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How government policies and regulations will affect share prices of online game companies in China

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Abstract

As a fast-developing emerging industry, online game companies are grasping attention from all over the world currently. Although the whole industry grows rapidly in terms of revenues and players, it is still not comprehensively regulated. As the country with the biggest number of users in the world, China is now on the way to regulate the online game industry. Thus, the purpose of this study is to examine the relationship between the share price reactions of Chinese online game companies and regulations or policies released by the government. To conduct this study, the event study and risk-adjusted model are used in the thesis. We identify that regulations or policies have significant reactions to share prices of Chinese online game companies.

Keywords: event study, regulations, policies, share price, Chinese online game companies

Table of content

1. Introduction

The online game industry in China has been confronting a booming growth and becoming one of the most significant sectors within creative industries in the past decade (Ström & Ernkvist, 2014). According to Newzoo (2018), the turnover of the online game market in China had reached an amount of $32.4 billion in 2017.

However, this fast growth had been tremendously disrupted due to a new policy released. After the publish of *Deepen the reform plan of the party and state institutions, the* Chinese government has resigned some management responsibilities of the State Administration of Press, Publication, Radio, Film, and Television to the Central Propaganda Department, then indirectly caused to a sudden suspension in approval of new games' licenses in March 2018 (Newzoo, 2018). It was explained by government officials that such adoption would make companies launch new games more difficult due to the halt in licensing, and could restrict the children's daily playtime since health and safety issues for instance myopia of teenagers had been increasing for a long time (Newzoo, 2018). But the whole industry was still holding positive views towards this new policy and believed that licensing would be given out quickly soon since this new policy could influence a lot on the Chinese games market adversely and the growth of the games market is mostly driven by the number of newly released games (Newzoo, 2018).

However, to everyone's surprise, in August 2018, the Chinese government took stricter actions, claiming that more harsh regulations and monitor systems will be adopted by authorities to existing games (Newzoo, 2018). It is believed that concerns about the addiction to huge multiplayer playing online games had been ignited by the Chinese government due to fast growth in Internet use (Bennett & Williams, 2005). Besides, an age-appropriate reminder system was also being explored to restrict children's playtime after taking deep considerations on such experiences in the US, South Korea, and the EU (Newzoo, 2018). After the news was released, Tencent, which is one of the biggest Chinese online game companies, announced that age-verification checks would be applied to their games with a requirement of registrations under users' real names (Newzoo, 2018).

As reform plan processing, it seems that Chinese government trends to take stricter actions towards the online game industry, especially after *Recommendations on accelerating the Rating system for online games* has been discussed in the National Committee of the Chinese People's Political Consultative Conference. In the foreseeable future, the new regulations may affect, even reshape, the whole online games industry in China.

1.1 Research purpose

The possibility of new regulation publications will obviously affect the profitability of game companies. In fact, they have already been affected, as they cannot get new licenses for their products on time. According to the website of the State Administration of Press, Chinese relevant departments have approved 9,651 domestic and overseas online games during 2017 (Zhang, 2019). Before the Chinese government suspended the licenses approved in 2018, there were still 1,982 domestic and overseas online games approved in the first three months (Zhang, 2019). This led to a result that most Chinese public game companies' growth in the first half of 2018 is slower than expected (Newzoo, 2018).

However, strict policies have not reached their bottom yet. In December 2018, the government established an assessment committee, which is responsible for guaranteeing that online games will meet certain codes of ethics, provide healthy entertainment products and protect adolescents from unhealthy impact (Newzoo, 2018). This tendency could be seen from several years back. Back in April 2004, the Ministry of Culture established a committee to check the content of online games, to rule out the excessive violence, sexual, or other problematic content (Macinnes & Hu, 2007). This policy is partially to respond to the increased concern that more and more adolescents are spending too much time and money on online games (Macinnes & Hu, 2007). Increasing demand for the treatment of online game addiction could be side proof of this phenomenon. According to the estimation of Li, Wang, & Wang (2008) and, also, Yip & Kwok (2005), the online game addiction among young adults has increased from 5.4% in 2005 to 11.6% in 2008 (Li & Wang, 2013). Naturedly, the government is considering taking measures on it, including forcing adolescents' offline if they continuously play online games for more than 18 hours (Macinnes & Hu, 2007). And such policy changes often could affect the value of companies, then reflect in the stock market. For example, in 2009, Hansson and Rüdow Fors (2009) found that banning short-

selling in financial stocks affected bid-ask spreads and trading activity (Hansson & Rüdow Fors, 2009). As the same as above, some researchers also found that the regulation change in 2001 impacted the Chinese stock market (Chen, Jiang, Li & Sim, 2010). The latest study even shows that even without publishing laws or mandates, China's Securities Regulatory Commission still could interfere with the market by state wills and bring temporary stabilization to the market (Hilliard & Zhang, 2019).

Although the approval of licenses has been opened again and the government also published some favorable policies, the Chinese government still has a high possibility of tightening the game industry again, especially the favorable policies are not directed towards the online game industry and the unfavorable policies are more articulated. Our study is to find out the impact of regulation changes on the online game industry and to analyze the possible function behind to advise Chinese game companies if the government changes the regulation again

2. Theory Section

This section consists of two metatheories and comprehensive literature reviews which are relevant to this study. As two most prevalent theories, efficient market hypothesis (EMH) and institutional theory are thought to enable flourish and provide solid standpoints to this study.

2.1 Efficient Market Hypothesis (EMH)

The efficient market hypothesis (EMH) is one of the theoretical premises for our master thesis and it stems from microeconomic price theory which focuses on predicting that share prices completely take in all accessible information in the market (Lidemar & Karlsson, 2015). Therefore, as new information, the impact of publishing new regulations will incorporate into the stock prices and be observed in the market. By observing changes in the stock market during the publication of new regulations, whether there is an impact existed could be determined.

Fama (1970) posits that there are three different forms of efficiencies, including strong form efficiency, semi-strong form efficiency, and weak-form efficiency. Besides, these different efficiency forms need to be tested in different ways since each of them has its nature to reach out to information (Fama, 1970).

The efficiency of the Chinese stock market, however, is highly controversial. According to the efficient market hypothesis, if the market only contains historical information, then investors cannot gain abnormal returns through analyzing the past information and the market follows the random walk (Roberts, 1967). Under this circumstance, the market should be considered as a weak-form efficient. Consequently, even if the occurrence of events or policies cause fluctuations in the stock market but not quickly enough to reflect that information and affect the result of the calculation.

Although we do not find evidence that the Chinese stock markets are semi-strong efficient, some studies are suggesting that Chinese stock markets are not weak-form efficient. For example, the study of Laurence, Cai & Qian (1997) finds that there is a significant serial correlation in the daily return series in the Chinese stock market, which could be interpreted as a violation of the weak form efficiency. And they point out that the U.S. stock market has a strong causal relation to Chinese stock markets (Laurence et al., 1997). They wrote that all of these suggest that the Chinese market is gradually integrating into the global economy (Laurence et al., 1997). By studying the duration properties of the Chinese stock market cycle, Chen, Chong & Li (2011) also reach a similar result that Chinese markets are not weak-form. In their paper, they reject the random-walk hypothesis for both Shanghai and Shenzhen stock markets and find that the Shenzhen B-share market is more efficient than the Shanghai A-share market (Chen, Chong & Li, 2011). Similar to Laurence, Cai & Qian (1997), Chang, Luo & Ren (2014)'s study shows that China's stock markets have become more efficient after the reform (Chang, Luo & Ren, 2014). Following their footsteps, Grochevaia and Hang (2016) examined whether Shanghai and Shenzhen stock exchanges exhibit signs of weak-form efficiency throughout the period from 1992 to 2015 and the hypothesis that the Chinese stock markets are weak-form efficient be rejected (Grochevaia & Hang, 2016).

However, other studies show a different result. By using the cointegration test and causality test, Liu, Song & Romilly (1997) suggest that the Chinese stock markets are inefficient collectively. Two years later, Mookerjee and Yu (1999) use daily stock price data to test the market efficiency of Shanghai and Shenzhen stock markets and conclude that there are significant inefficiencies present on both exchanges (Mookerjee & Yu, 1999). And they also find that negative weekend and positive holiday effects exist in both markets (Mookerjee & Yu, 1999). Using the data set between 1990 and 1998, the efficiency of China's stock market

(Ma, 2004) aims to examine the efficiency of China's stock market and, in the book, the author also summarizes the factors of Chinese stock market inefficient, including market segmentation, excessive government intervention, inadequate government regulation and poor corporate governance in China's listed companies (Ma, 2004).

2.2 Institutional Theory

Setting off from a macro organizational perspective (Suddaby, 2010), the institutional theory could be used as a tool to understand and explain organizational behavior and why/how organizations tend to become more homogenous over time (Clegg & Bailey, 2008). If this impact exists, we employ institution theory to explain why this impact exists, since the new regulations could be considered as coercive isomorphism or normative isomorphism.

According to Hawley (1968), this process of homogenization can be described most accurately by the concept of isomorphism. Institutional isomorphism consists of coercive isomorphism, normative isomorphism, and mimetic isomorphism (Martínez-Ferrero & García-Sánchez, 2017). Coercive isomorphism posits that the change in the institutions is introduced due to the force imposed by relevant authorities, for instance, the Sarbanes-Oxley (SOX) Act to enhance internal control mechanisms of companies which are listed in the US was forced by SEC (DiMaggio and Powell, 1983). For the mimetic isomorphism, it means companies will mimic other successful companies to legitimize their businesses when uncertainties are existing in firms (Zucker, 1987). Lastly, normative isomorphism refers to changes that are brought on by obeying professional practice and standards, as well as industry norms (Zucker, 1987).

While, the institutional theory is criticized by just focusing on some factors within the institutional realm which only have impacts on organizational behaviors and actions, instead of paying attention to factors which have pure economic rationalities and can result in profit and efficiency maximizations (Berrone, Gelabert, Fosfuri & Gómez-Mejía, 2008). Therefore, companies will only respond to other institutions and their environments which legitimacy can be obtained and lead to homogenization, but could jeopardize the efficiency or performance in terms of economics (Berrone et al., 2008).

Since the Chinese government has been issuing much stricter regulations towards the online games industry from 2018, Chinese online games companies are taking measures now trying

to make themselves fit in these regulations through coercive or normative isomorphism to legitimate their businesses (Newzoo, 2018; DiMaggio & Powell, 1983).

2.3 Literature Review

The literature review includes prior researches in this area and addresses regulations in the online game industry and impacts on the market.

2.3.1 Regulations of online game

Costs and fundamental efficiency effects of the regulation on economic activities from an efficiency perspective are investigated and analyzed in the majority of current studies, while the process by which regulations are created and evolved to cope with market failures is barely explained (Reynolds, 1981). Reynolds (1981) believes that perceived market failures which include efficiency, equity, or both, are the reason why regulations are created by lawmakers. While, a health issue can also be a standpoint for the effect of regulations instead of only economic activities (Lee, Kim & Hong, 2017). Lee, Kim & Hong (2017) explain that the new legalized regulation of blocking access to online games for young people after midnight in South Korea reduced the possibility of juvenile internet addiction and increased sleep durations. While under the different contexts of institutions, the same regulation may not be suitable for another. In countries such as the United States, Japan, and European Union, the game industry is restricting their services by autonomous regulations, therefore promoting not only the online game industry but also securing legitimacy, which are different from countries such as China, Thailand, and South Korea who apply the compulsory shutdown regulation in their context of institutions (Lee et al., 2017).

2.3.2 Market impact of regulations

According to EMH, the release of new information should have an impact on market performance. New information, based on previous research, could be separated into mainly two categories - policy events and industry events.

For example, in the article of Dooley and Hutchison (2009), they divide the news into 15 categories, covering both policy events and industry events, then investigated whether the release of major news on the real economy and financial system in the United States during the 2008 financial crisis had an impact on stock markets in emerging markets. And they found that

those events - deteriorating the US financial system and the real economy - have had a huge impact on emerging market countries (Dooley & Hutchison, 2009).

For industry events, impacts of announcements and scandals have been studied a lot in the past decades. Bartz, Molchanov & Stork (2013) made a research about how firms' value, which is measured by abnormal stock returns, would be affected by announcements of disgraces and scandals of celebrities. It turns out that misbehavior of celebrities can have negative impacts on sales and market values (eg, share prices) of endorsed companies since what celebrities did can lead to adverse public images of these companies (Bartz et al., 2013). Thus, in turn, these would result in abnormal stock returns around the event date (Bartz et al., 2013). Similarly, Dawar and Arora (2016) found out that the announcement of Tara's new model Zest has an impact on the stock price and the value of the company.

For the policy events side, Hansson and Rüdow Fors (2009) investigated how new policy - ban short-selling in financial stocks - during one of the most intense periods of the financial crisis will affect the stock market. The ban aimed to guard against instability and calm the market (Hansson &Rüdow Fors, 2009). And they found strong evidence that the bid-ask spreads in the affected stocks widened during the ban and that the trading activity in the banned stocks decreased (Hansson & Rüdow Fors, 2009). Also, in the paper of Krüger & Hedin (2003), they found that Market deregulation could have a positive effect on profitability in the US and the EU airline industry, although no indication that the EU airlines improved in profitability after the final deregulation. Similar with our article, Chen, Jiang, Li & Sim (2010) have studied the regulation change on February 19, 2001, which allowed Chinese domestic investors to trade in the B-share market, and then lead to structural changes of volatility spillovers between Chinese A-share and B-share markets (Chen et al., 2010).

2.3.3 Regulations and institutional theory

Pattit, Raj & Wilemon (2012) apply a pan-disciplinary view of the institutional theory which consists of economics and sociology for investigation of U.S. technology development trends since the mid-19th century. The reason why institutional theory is suitable for this research is because of the historical longitudinal nature of studies by which the institutional changes can only be observed (Barley & Tolbert, 1997). The emergence of technologies, for instance the internet is believed to encourage the recent tide of decentralization within firms since they can facilitate more complicated interactions, which is achieved by different units and processes

within the organization (Castells, 2000). While it does not mean that such changes of technologies only happen in an isolated vacuum, instead it is placed within a social context and is shaped by it as well (Castells, 2000). Besides, Castells (2000) also posits that the government has an impact on technological changes since it can set up, unleash, or even result in innovations of technologies. While, it is impossible to generalize about the impact of a single rule without taking the whole institutional setting in which the rule is embedded into account (Pattit et al., 2012). Besides, both informal and formal rules and constraints affect these technology development trends, suggesting that institutional settings can do a favor in explaining the decisions made by managers which cannot be accounted for by firm-level theories alone (Pattit et al., 2012). Thus, the innovation of technology and emerging technological opportunities is influencing shaping institutions as well as being shaped by institutions simultaneously (Pattit et al., 2012).

When the regulation is released, companies usually need to take actions to conform to it. Since 2012, European Union has been consistently in the process of changes of cabotage regulation, which led to a high degree of competition within member countries and related companies in this industry, which is trying their best to adapt to new regulations to make their business more competitive and legitimate (Hilmola, Kiisler & Hilletofth, 2017).

3. Hypothesis Development

The coercive isomorphism may lead companies to change their ways of doing business to legitimize their businesses and avoid potential punishments from the government. This could be a helpless move caused by the pressure from the government and could have great uncertainties on companies' value and shareholders' wealth. However, the government also could encourage certain behaviors by losing the restrictions or providing favorable policies, which could be regarded as an isomorphism, although the negative policies seem more direct and evident.

However, as mentioned before, the negative policies are more direct towards the online game industry, such as restricting the time of adolescents online, controlling the number of licenses approved. The favorable policies, on the other hand, are mostly published by the local government or are towards all culture industries. Since we only study the policies which are published by the central government, the positive policies may have fewer possibilities to affect

the online game industry than the negative one. Therefore, we decided to separate positive and negative policies and analyze two separately.

Besides, although the efficiency of Chinese stock market is controversial, according to the literature reviews above, it seems that after the reform of Chinese stock market, the market efficiency has been gradually improved and has gotten rid of the weak form, even though we do not find any evidence for the semi-strong form. But as long as markets are not weak-form efficient, we could assume that the Chinese market follows the semi-strong form efficiency. Thus we come up with two hypotheses below:

H1: the negative policies will adversely affect online game companies' stock prices.

H2: the positive policies will not affect online game companies' stock prices.

4. Methodology

In the theoretical part, we pose two hypotheses that the negative policy will affect companies' performance and the positive one will not. In order to confirm our hypotheses, we need to look at the performance in the online game industry.

According to the efficient market hypothesis (Fama, 1970), the market price will incorporate all the public information, if the market is the semi-strong form (Lidemar & Karlsson, 2015). Although the efficiency of the Chinese stock market is controversial, as mentioned above, as long as markets are not weak-form efficient, we believe that market performance could be a good indicator to reflect the impact of regulation changes. Also, the nature of the online game industry may be more suitable for market measurement, since they tend to have a large proportion of intangible assets, face fast product restructuring and high investment risks and more rely on R&D and innovation capabilities. Therefore, the event study may be a suitable choice for determining whether the regulation changes will affect market performance.

4.1 Data and sample description

This study aims to examine how the change of regulations or policies could affect the share price of the online game companies in China, thus we selected 30 online game companies or the companies which are closely connected with the online game industry, such as gaming platforms, in China who have been public. In order to collect our samples, we used S&P Capital

IQ as our source to search all public Chinese online game companies and to access all available data that we need for our thesis study. First, we set the research period from September 1st 2017 to December 31st 2019, since we need to set the estimation window for the event study. Then we used four criteria to filter out our samples in S&P Capital IQ, which are "Interactive Home Entertainment (primary)", "China (primary)", "Public Company" and "Operating". The reason why we use the criteria of "Operating" is that we are supposed to ensure that companies used in our research are actively operating in the public market and are not bankrupt. At this point, we extracted 53 companies. To make our samples more relevant to study, we only chose target companies whose more than 50% of total revenues stem from online games or relevant industry. After selecting based on the criteria above, we eventually extracted 39 samples from S&P Capital IQ. However, 9 companies do not have enough observations for the event window or estimation window, including 7 Road Holdings Limited, Digital Hollywood Interactive Limited, FingerTango Inc., Giant Network Group Co., Ltd., Kingnet Network Co., Ltd., Shanghai Fukong Interactive Entertainment Co., Ltd., CMGE Technology Group Limited, Hunan Tianrun Digital Entertainment &Cultural Media Co., Ltd. and XD Inc. After excluding these 9 companies, we decide to use the data to observe how the share price of these companies fluctuates during the event period. The companies present in the Table 1 below.

Table 1: List of Companies

Company name
A8 New Media Group Limited
BAIOO Family Interactive Limited
Beijing Kunlun Tech Co., Ltd.
Boyaa Interactive International Limited
Changyou.com Limited
Dalian Zeus Entertainment Co., Ltd.
Feiyu Technology International Company Ltd.
Fire Rock Holdings Limited
Forgame Holdings Limited
G-bits Network Technology (Xiamen) Co., Ltd.
Great Wall International ACG Co., Ltd.
Hangzhou Electronic Soul Network Technology Co., Ltd.
Hangzhou Shunwang Technology Co,Ltd
Kaiser (China) Culture Co., LTD
Linekong Interactive Group Co., Ltd.
NetDragon Websoft Holdings Limited
Ourgame International Holdings Limited
Ourpalm Co., Ltd.
Perfect World Co., Ltd.
SHENZHEN ZQGAME CO., LTD
Shanghai U9 Game Co.,Ltd.
Shen Zhen Shengxunda Technology Co.,Ltd
Shenzhen Bingchuan Network Co.,Ltd.
Sichuan Xunyou Network Technology Co., Ltd.
The9 Limited
Wuhu Sanqi Interactive Entertainment Network Technology Group Co., Ltd.
Wuxi Boton Technology Co., Ltd.
YOOZOO Games Co., Ltd.
Zhejiang Daily Digital Culture Group Co.,Ltd.
Zhejiang Juli Culture Development Co.,Ltd.

We use a total of 8 variables in our analysis and contain 17,130 observations, including event, price, and returns, etc. (Table 2). The mean of 30 companies' market prices is 3.34. The min and max of the market prices are 0 and 46.07 separately. The mean of 30 companies' market returns is -0.03. The min and max of the market returns are -1 and 0.656 separately. The mean of market return during the tested period is 0.00. The min and max are -0.078 and 0.06 separately (Table 2). As the chart shows below, there are no missing values in the sample.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Company Obs	17130	15.504	8.661	1	30
Price	17130	3.341	6.369	0	46.07
R	17130	-.003	.057	-1	.656
Average R	30	-.003	.002	-.007	.001
Rm	17130	0	.013	-.078	.06
Average Rm	1	-.003	.	-.003	-.003
R-Rm	17130	-.003	.055	-1.008	.661
Event	17130	.005	.072	0	1

4.2 Event study

The event study methodology is one of the most frequently used statistical analysis research methods in financial research (Peterson, 1989) and its objective is to assess the excess or abnormal returns, which investors earned from an event that carries new information, where the abnormal return is the difference between observed and expected returns, which can be predicted by an appropriate asset pricing model when the event is of absence (Sorescu, Warren & Ertekin, 2017).

The underlying of this methodology is a semi-strong form of efficiency, which contains two assumptions. The stock prices reflect all publicly available information and will instantly change when information is available (Fama, 1970). Under this assumption, it enables researchers to isolate the impact of the event from the overall performance of the firm (Sorescuet al., 2017). By examining the stock's price or yield before and after a specific time, which means the before and after the event date, to determine whether and when the new information causes the stock price or yield changes (Reese & Robins, 2017).

These events often are related to the release of information through the financial press or corporate release due to companies themselves, such as earnings announcements, merger announcements, stock splits, or proxy statements (Peterson, 1989). But these events also could be caused by other institutions, such as regulatory or competitors (Sorescu et al., 2017).

To be plain, event study is to examine whether the market responds to certain events, whether the relation between the two is positive or negative, and whether the impact of this event is significant. Since we are studying the impact of regulation changes on the online game industry. Therefore, the event study could be perceived as relatively suitable according to our aims.

4.2.1 Events description

In order to make the analysis more clearly, we have made some assumptions in event selection:

1) We only selected the policy events, since we are analyzing the impact of regulations and policies;

2) The regulations and policies have been published by Chinese government formally and we do not include the polices which be published by local government, because the impact of a policy which is published by first-tier cities will be different with one which is published by small cities;

3) Also, the impact of the event should be direct and clear. For example, t*he Urgent Notice on Prevention of Internet Education for Elementary and Middle School Students* which was published by the Ministry of Education of China. Although it could have an impact on the online game industry, the notice didn't provide explicit guidance on how to conduct it, then the impact could be considered less clearly. For the same reason, *the Core Information and Interpretation of Chinese Youth Health Education (2018)* is also excluded;

4) And we only include the events which happened after the reform of government, since the Chinese government may act differently after the reform, which makes the events before reform less relevant;

According to the assumptions above, we have selected three negative and positive events as the chart shows in appendix. Although the positive events point to the “culture companies” rather than “online game” industry, the policy still could be considered direct and clear, since more than 30 companies which be rewarded have direct connect to the online game industry and the loosing financing policy could generally promote one industry. Therefore, the three positive events could be considered as relevant as well.

4.2.2 Estimation window and event window

The design of the event study includes two types of windows - an estimation window and an event window. As mentioned above, if the event does not occur, normal or predicted returns for security are those returns expected to be observed. Normal returns generally are estimated over a while other than the event window, which is very common to include the pre-days of the events to address the potential for leaked or insider information (Watson & Arunachalam, 2018). According to the studies of events, the determinants of normal returns may change due to the event (Peterson, 1989). Therefore, the estimation windows may fall into either or both sides of the event period. Unlike the normal returns, abnormal returns will be calculated from the event window.

The selection of the length of the event window and estimation window is affected by many factors. According to the study of Peterson (1989), we need to weigh the benefits of a longer period, which may improve prediction models, and the cost of a longer period, which may lead to instability of the model parameter (Peterson, 1989). For example, Reese & Robins(2017)' guide for finance students uses the event window, which ranges from the day -10 to day +10, that is, the 10 trading days prior and the 10 trading days after the event. The estimation window is days -110 to -11, which is the 100 trading days just before the event window (Reese & Robins, 2017). And Watson & Arunachalam study of firms and society used the event window which includes the beginning 3 days before and ending 3 days after the event and the estimation window which includes 360 to 10 days before the event (Watson & Arunachalam, 2018). Also studies are using more than one event window. For instance, the study of the China–Pakistan Economic Corridor in 2020 used the estimation window of [−40, −20] and two event windows [0, +9] and [0, +20] (Yeung, Pang, & Aman, 2020).

We define the event window as [-4, 4], which is 8 days, and the estimation window [-5, -104], which is 100 days. Then to determine whether the result is robust, we used two event windows [-3, +3] and [-5. +5] with the same 100 days estimation windows.

4.2.3 Risk-adjusted return model

Mackinlay (1997) simply grouped all approaches to calculate the normal return of given security into two categories which are the statistical model and economic model. The

economic model mainly includes Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT), while the economic model was taken over by the market model in the event study since the 1980s due to some drawbacks of CAPM and APT. Brown & Weinstein (1985) also found that APT is not more robust than the market model in event studies. Thus, we will use the market model in our research to evaluate the normal return of stocks.

The market model is a statistical model that assumes that there is a linear relationship between the return of any given security and the return of the market portfolio (Mackinlay, 1997). The formula of the market model is illustrated below:

$$AR_{it} = r_{it} - \mathrm{E}(r_{it}) \quad \text{(Eq.1)}$$

AR_{it}: The abnormal return in event period *t* for security *i*;

r_{it}: The real return in event period *t* for security *i*;

$\mathrm{E}(r_{it})$: The expected return in event period *t* for security *i*.

$$\mathrm{E}(r_i) = \alpha_i - \beta_i r_m \quad \text{(Eq.2)}$$

$$\beta_i = \frac{\sum_{t=T_{0+1}}^{T_1}(r_{it}-\overline{r_t})(r_{mt}-\overline{r_m})}{\sum_{t=T_{0+1}}^{T_1}(r_{mt}-\overline{r_m})^2} \quad \text{(Eq.3)}$$

$$\alpha_i = \frac{\sum_{t=T_{0+1}}^{T_1} r_{it} - \beta(\sum_{t=T_{0+1}}^{T_1} r_{mt})}{N} \quad \text{(Eq.4)}$$

$\mathrm{E}(r_i)$: The expected return for security *i;*

α_i: The risk-adjusted return;

β_i: β For security *i;*

r_m: Market return

The Average Abnormal Return (AAR) is to simply average the Abnormal return of all samples. The formula is presented below:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad \text{(Eq.5)}$$

N: the number of samples in the research.

Abnormal return rate measures how a certain event has an impact on the share price and to what degree. In our thesis, we assume that the event no matter industry events or policy events will affect the share price before, during, and after the event. Mackinlay (1997) also recommended that a cumulative abnormal return (CAR) is essential to accommodate a multiple period event windows, which can be calculated by the abnormal return of each sample.

$$CAR_t = \sum_{t=T_{1+1}}^{T_2} AR_{it} \quad \text{(Eq.6)}$$

The Cumulative average abnormal return (CAAR) can be calculated by average CAR.

$$CAAR = \frac{1}{N}\sum_{i=1}^{N} CAR_i = \sum_{t=T_{1+1}}^{T_2} AAR \quad \text{(Eq.7)}$$

4.2.4 Hypothesis testing

The event study aims to detect whether the event will affect the share price abnormally and to what extent. Since it is difficult to measure abnormal influences through eyes, we need to apply hypothesis testing for abnormal returns to verify if AAR and CAAR are significant which means both AAR and CAAR do not equal zero. According to Brown & Warner (1980), the cross-sectional method was recommended to test the hypothesis. The steps are illustrated below:

(1) Setting up the hypothesis and significance level:
Null hypothesis:H_0: AAR=0, there is no abnormal return in the event period *t.*
Alternative hypothesis:H_1: AAR≠0, there is abnormal return in the event period *t.*

(2) Calculating statistics:

$$t_{AAR} = \sqrt{N}\frac{AAR_t}{S_{AAR_t}} \quad \text{(Eq.8)}$$

S_{AAR_t} represents the standard variation of all samples' AAR, the formula is present below:

$$S^2{}_{AAR_t} = \frac{1}{N-2}\sum_{i=1}^{N}(AR_{it} - AAR_t)^2 \qquad \text{(Eq.9)}$$

(3) Confirm the probability and make a judgment.

As for CAAR, the testing is the same as AAR.

5. Analysis

This section will analyze the data above with the Risk-adjusted return model. In order to make the analysis clearer. This section will be divided into analysis of negative event and positive event and robust check for both events. The 5.1 and 5.2 will be the analysis of negative and positive events and the robust check of both events respectively.

5.1 Events study

Our study is focusing on the impact of Chinese new policies and regulations in the online game industry, especially towards companies' returns. The cumulative abnormal return (CAR) and the T-test of three negative events are shown at Table3 below:

Table 3: List of Negative event in [-4,+4] Event Window

Company name	Cumulative abnormal return	Test
Boyaa Interactive International Limited	-0.006	-0.237
Dalian Zeus Entertainment Co., Ltd.	0.035	0.942
Feiyu Technology International Company Ltd.	-0.007	-0.280
Fire Rock Holdings Limited	-0.006	-0.236
Forgame Holdings Limited	-0.006	-0.220
G-bits Network Technology (Xiamen) Co., Ltd.	0.033	1.194
Great Wall International ACG Co., Ltd.	0.032	0.805
Hangzhou Electronic Soul Network Technology Co., Ltd.	0.034	1.213
Hangzhou Shunwang Technology Co,Ltd	0.028	0.691
Kaiser (China) Culture Co., LTD	0.027	0.688
Linekong Interactive Group Co., Ltd.	-0.006	-0.237
NetDragon Websoft Holdings Limited	-0.008	-0.290
Ourgame International Holdings Limited	-0.006	-0.234
Ourpalm Co., Ltd.	0.036	0.862
Perfect World Co., Ltd.	0.027	0.679
Shanghai U9 Game Co.,Ltd.	0.028	0.984
Shenzhen Bingchuan Network Co.,Ltd.	0.031	0.787
Sichuan Xunyou Network Technology Co., Ltd.	0.027	0.683
The9 Limited	-0.001	-0.019
Wuhu Sanqi Interactive Entertainment Network Technology Group Co., Ltd.	0.028	0.695
Wuxi Boton Technology Co., Ltd.	0.024	0.567
YOOZOO Games Co., Ltd.	0.030	0.750
Zhejiang Daily Digital Culture Group Co.,Ltd.	0.026	0.916
Zhejiang Juli Culture Development Co.,Ltd.	0.023	0.559
Beijing Kunlun Tech Co., Ltd.	0.027	0.684
Changyou.com Limited	0.000	0.011
Shen Zhen Shengxunda Technology Co.,Ltd	0.033	0.845
SHENZHEN ZQGAME CO., LTD	0.029	0.730
A8 New Media Group Limited	-0.006	-0.229
BAIOO Family Interactive Limited	-0.006	-0.231

As the chart above shows, 10 of 30 companies' CARs are negative in the event window [-4, +4]. The maximum CAR is from Ourpalm Co., Ltd. with 0.036. And the minimum CAR is from NetDragon Websoft Holdings Limited with -0.008. Both negative and positive CARs in chart shows that the impact of three negative events seems mixed in event window [-4, +4].

The T-test shows in the right column, which is calculated from T-statistic based on the previous model. When the null hypothesis is true, normal T-statistic should follow the T-distribution. Generally, when 1.64<=|t|<1.96, the abnormal return of the market stock is different from 0 at the 10% significance level. When 1.96<=|t|<2.58, the abnormal return of the market stock is different from 0 at the 5% significance level. And when |t|>=2.58, the abnormal return of the market stock is different from 0 at the 1% significance level.

Judging from the data above, no company has an absolute value above 1.64. Therefore, at the significance level of 10%, all 30 companies' abnormal returns of market stock are not different from 0, which means the events which we chose do not affect the abnormal returns of online game companies. The impact of negative events seems not significant when we study the company individually.

Other than the need to understand whether the abnormal return of each company is statistically different from 0, we also need to calculate the CAR of all companies, which means to treat all companies as a whole and then calculate whether the abnormal return is statistically different from 0. The result are shown at Table 4 below:

Table 4: Linear Regression for all Companies

Cumulative abnormal return	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Constant	0.017	0.003	5.29	0.000	0.010	0.023	**
Mean dependent var		0.017	SD dependent var			0.017	
R-squared		0.000	Number of obs			30.000	
F-test		0.000	Prob > F			.	
Akaike crit. (AIC)		-157.209	Bayesian crit. (BIC)			-155.808	

*** p<0.01, ** p<0.05, * p<0.1

The P-value of the regression equation will give the significance level of the CAR of all companies. Then the p-value will be calculated based on the T-statistic value. According to the calculated result, we can decide to accept or reject the null hypothesis. The significance level of the p-value is generally classified as significant when the p-value is less than 0.05 and as

very significant when the p-value is less than 0.01, which means that the probability that the difference is caused by sampling error is less than 0.05 or 0.01.

According to the data in the chart above, the t-value is 5.29 and the p-value is less than 0.001. Judging from the content above, when |t|>=2.58, the data is significant at the level 1%. Also, the probability that the difference is caused by sampling error is less than 0.01, which means that the data is very significant according to the p-value. Therefore, we can completely reject the null hypothesis:H_0: AAR=0, there is no abnormal return in the event period *t*, which means that the negative events do affect the company when we perceive the 30 companies as whole.

Then the same analysis has been conducted in positive events as well. As the Table 9 shows below, all 30 companies' CARs are negative in the event window [-4, +4]. The maximum CAR is from Boyaa Interactive International Limited with -0.015. And the minimum CAR is from Great Wall International ACG Co., Ltd. with -0.134.

Table 9: List of Positive Event in [-4,+4] Event Window

Company name	Cumulative abnormal return	Test
Boyaa Interactive International Limited	-0.015	-0.627
Dalian Zeus Entertainment Co., Ltd.	-0.121	-3.341
Feiyu Technology International Company Ltd.	-0.033	-1.244
Fire Rock Holdings Limited	-0.031	-1.181
Forgame Holdings Limited	-0.034	-1.189
G-bits Network Technology (Xiamen) Co., Ltd.	-0.096	-3.104
Great Wall International ACG Co., Ltd.	-0.134	-3.530
Hangzhou Electronic Soul Network Technology Co., Ltd.	-0.096	-3.083
Hangzhou Shunwang Technology Co,Ltd	-0.118	-3.306
Kaiser (China) Culture Co., LTD	-0.117	-3.262
Linekong Interactive Group Co., Ltd.	-0.024	-0.893
NetDragon Websoft Holdings Limited	-0.030	-1.146
Ourgame International Holdings Limited	-0.031	-1.210
Ourpalm Co., Ltd.	-0.127	-3.843
Perfect World Co., Ltd.	-0.116	-3.131
Shanghai U9 Game Co.,Ltd.	-0.097	-3.074
Shenzhen Bingchuan Network Co.,Ltd.	-0.118	-3.373
Sichuan Xunyou Network Technology Co., Ltd.	-0.118	-3.306
The9 Limited	-0.045	-1.220
Wuhu Sanqi Interactive Entertainment Network Technology Group Co., Ltd.	-0.116	-3.221
Wuxi Boton Technology Co., Ltd.	-0.121	-3.358
YOOZOO Games Co., Ltd.	-0.118	-3.315
Zhejiang Daily Digital Culture Group Co.,Ltd.	-0.094	-2.993
Zhejiang Juli Culture Development Co.,Ltd.	-0.124	-3.441
Beijing Kunlun Tech Co., Ltd.	-0.115	-3.293
Changyou.com Limited	-0.043	-1.243
Shen Zhen Shengxunda Technology Co.,Ltd	-0.111	-3.004
SHENZHEN ZQGAME CO., LTD	-0.117	-3.304
A8 New Media Group Limited	-0.031	-1.196
BAIOO Family Interactive Limited	-0.029	-1.194

Judging from the data, there are 11 companies whose absolute values are below 1.64, which means, 19 of 30 companies are different from 0 at the significance level of 10% and are affected by the positive events. Moreover, those 19 companies' t-test shows that, at the significance

level of 1%, the impact is evident. The result of positive events seems more significant than negative above and more than half of the 30 companies have been affected by events. Also, negative CARs could be due to the market environment that the performance of the whole industry.

Similar to the analysis above, we then checked for all 30 companies. The result are shown at Table 10 below:

Table 10: Linear Regression of all Compaines

Cumulative abnormal return	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Constant	-0.084	0.008	-10.98	0.000	-0.099	-0.068	***
Mean dependent var		-0.084	SD dependent var			0.042	
R-squared		0.000	Number of obs			30.000	
F-test		0.000	Prob > F			.	
Akaike crit. (AIC)		-104.335	Bayesian crit. (BIC)			-102.934	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The CAR with the event window [-4, +4] of all companies' t-value is -10.98, which means the result is significant in the level of 1%, and the p-value is below 0.00. Therefore, we can safely reject the null hypothesis: H_0: AAR=0, there is no abnormal return in the event period *t.* This result is same with the negative one, which the positive events do affect the companies when we perceive the 30 companies as whole.

5.2 Robust check

In order to determine whether the result is robust, we also used two event windows [-3, +3] and [-5, +5] with the same 100 days estimation windows for both negative and positive events. And to be more clear, this part will start with event window [-3, +3] and then event window [-5, +5] for both events.

1) Event window [-3, +3] with 100 days estimation period for negative events (Table 5).

Table 5: List of Negative Event in [-3,+3] Event Window

Company name	Cumulative abnormal return	Test
Boyaa Interactive International Limited	-0.042	-1.927
Dalian Zeus Entertainment Co., Ltd.	-0.013	-0.390
Feiyu Technology International Company Ltd.	-0.043	-1.985
Fire Rock Holdings Limited	-0.042	-1.934
Forgame Holdings Limited	-0.041	-1.919
G-bits Network Technology (Xiamen) Co., Ltd.	-0.007	-0.306
Great Wall International ACG Co., Ltd.	-0.023	-0.676
Hangzhou Electronic Soul Network Technology Co., Ltd.	-0.012	-0.664
Hangzhou Shunwang Technology Co,Ltd	-0.028	-0.834
Kaiser (China) Culture Co., LTD	-0.025	-0.789
Linekong Interactive Group Co., Ltd.	-0.042	-1.938
NetDragon Websoft Holdings Limited	-0.043	-2.013
Ourgame International Holdings Limited	-0.042	-1.932
Ourpalm Co., Ltd.	-0.025	-0.696
Perfect World Co., Ltd.	-0.025	-0.769
Shanghai U9 Game Co.,Ltd.	-0.017	-0.839
Shenzhen Bingchuan Network Co.,Ltd.	-0.024	-0.725
Sichuan Xunyou Network Technology Co., Ltd.	-0.026	-0.778
The9 Limited	-0.037	-1.033
Wuhu Sanqi Interactive Entertainment Network Technology Group Co., Ltd.	-0.026	-0.786
Wuxi Boton Technology Co., Ltd.	-0.024	-0.610
YOOZOO Games Co., Ltd.	-0.024	-0.728
Zhejiang Daily Digital Culture Group Co.,Ltd.	-0.018	-0.886
Zhejiang Juli Culture Development Co.,Ltd.	-0.030	-0.860
Beijing Kunlun Tech Co., Ltd.	-0.028	-0.861
Changyou.com Limited	-0.031	-0.944
Shen Zhen Shengxunda Technology Co.,Ltd	-0.023	-0.728
SHENZHEN ZQGAME CO., LTD	-0.023	-0.687
A8 New Media Group Limited	-0.042	-1.929
BAIOO Family Interactive Limited	-0.042	-1.932

As the chart above shows, unlike the event window [-4, +4], all 30 companies' CARs are negative in the event window [-3, +3]. The result of the t-test shows some similarities with the result of the event window [-4, +4]. There are 9 of 30 companies that have absolute values above 1.64, which means that those companies are significant at the level of 10% and the majority samples of the companies are not significant.

Unlike the data calculated from each company, Table 6 shows that CARs of all companies' t-value are -15.1 and the p-value is smaller than 0.001.

Table 6: Linear Regression for all Companies

Cumulative abnormal return	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Constant	-0.029	0.002	-15.10	0.000	-0.033	-0.025	***
Mean dependent var		-0.029	SD dependent var			0.010	
R-squared		0.000	Number of obs			30.000	
F-test		0.000	Prob > F			.	
Akaike crit. (AIC)		-187.267	Bayesian crit. (BIC)			-185.866	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Judging from the content above, when |t|>=2.58, the abnormal return of the market stock is different from 0 at the 1% significance level. Although the impact of negative events seems do

not obvious when analysing the companies separately, the impact is still significant when testing for all companies. Moreover, the negative CARs of all companies seems to be a side prove for semi-strong market efficiency and the impact of events seems to be more quickly shows on market than our estimation.

2) Event window [-5, +5] with 100 days estimation period for negative events (Table 7).

Table 7: List of Negative Event in [-5,+5] Event Window

Company name	Cumulative abnormal return	Test
Boyaa Interactive International Limited	0.041	1.422
Dalian Zeus Entertainment Co., Ltd.	0.030	0.907
Feiyu Technology International Company Ltd.	0.040	1.371
Fire Rock Holdings Limited	0.041	1.434
Forgame Holdings Limited	0.042	1.449
G-bits Network Technology (Xiamen) Co., Ltd.	0.045	1.802
Great Wall International ACG Co., Ltd.	0.041	1.151
Hangzhou Electronic Soul Network Technology Co., Ltd.	0.041	1.661
Hangzhou Shunwang Technology Co,Ltd	0.033	0.918
Kaiser (China) Culture Co., LTD	0.030	0.852
Linekong Interactive Group Co., Ltd.	0.041	1.423
NetDragon Websoft Holdings Limited	0.039	1.371
Ourgame International Holdings Limited	0.041	1.423
Ourpalm Co., Ltd.	0.038	0.990
Perfect World Co., Ltd.	0.031	0.864
Shanghai U9 Game Co.,Ltd.	0.037	1.445
Shenzhen Bingchuan Network Co.,Ltd.	0.034	0.955
Sichuan Xunyou Network Technology Co., Ltd.	0.030	0.838
The9 Limited	0.016	0.504
Wuhu Sanqi Interactive Entertainment Network Technology Group Co., Ltd.	0.030	0.844
Wuxi Boton Technology Co., Ltd.	0.031	0.800
YOOZOO Games Co., Ltd.	0.031	0.881
Zhejiang Daily Digital Culture Group Co.,Ltd.	0.035	1.353
Zhejiang Juli Culture Development Co.,Ltd.	0.025	0.667
Beijing Kunlun Tech Co., Ltd.	0.035	0.989
Changyou.com Limited	0.014	0.457
Shen Zhen Shengxunda Technology Co.,Ltd	0.040	1.145
SHENZHEN ZQGAME CO., LTD	0.031	0.871
A8 New Media Group Limited	0.041	1.421
BAIOO Family Interactive Limited	0.041	1.422

Unlike the other two event windows, all 30 companies' CARs are positive in the event window [-5, +5]. The result of the t-test shows some similarities with the result of the event window [-4, +4]. There are 3 of 30 companies that have an absolute value slightly higher than 1.64 and the majority of the companies in the sample are not significant. This could be another prove of semi-strong market efficiency. The CARs seems gradually became positive as the time goes by, which means the impact of events is gradually decreasing.

Similar to the data calculated from the event window [-4, +4], Table 8 below shows that the CAR of all companies’t-value is 25.82, and the p-value is less than 0.001.

Table 8: Linear Regression of all Companies

Cumulative abnormal return	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Constant	0.035	0.001	25.82	0.000	0.032	0.038	***
Mean dependent var		0.035	SD dependent var			0.007	
R-squared		0.000	Number of obs			30.000	
F-test		0.000	Prob > F			.	
Akaike crit. (AIC)		-208.292	Bayesian crit. (BIC)			-206.891	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Judging from the content above, when |t|>=2.58, the data is significant at the level 1%. Also, the probability that the difference is caused by sampling error is less than 0.01, which means that the data is very significant according to the p-value. Since the results are not changed when using the different event windows and estimation periods, the analysis could be regarded as robust, which means the results have good credibility.

3) Event window [-3, +3] with 100 days estimation period for positive events (Table 11).

Table 11: List of Positive Event in [-3,+3] Event Window

Company name	Cumulative abnormal return	Test
Boyaa Interactive International Limited	-0.021	-0.776
Dalian Zeus Entertainment Co., Ltd.	-0.092	-2.372
Feiyu Technology International Company Ltd.	-0.038	-1.283
Fire Rock Holdings Limited	-0.033	-1.107
Forgame Holdings Limited	-0.037	-1.157
G-bits Network Technology (Xiamen) Co., Ltd.	-0.066	-2.129
Great Wall International ACG Co., Ltd.	-0.104	-2.526
Hangzhou Electronic Soul Network Technology Co., Ltd.	-0.068	-2.191
Hangzhou Shunwang Technology Co,Ltd	-0.090	-2.347
Kaiser (China) Culture Co., LTD	0.089	2.317
Linekong Interactive Group Co., Ltd.	-0.034	-1.159
NetDragon Websoft Holdings Limited	-0.034	-1.121
Ourgame International Holdings Limited	-0.033	-1.157
Ourpalm Co., Ltd.	-0.096	-2.763
Perfect World Co., Ltd.	-0.086	-2.131
Shanghai U9 Game Co.,Ltd.	-0.069	-2.167
Shenzhen Bingchuan Network Co.,Ltd.	-0.091	-2.459
Sichuan Xunyou Network Technology Co., Ltd.	-0.090	-2.350
The9 Limited	-0.022	-0.545
Wuhu Sanqi Interactive Entertainment Network Technology Group Co., Ltd.	0.088	2.284
Wuxi Boton Technology Co., Ltd.	0.093	2.394
YOOZOO Games Co., Ltd.	-0.090	-2.357
Zhejiang Daily Digital Culture Group Co.,Ltd.	0.066	2.115
Zhejiang Juli Culture Development Co.,Ltd.	-0.095	-2.453
Beijing Kunlun Tech Co., Ltd.	-0.090	-2.436
Changyou.com Limited	-0.021	-0.557
Shen Zhen Shengxunda Technology Co.,Ltd	-0.086	-2.140
SHENZHEN ZQGAME CO., LTD	-0.090	-2.369
A8 New Media Group Limited	-0.034	-1.141
BAIOO Family Interactive Limited	-0.034	-1.239

The result shows a great similarity with the event window [-4,+4] - all the CARs are negative and 19 of 30 companies are significant at level 5% since the absolute numbers of t-values are

greater than 1.96. Similar to the analysis above, we then checked for all 30 companies. The result are shown at Table 12 below:

Table 12: Linear Regression of all Companies

Cumulative abnormal return	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Constant	-0.066	0.005	-12.61	0.000	-0.077	-0.055	***
Mean dependent var		-0.066	SD dependent var			0.029	
R-squared		0.000	Number of obs			30.000	
F-test		0.000	Prob > F			.	
Akaike crit. (AIC)		-126.953	Bayesian crit. (BIC)			-125.551	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The result of the regression of all companies with the event window [-3, +3] is also close to the result of the event window [-4, +4]. The t-value is -12.61, which has an absolute value greater than 2.58 and indicates the data is significant at a level of 1%. At the same time, the p-value is smaller than 0.001 which indicates that we could reject the null hypothesis. This result is almost the same with the event window [-4, +4].

4) Event window [-5, +5] with 100 days estimation period for positive events (Table 13).

Table 13: List of Positive Event in [-5,+5] Event Window

Company name	Cumulative abnormal return	Test
Boyaa Interactive International Limited	-0.036	-1.496
Dalian Zeus Entertainment Co., Ltd.	-0.093	-2.402
Feiyu Technology International Company Ltd.	-0.060	-2.222
Fire Rock Holdings Limited	-0.055	-2.105
Forgame Holdings Limited	-0.058	-2.054
G-bits Network Technology (Xiamen) Co., Ltd.	-0.069	-2.033
Great Wall International ACG Co., Ltd.	-0.105	-2.569
Hangzhou Electronic Soul Network Technology Co., Ltd.	-0.068	-2.006
Hangzhou Shunwang Technology Co,Ltd	-0.091	-2.359
Kaiser (China) Culture Co., LTD	-0.089	-2.321
Linekong Interactive Group Co., Ltd.	-0.050	-1.876
NetDragon Websoft Holdings Limited	-0.055	-2.055
Ourgame International Holdings Limited	-0.053	-2.039
Ourpalm Co., Ltd.	-0.102	-2.776
Perfect World Co., Ltd.	-0.087	-2.165
Shanghai U9 Game Co.,Ltd.	-0.069	-2.007
Shenzhen Bingchuan Network Co.,Ltd.	-0.090	-2.387
Sichuan Xunyou Network Technology Co., Ltd.	-0.091	-2.361
The9 Limited	-0.049	-1.486
Wuhu Sanqi Interactive Entertainment Network Technology Group Co., Ltd.	-0.090	-2.328
Wuxi Boton Technology Co., Ltd.	-0.094	-2.428
YOOZOO Games Co., Ltd.	-0.090	-2.339
Zhejiang Daily Digital Culture Group Co.,Ltd.	-0.066	-1.935
Zhejiang Juli Culture Development Co.,Ltd.	-0.097	-2.475
Beijing Kunlun Tech Co., Ltd.	-0.088	-2.345
Changyou.com Limited	-0.045	-1.443
Shen Zhen Shengxunda Technology Co.,Ltd	-0.076	-1.879
SHENZHEN ZQGAME CO., LTD	-0.089	-2.341
A8 New Media Group Limited	-0.056	-2.120
BAIOO Family Interactive Limited	-0.053	-2.142

For the CAR, the event window [-5, +5] is very similar to the other two calculations. But the t-value shows a better significant level than the other two that 24 of 30 companies are significant at the level 5%.

The regression shows almost the same result as the other two calculations above in the Table 14.

Table 14: Linear Regression of all Companies

Cumulative abnormal return	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Constant	-0.074	0.004	-20.53	0.000	-0.081	-0.066	***
Mean dependent var		-0.074	SD dependent var			0.020	
R-squared		0.000	Number of obs			30.000	
F-test		0.000	Prob > F			.	
Akaike crit. (AIC)		-149.537	Bayesian crit. (BIC)			-148.136	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Both t-value whose absolute value is largely greater than 2.58- and p-value, which is smaller than 0.001, are significant. Although not all companies are significant at level 5% when calculating each company, the results are all significant when testing for all companies. And the results do not change when using different event windows. Therefore, the results of event window [-4, +4] could be regarded as trustworthy.

6. Results

According to the data run above, it turns out that both hypothesis present significant results. In the *H1: the negative policies will adversely affect online game companies' stock price,* CAARs of 30 observed companies are positive under event windows with [-4,+4] and [-5,+5], which are controversial to *H1* since it means the negative policies do not affect stock price adversely instead affect the price favorably. While CAARs of 30 observed companies are negative under event windows with [-3, +3] which are in line with the *H1*. The reason why the stock prices reflect adversely with [-3,+3] compared to the other two event windows is that we assume the Chinese stock market is semi-strong form efficient which means the market will reflect the public information for instance regulations promptly upon the share price. In order to avoid the slump of the share price due to the noncompliance of regulations, Chinese online game companies are trying to predict and take some actions to make their businesses more compliant

before the release of new regulations by the government. Thus, we believe that this coercive isomorphism from the government is making majorities of Chinese online game companies more homogenous to each other in the foreseeable future.

In the *H2: the positive policies will not affect online game companies' stock price*, CAARs of 30 observed companies are surprisingly negative in all three event windows. Generally, the CAARs reflect the impact of certain events on investor confidence. If the CAARs are positive, it represents that the investors believe that the event will enhance the value of the company, then raise their expectations for the future. While, if it is negative, investors may not be optimistic about the company's future, which indicates that the events have no or negative impact on investor confidence. The CAARs of 30 observed companies are -0.084, -0.066, and -0.074 within the event windows [-4, +4], [-3, +3], and [-5, +5] respectively. It presents that the positive events that should have boosted market confidence, on the contrary, brought negative abnormal returns, which means that these policies have not reached their original targets - boost the investor confidence. One good guessing is that the boosting effect of these policies may be overwhelmed by the concerns, as mentioned above, of further law improvements, such as the establishment of a grading system or limitation of the adolescents for playing, or the concerns of the unclear attitude of governments to this emerged industry, especially after the halt of issuing licenses suddenly.

7. Conclusion

In summary, our thesis researches the Chinese market's reaction in terms of the share price to new regulations or policies released by the government from September 1st, 2017 to December 31st, 2019. We apply the risk-adjusted return model to determine the CAR, then examine the relationship between government policies and stock performances within 6 events. Our findings identify that regulations or policies have significant reactions to share prices of Chinese online game companies. When negative regulations or policies are published, stock prices of all 30 companies decrease in the early event window [-3, +3], then gradually increase in the next two days. The positive events also show the significant impacts on stock prices but with negative returns. A possible explanation is that the uncertainty about further law improvements may raise the concern of the investors and limit the boosting effect of these policies.

Meanwhile, our thesis has some limitations. Firstly, we only generate 30 valid companies in our research which are still not enough to form a solid foundation for the research. However, there are not plenty of public online game companies in Chinese, thus this reality hinders our research. Secondly, the methodology that is used in our thesis is more suitable to the western market economic system, while the market economic system in China is influenced by too many aspects, especially by the government compared to western countries, thus some deviations are existing in market reactions.

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Appendixes

Appendix 1: Negative Events

	Date	Event	Content
Event 1	2018/08/30	Implementation plan for comprehensive prevention and control of myopia in children and adolescents.	Control new online games operating, explore the age reminding system, and limit the use time of minors.
Event 2	2018/12/07	Establishment of an online gaming ethics committee.	Conducting moral reviews and providing references for government.
Event 3	2019/11/05	Notice on preventing minors from indulging in online games.	Implementing a real-name registration system, controlling time of minors' playing, and regulating the provision of services to minors.

Appendix 2: Positive Events

	Date	Event	Content
Event 1	2018/03/27	Notice on applying for the transfer payment project of the special funds of cultural industry development in 2018.	Local cultural enterprise listing in the 2017-2018 National Cultural Export Enterprises and having good export performance in2017 will be rewarded in proportion to the 2017 export value.
Event 2	2018/12/07	Notice on applying for the transfer payment project of the special funds of cultural industry development in 2019.	Local cultural enterprise listing in the 2018-2019 National Cultural Export Enterprises and having good export performance in2018 will be rewarded in proportion to the 2018 export value.
Event 3	2019/11/05	Provisions for further support the development of cultural enterprises	Further promote loan business such as intellectual property pledge financing, supply chain financing, merger and acquisition financing, etc., and increase effective credit investment to culture enterprise.