all 12 firms to control confounding effects, especially financial issues. We retrieve the game rating information from the Korean Game Rating Board website. We dropped GameHI and JCEntertainment data. These two firms were listed in 2009, so it was not enough to calculate normal returns.

So we used ten firms for the event study test. The sample size of this study is small, but Brown and Warner (1985) showed that the specification of the test statistics is not dramatically altered if sample size is less than 20 compared to 50 in their sensitivity analysis.

Press releases contain broad information such as: announcements of a new online game development; announcements of close beta tests and open beta tests; commercialization schedules, promotions of upkeep and new online games; and update notices of upkeep games. We chose Yonhap News Agency as a source of press releases because Yonhap News provides the most comprehensive database of news, other printed information, and press releases. This database provides press releases from January 2004 to May 2009. We supplemented them from the firm's own website when necessary.

The Korean Game Rating Board is a regulatory agency granting rates for computer game publications. It is the Game Industry Promotional Act enacted in 2006 that prevents the publishing of a game without a rating. The Game Rating Board demands expressions and substances of sustaining coherence to retain a rating. If expressions or the substances of a game are changed without prior notice, the board has the authority to suspend any further commercial/non-commercial service.

We acquired game rating information from the website of the Game Rating Board. All the game rating information of our targets are available after 2000 . For this study we only included data regarding online games. We excluded new games or sequels in the other gaming platforms such as mobile and video game platforms. As of 2008, there were a total of 4,426 cases requesting the game rating. 3,375 cases (76.25%) received an "Everyone" grade and 749 cases (16.92%) were granted an "Adults only" grade. The "Above 12" and "Above 15" grades only took up very small portions of the total cases, just 184 (4.15%) and 118 (2.67%) respectively. Due to their small portions we did our tests only with the "Everyone" and "Adults only (above 18)" cases.

After the data gathering, we deleted invalid events that lacked sufficient event window spans of at least three days (event day +/- 1 day). Publishers generated press releases for their individual games on the daily basis. So many press releases about updates and promotions of the games have less than three days. Filtering procedure to remove overlapped events for the game rating is similar to the press release. However game rating is less frequent than the press release, deleted events percentages of the game rating is less than the percentages of the press release.

Many studies used event study methodology for extracting the reactions between events and stock price changes. Event study was first adopted in the finance sectors (Dodd and Warner 1983).

We adopted the traditional assumptions on the event study method: efficient market hypothesis, unanticipated events, and confounding effects (McWilliams and Siegel 1997). In this study, we adopted the traditional event study that was used in McWilliams and Siegel (1997) and Im et al.(2001). It is a standard residual analysis technique based on the market model. We set the event day as $t = 0$, which is shown in press releases or game ratings information. The trading day prior to event day is numbered as minus, $t = -1$, $t = -2$, and trading day after event day set as plus, $t = +1$, $t = +2$. We estimated daily market model parameters for each event using two hundred day returns from $t = -250$ to $t=-51$. Similar studies generally use two hundred days to estimate normal returns.

$$R_{it} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (1)$$

Regression (1) is used to estimate the coefficients of the daily market model. Rit is the common stock return of firm i on day t calculated by (2), and Rmt is the market return on day t calculated by (3). Because the common stock return, Rit, and the market return, Rmt, are evaluated as the difference of each price respectively, we do not put the control variables in the regression (1). Two parameters, ai and bi, are ordinary least squares estimators, and εit is the market model error.

$$R_{it} = \frac{price_{i,t} - price_{i,t-1}}{price_{i,t-1}} \quad (2) \qquad R_{mt} = \frac{price_{m,t} - price_{m,t-1}}{price_{m,t-1}} \quad (3)$$

In this study, we calculated abnormal returns from the difference between the expected return of market returns at time t and individual firm i's returns at time t that is calculated in (4). The standard errors are calculated by the formula defined by Im et al. (2001).

$$AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_{m,t}) \quad (4)$$

$$\mathrm{var}(AR_{i,\tau}) = \left(S_i^2 \left[1 + \frac{1}{T} \frac{\left(R_{m,\tau} - \overline{R_m} \right)^2}{\sum_{t=1}^{T} \left(R_{m,t} - \overline{R_m} \right)^2} \right] \right) \quad (5)$$

We used the cumulative abnormal return (CAR) values for specified window sizes that contain event days. We used (6) to calculate the cumulative abnormal return (CAR) for various window sizes. τ and τ' can be different if the window size is not symmetric. Under the assumption that the returns on each day are independent, the standard error of the cumulative return is the sum of the standard errors (Subramani and Walden 2001).

$$CAR_{i,\tau} = \sum_{i=-\tau}^{\tau} AR_{i,i} \quad (6) \qquad \mathrm{var}(CAR_{i,\tau}) = \sum_{j=-\tau}^{\tau} \mathrm{var}(AR_{i,j}) \quad (7)$$

As this study is the first trial event study about the online game industry, a field where this method has never been applied, we tried several window sizes: t=-1~1, t=-3~3, t=-5~1, t=-5~5, t=-10~1, and t=-10~10 to determine which one would be appropriate empirically. We tested asymmetric windows due to the issue of information leakage. If any information is leaked, asymmetric windows should show higher returns than other windows. Through testing six window sizes, we finally adopted three windows sizes in order to achieve bigger cumulative abnormal returns than other returns. The adopted sizes are: t= -3~3, t= -5~ 1 and t= -5~5. An asymmetric window was accepted to reveal information leakage. In the results, the values of cumulative abnormal returns (CAR) of the asymmetric window are superior compared to symmetric windows.

$$\overline{CAR_\tau} = \frac{1}{N} \sum_{i=1}^{N} CAR_{i,\tau} \quad (8) \qquad \mathrm{var}(\overline{CAR_\tau}) = \frac{1}{N^2} \sum_{i=1}^{N} \mathrm{var}(CAR_{i,\tau}) \quad (9)$$

Finally, we employed a conventional t-test for the significance test with average standardized cumulative abnormal return (ASCAR) and its variance.

$$t = \frac{\overline{CAR_\tau}}{\sqrt{\mathrm{var}(\overline{CAR_\tau})}} \sim t_{(\alpha, df=N-1)} \quad (10)$$

We took stock market index and daily stock price information of our target firms from Fnguide.com . We utilized a rectified stock price of each firm provided by this web site. As we assumed two hundred days as the daily market model estimation time, two firms did not achieve these criteria and we could not analyze them. Neowiz Holdings announced in 2007 they would divide their online game business division into Neowiz Games. But Neowiz Holdings kept governing Neowiz Games even after being listed in KOSDAQ as a separate firm. So we only analyzed Neowiz Holdings data and excluded Neowiz Games from our analysis with the purpose of avoiding duplication and maintaining stock price consistency.

$$AR_{i,t} = (R_{i,t} - R_{free,t}) - (\alpha + \beta(R_{m,t} - R_{free,t})) \quad (11)$$

We use another estimation model to control macroeconomic influences: capital asset pricing model, the equation (11). We adopted the three year Korean government bond rate as the risk free rate. The results of the CAPM model is almost similar to the market model. It also supports the robustness of our results.

4 Results

Table 1 presents average cumulative abnormal return (ACAR) values of our estimated three different window sizes associated with online game development and publishing events. The numbers inside the parenthesis represent p-values respectively. We display the level of p-values as asterisks next to the parentheses: a value that is $p < 0.10$ represents cross (†), values that are $p < 0.05$ are represented with one asterisk (*), and values that fall under $p < 0.01$ are depicted as two asterisks (**).

Regarding our overall observations, we conclude that game rating events have significant meanings. In the case of game rating event, ACARs shows positive and significant values for unbalanced window t = -5 to t=1. On the other hand, press releases are insignificant. An important premise of this research is that generally stock price reactions to game rating events will show significantly positive values rather than zero. The information from a game rating is regarded as a signal of the possibility that the product will be introduced into the market and also includes an outline of the game.

Many investors and managers inferred that each beta test and the final commercialization of a product would raise the firm value: this assumption does not fit with our results. Usually plenty of media reports already deliver related information before press releases to the market before beta tests are conducted or commercialized. We guess that lots of media reports leak related information about new games and as an effect reduces the abnormal return on the actual event days. These events can be interpreted as earning shocks if the real earning of a firm in the annual report is less the same as to the

expectation of the earning. All information is already leaked and the information is realized as a price of the stock.

Event Classification	Window Size (in days)	-3 ~ +3	-5 ~ +1	-5 ~ +5
Stock Price Reactions	Game Rating	.0016 (.119)	.00178 (.091)†	.0014 (.105)
	Press release	.0001 (.396)	-.0004 (.371)	-.0010 (.177)
Reactions to Game Rating by Age Grades	Everyone	.0035 (.039)*	.0039 (.025)*	.0036 (.013)*
	Adults Only	-.0003 (.389)	-.0009 (.334)	-.0010 (.307)
Reactions to Game Rating by Category	MMOGs	.0002 (.394)	.0011 (.297)	.0005 (.372)
	Casual game	.0026 (.065)†	.0024 (.087)†	.0029 (.024)*
Reactions to Game Rating by Business Structure	Vertical Integration	.0015 (.239)	.0014 (.242)	.0019 (.128)
	Independent Developer	.0029 (.130)	.0043 (.041)*	.0033 (.056)†
	Independent Publisher	.0002 (.392)	-.0010 (.348)	-.0035 (.070)†
Reactions to Press Release by Business Structure	Vertical Integration	.0017 (.116)	.0002 (.391)	.0001 (.394)
	Independent Developer	-.0024 (.175)	-.0043 (.389)	-.0015 (.229)
	Independent Publisher	-.0021 (.178)	-.0037 (.194)	-.0038 (.122)

Table 1. Stock price reactions to online game events[1]

Game rating events were tested according to the rating grade the game has received. The results are also summarized in table 1. We found that all ACARs of "Everyone" rates are positive and show significant values for all event window sizes. We guess that this result mainly stems from the existence of direct network externality. The smaller potential customer size of the "Adults only" grade is one of the main reasons to show negative ACARs, which is not significant. Another reason is the diversity of preferences of adult users. Many people develop their own tastes while growing up. So many "Everyone" grade online games have similar appearance as they have the same large pool of potential users; whereas "Adults only" rated online games mostly contain different contents. This leads to the result that the "Everyone" rated games have bigger potentials than "Adult only" rated games. This result can be interpreted as a sign that as direct network externality exists in online games, which supports our Hypothesis 1.

To test Hypothesis 2 by stock price reactions to game ratings that are classified according to categories, we received the following expected result: stock price reactions

[1] *: $p < .05$, **: $p < .01$, †: $p < 0.10$. The value in the parentheses is p-value. Less than .001 reported as <.001.

to game ratings of casual games are positive and show significant values. So we can accept hypothesis 2. As opposed to the results of casual games, stock price reactions to game ratings of MMOGs do not show any significance. Due to the simple game structure and contents, relatively small sizes that make them easy to download and install, casual games can usually gather more attention in a given short time compared to MMOGs. It is reasonable to assume that many investors are also able to make proper decisions within a shorter time about casual games compared to cases of MMOGs.

If the Korean market just preferred the casual games, then the new portfolio which contains casual games for each grade, "Everyone" and "Adult only", will show positive and significant stock returns respectively. But the results do not match this opinion. Table 2 shows the results for casual games. As we expected with Hypothesis 1, casual games with the "Everyone" grade which have more potential players show positive and significant stock returns. Casual games which rated "Adult only" show no significant relationship with stock returns. We also did the same tests for MMOGs, but all rated MMOGs show no significant relationship with stock returns.

Event windows	ACAR casual games	
	Everyone	Adult only
-3 ~ +3	.00385(.040)*	.00017(.395)
-5 ~ +1	.00455(.017)*	.00051(.382)
-5 ~ +5	.00411(.017)*	.00037(.385)

Table 2. ACAR for casual games

We can see that independent developers show positive and significant impacts on stock reactions to game ratings by business structure in Table 1. But vertically integrated firms do not show significant stock returns. So we partially accept Hypothesis 3. Because of the important technological aspects of the industry, the development capability is considered as an important factor in the online game industry. The reason that independent developers are seeing higher stock price reaction than other models lies in the timing of capitalization: independent developers can capitalize some part of the expected total earnings by licensing the product to the publisher, but firms which adopted the vertical integration model have to pay additional costs for beta tests, marketing campaigns, and commercial distribution. Generally vertically integrated firms are able to capitalize larger amounts of financial resources for a game than other models, but the realization of such a capitalization takes more time than firms which adopted the independent developer model.

We proposed the impacts of business models in the online game industry with Hypothesis 4. Against our expectations, vertically integrated firms did not show higher stock returns than other business models.

5 Conclusions

This paper found that not only online game characteristics but also the online game industry structure that is favorable to market reactions. The findings of this paper have strategic implications to policy makers and online game makers.

We derived the following results. First, it is likely for online games to have direct network externalities generated by interactions within potential players. Its managerial implication is that the firms pay more attentions to boost network externalities through interactions in the game to ensure their success in the online game industry. Sustaining development ability (or technological competence) is an important factor in the online game industry. Online games are complex experience goods: they are technology-intensive, but the contents are also important (Choi et al. 2007). Continuous technological innovation and maintenance with technological competence can make differences to competitors. Hence, the independent publishers may be seriously disadvantaged in this industry than in the traditional video game industry. The downtime of World of Warcraft in China was due to a change-over in the Chinese game operation license regulation. This was an inevitable incident to Activision-Blizzard . It is an example that an independent publisher can suffer in the market.

Casual games, which are generally simpler than MMOGs, generate stronger market reactions in the short term due to ease of quality evaluation, possibly the shorter payback cycle of investments and smaller capital requirements for development, all of which lead to lower risks. But it does not mean that casual games show superior performance in the long run. High stock returns in the short term do not guarantee high performance in the long term. Stronger market reactions of the casual games could be based on the market preference, but it is not easy to identify market preference publicly. We pooled casual games and MMOGs in this study. However, as mentioned before, MMOGs have much longer service cycles and more various pricing strategies after our data period. Therefore, MMOGs may require studies over a much longer time.

We studied relationships between events and stock price reactions only. Linking market responses to actual game success may be an interesting topic to be explored further. As we tested in this game, many online games are launched in the market every year, while many online games are withdrawn from the market. That may test the efficiency of financial markets in assessing online games' success in the market.

While our study is limited to online games, expansion to other entertainment genres may shed more light on similarities and dissimilarities of the online game industry against traditional entertainment markets.

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