The Application Analysis of Game Theory on Double Eleven

Jiawei Bai [1, *, †] Zhuoqun Li [2, †] Yanya Lin [3, †]

[1] *Hangzhou RDFZ, Hangzhou, 310000, China*
[2] *Gezhi High School, Fuzhou, 350001, China*
[3] *Beijing Huijia Private School, Beijing, 100000, China*
Corresponding author. Email: bai.jiawei@rkcshz.cn
[†] *These authors contributed equally*

ABSTRACT

Double Eleven is a shopping festival in China. Millions of people wait until 12 a.m. of that day only to spend more money on various online shopping platforms. The reason people do this on Double Eleven is that all the online shopping companies will make a great discount on that day. Not only the consumers will benefit from the day of Double Eleven, but companies also gain a huge number of profits from this. Double Eleven also provides an opportunity for online shopping companies to attract more consumers through a greater number of discounts for their products. Since the demand will always go up whenever there are discounts on the products according to the law of demand. As a result, there are two choices for the companies during this opportunity of Double Eleven: price war and cooperation. The price war will make their products more attractive to consumers due to the lower prices in the market, whereas cooperation would make a win-win situation in which they both gain profits. This study focuses on that to what situation should firms choose to cooperate. It indicates that if the discounted rate is larger or equal to 0.5, companies will cooperate. On the contrary, the companies will choose to establish the price war if this parameter is smaller than 0.5, involving more profitability than cooperation. The result of this study can be helpful when firms decide a strategy.

Keywords: Double Eleven, Shopping Strategy, Price War, Cooperation

1. INTRODUCTION

1.1. Background

In China, there is a shopping festival called Double Eleven, which is held on 11th November. On this day, sellers will offer greater discounts than usual to encourage consumers to purchase more so that they will gain more profits by doing so. Additionally, the companies that have online shopping applications hold many activities to increase their sales volume. It is reported that on the day of " Double 11" in 2018, the national online retail transaction volume almost exceeded 300 billion yuan, reaching a new record. Also, the degree of internationalization was further improved. From November 1st to 11th, the sales of cross-border e-commerce imported goods exceeded 30 billion yuan. Japan, the United States, South Korea, Australia, and Germany ranked among the top five import source countries. A well-known domestic e-commerce platform introduced nearly 19000 overseas brand goods from 75 countries and regions to participate in the promotion. At the same time, more than 2 million overseas consumers spent 204.4all nearly 3 billion yuan on China's e-commerce platform. All these reports can show that double 11 is not only a big day for consumers but also for sellers and companies.

Tmall and JD are the top two biggest online shopping companies in China. Tmall is a comprehensive shopping website, which is created by Yun Ma who is the CEO of Alibaba group. In 2019, Tmall's " Double Eleven" shopping carnival reached a total transaction volume of 268.4 billion yuan. Whereas JD is China's self-supporting e-commerce enterprise, which was created by Qiangdong Liu, who served as the chairman of the board of directors and CEO of Jing Dong group. JD's cumulative order amount exceeded 204.4 billion yuan in 2019. As a result, JD and Tmall are competitors. Double 11 is a great opportunity for them to gain benefits. There are several strategies they can use on the day. However, both of them reduced the extent of discounts in recent years.

1.2. Related Research

Liu adopted Kerry's research results on the culture spread, which defined the spread into two types: a transmission view of communication and a ritual view of communication. Liu considers to figures out the relationship between double eleven and festive ceremony culture. Liu pointed out that Tmall propagated double eleven as a festival that has a ritual sense. In other words, Tmall held a lot of activities to make consumers think double eleven is a special day. This brought consumers the same feeling, which leads to high consumption enthusiasm [1].

Cheng used a quantitative research method to study the marketing of Taobao on double eleven, reviewed the development of the internet, and the cause of double eleven. The reason why Taobao succeed is that there are many goods and the discounts are huge. Also, the seamless publicity before the double eleven festivals is important. In addition, Cheng believes that if Taobao wants to keep the success of the double eleven festivals, it is necessary to protect the sells' rights, improve consumer experience and improve the supporting services of online shopping. What is more, innovation is the most important factor that can make Taobao successful [2].

Zhan reviewed the transaction volume of Taobao from 2009 to 2012, which can show that the participating brands and the transaction are increasing from year to year. Zhan thinks that Taobao chooses November 11st to make an online shopping festival is because that it is in the blank period of the traditional retail golden week and Christmas promotion season. Zhan pointed out many methods to make the development of e-commerce suitable. The methods include improving the rules of online shopping, increasing the quality of goods, improving resource management, using sustainable development, and realizing online and offline interaction [3].

Zhang describes the phenomenon that online shopping companies eventually choose to play price war for potential profit and the worry that their opponents will reduce price and take over their market share. He then claims two ways to end this negative price war, one is that the online shopping platforms change their way of evaluating the benefit and disadvantages of the price war. The other one is the join of a third-party regulator. There are models listed and some calculations processed. After all, the price war will not end until one of the conditions above is achieved. This is related to our research because recently the way of valuing the benefit that can be brought by price war has changed due to the decrease of potential future users and more specific target consumers for each firm. That fits the second condition described by Zhang [4].

Ellison exams a group of internet retailers on their strategies to lower consumers' price sensitiveness. The main way to do that is to make confusions and some obstacles for consumers to search the price. According to his research, if it is difficult for consumers to figure out the price of a product or they miss-interpret the price by the misleading information posted by firms, they focus on the price will be reduced [5].

Slade explains how the choice of punishment strategy, the specification of the stochastic shocks to the system, and the assumptions regarding observability determine the pricing dynamics implicit in several theoretical price-war models. Theories are classified into imperfect monitoring models, in which players' actions cannot be observed: learning models, in which structural parameters are unknown to the players; and cyclical models, in which observability is perfect but business cycles affect the difficulty of colluding. The second half, in contrast, examines data on prices set by firms in industries that are subject to periodic wars. When the models are confronted with the data, oligopoly theory explains the behavior of the firms in these industries. The object of the exercise is not to pick a winner. Instead, the role of industry characteristics in determining pricing dynamics is assessed, and the reasons why simple models may fail to explain complex pricing patterns are examined [6].

The paper conducted by Kandori illustrates the correlations between demand shocks and the phenomenon of price competition during economic booms based on Rotemberg and Saloner's model. This essay demonstrates some empirical evidence related to this phenomenon. The author argues that for a firm to maximize its profits during such booms, it will behave collusively by providing a price that undercuts the agreed price. This action of the firm that doesn't want to cooperate will in turn reverse the Bertrand competition model forever. Therefore, the prerequisite for the firms to tolerate the agreed price in the cooperation during booms is that their gain from deviating with the agreed price, which are all the profits earned by other firms in the market, is smaller than the loss. The author indicates two parameters of situations in which show the relationship between the discount factor and the number of firms in the market. The first condition is that the discount factor exceeds $(N-1)/N$, in which N represents the number of firms [7].

Ran points out the fact that the level of discounts in recent years is lower than that in the past, which indicates that the price wars are not like that fierce anymore. However, on the other side of the lowered discounts, firms in the online shopping markets are making their products more and more irreplaceable and diverse. All of which have contributed to the improved quality of online shopping products. Another factor behind this is that with the economic growth, people's income has increased as

well so that lower prices become less attractive for people nowadays who are trying to find goods that have better quality. The authors explained the reason for this in which the consumers' needs and the environment of this online shopping market are changing. As a result, only lowering prices will not make the firms gain that much from price wars during booms of online shopping festivals [8].

Liu compares the "Black Friday" in the U.S and "Double-Eleven" in China from the perspectives of their corresponding strategies during such booms and the issues of quality and safety of the products. The author demonstrates that the rate of increase for "Double-Eleven" in China far exceeds the increase rate for "Black Friday". The reason behind this could be the more advanced after-sale services provided by the firms. In addition with the change in consumers' needs nowadays to more than just low prices, but also the quality of the goods or services from the online shopping. Despite this, the author also points out the importance of diversity for firms during such booms [9].

Huang researched the online finance about e-commerce, used the quantitative research method. Huang pointed out the background of e-commerce at first: low trade cost and relatively perfect information. Then, Huang summarizes five ways for consumers and sellers to borrow money, which are consumer credit lending, enterprise credit lending, third party credit lending, supply chain lending, and order lending. After that, Huang reviewed that there are three risks (technology risk, operation& credit risk, and low risk) that e-commerce may meet. The method to solve these risks is to improve supervision [10].

Rotemberg and Saloner gave a view that when the demand increases, the price decreases. There are two reasons why the phenomenon happens. One is that firms may face the monopoly price in the short run increasing returns to scale. Temporary closings of firms or reductions of work times are usually done under this situation. These reductions would always start with the most inefficient firms and workers thus suggesting at most constant returns to labor in the short run. Another one is that limited pricing may be more salient in a rapidly increasing economy if the threat of potential entry is also greater at that time [11].

Soble reviewed the economic studies, which helped to figure out the relationship between credibility and the action of firms. Sobel said that the agent uses the person's historic action to decide whether the person is credible. So, people, even the competitors, need to be friendly to increase their chance to have cooperation [12].

1.3. Objective

This study cares about the phenomenon on the day of Double Eleven and to what extent can make the e-commerce chooses to cooperate. The conclusion can be helpful for consumers to know more clearly about how e-commerce works, the reasons behind the different extent of discounting, and also predict companies' strategies in the future.

2. DOUBLE ELEVEN

2.1. History

Double eleven is a shopping festival in China. Every company makes discount in this day. It is a big day for consumers because they can get a large discount on this day and they will spend more money on shopping applications as they think they can purchase goods at a cheaper price compared with usual. It is also a big day for sellers because they know that they can have huge sale volume as the double eleven encourages consumers to purchase more. Therefore, it is a good day for both consumers and sellers.

The companies always prepare to celebrate this day to make more profit. Even the attraction of new consumers is less than before, it still needs to make a great discount. Because a lot of people have different online shopping applications at the same time. So, the companies need to take a discount that makes consumers prefer to purchase in their applications, instead of their competitors. In this case, they may send a lot of discounts to users and attract more consumers. So, there is still a price war between companies. But they can choose to cooperate and have a win-win. To what situation they will choose price war and to what situation they will choose cooperation? It is discussed in the next section.

2.2. Decreasing Extent of Discount

JD and Tmall have decreased their extent of discounts in recent years. the main reason for this situation may be the more stable consumer group. In the beginning, companies also try their best to attract more consumers to use their applications. The most workable way is to lower prices because most people want to buy the same goods and services with lower payments. So, in this essay, it is assumed that at the beginning all people are rational, which means they will choose the goods with lower prices. As the result, if the company wants to account for the market, they used to decrease their price. In this case, they usually send to their users with discount tickets. For example, consumers can get a free 100 by buying goods that cost 200. Because this kind of discount can not only attract users but also make users buy more to achieve 200. Under the assumption that consumers choose the lower prices, the application which has the larger extent of discount can have more consumers.
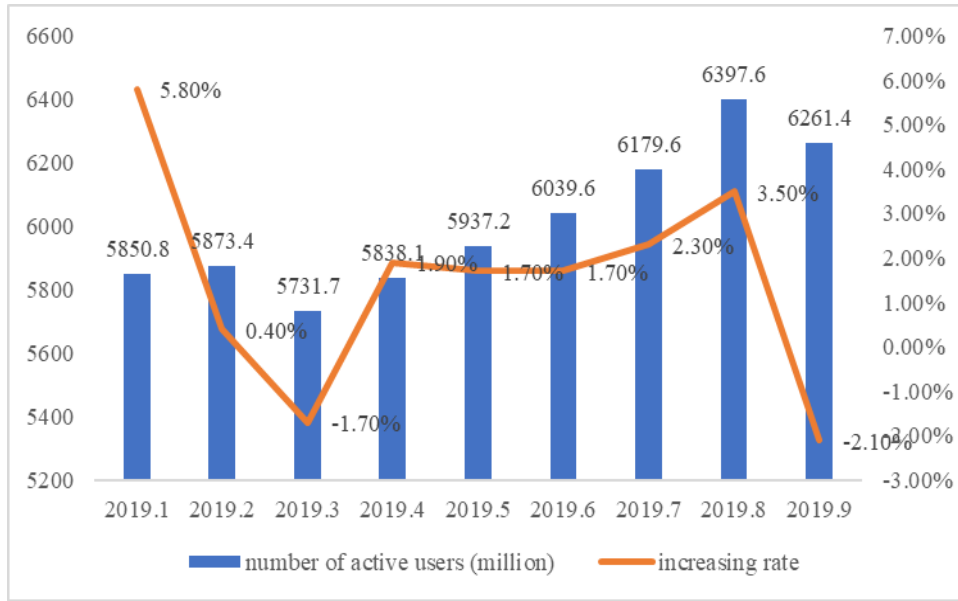
Figure 1. Tmall active users

However, the number of new consumers decreases from time to time. the figure above is about the rate of increase inactive users in 2019 in the Tmall application. The orange line stands for the increased rate of the number of users. And the blue histogram stands for the total number of active users. as the figure shows, even the number of active users is increasing every year, the increase rate is decreasing, which means that although the total number of users rises with years, there are fewer and fewer new users. Therefore, the benefit of using great discounts to attract new consumers seems to be less helpful. This is highly related to "K", which is the discount rate. When there is a great increase of users drawn by the discount, companies are patient enough to get the money in the future because these new users are going to contribute to the companies' income in the future.

In addition, a reason why this situation happens is that after doing this kind of discount, maybe one or two years, consumers are used to using this application and become loyal customers. This is because that people have habits, which maybe can be described that people are lazy that they do not want to change the choice when they use this application for a long time, they do not want to move to another application. For example, the Chinese choose Unicom and China Mobile when they are buying phone services. It is not likely for a person who use Unicom before to move to China Mobile after. Because the person is familiar with Unicom and wants to use it. Therefore, then the company has kept the consumers for a long time, it may be easy for them to keep the consumers for a longer time, which means the consumers may not move to another application easily.

Another phenomenon is that the new consumers will become less and less when the market has come into being from years to years. Because in early years people did not have the habit to shop online. As a result. A great number of people were attracted to shop online by the low prices and adapted online shopping forever. But the population is relatively fixed, and even it increases, it cannot increase so rapidly. So, from years to years, people come to use online shopping applications, which means there is a fewer number of people that do not use online shopping. In other words, in the early years, the lower discount makes more profit by attracting a huge number of new consumers. Recently, almost every Chinese has had online shopping platforms. Therefore, the companies do not use it as they have a stable consumer group.

Another reason that companies try to reduce the extent of discounts is that making discounts has an opportunity cost, which means that when companies decide to give discounts, they should pay some money to the shops to make them agree with the discount. Therefore, they cannot spend this money to do another thing. In the beginning, this choice seems to be profitable as it can attract a lot of consumers and these consumers can purchase more on their online application. Therefore, the benefit to use a discount is larger than its opportunity cost when the market starts. However, years after, as the benefits decrease, the opportunity cost seems to be larger than its benefits. So, the companies tend to spend their money on other things. For example, they can put money into technology and research to give better service by creating more convenient functions or more beautiful views of applications. These things can make consumers that are loyal to the application feel more sense of well-being and may fix more consumers more easily. In this case, the spending on other things is quite better than spending on making discounts as the attraction for new consumers is less and less.

3. GAME WITH A MODEL

As mentioned above, this paper tries to build a simple assumption to evaluate this phenomenon. In the game, player 1 is JD, and player 2 is Tmall. They both have two strategies, which are price war and cooperation. The payoff is shown as follows and 'π' means the maximized benefits they can get. This game assumes that players are patient enough and the players can divide the benefits equally when they choose the same.

Table 1. Repeated game model

Tmall/JD	Price war	Cooperation
Price war	(0, 0)	(πm, 0)
Cooperation	(0, πm)	(πm/2, πm/2)

As table 1 shows, the equilibrium payoff is (0,0), and the deviation payoff is π and the punishment payoff is $(\pi/2) \times (k/(1-k))$. (k means the rate that the next day will pay, which is smaller than 1)

Therefore, for both stopping price war, the equation is

$$U(JD) = \pi/2(1-k) \quad (1)$$

And the equation can be obtained as

$$\pi/2(1-k) \geqslant \pi \quad (2)$$

After calculation, the result is

$$k \geqslant 0.5 \quad (3)$$

Therefore, only when the k is larger or equal to 0.5, two companies will choose cooperation, which means that the price war will happen when the k is smaller than 0.5.

The k will be affected by various factors. The value of k is relating to the growth of the economy. More importantly, it is related to the payoff companies going to receive by attracting new consumers in the future, matched with our data about the growth of the number of users in the previous part, k for JD and Tmall is decreasing.

4. PDD'S PARTICIPATION

In this case, the players are limited to JD or Tmall in this essay. But the fact is that people are using JD and Tmall at the same time. There are also many shopping applications in this market and many competitors try to account for a position in the market. For example, PDD is a new shopping application. Although the online shopping market is very stable nowadays, PDD still made its strategy and get a position in the market successfully. The decision PDD made is to use a very low price and send money to users, similar to the strategies JD and Tmall used in the early years.

The PDD made an activity about sending money. The users can get money by sharing the application with their friends. Their friend should download the application and sign up for an account. Then, they can get a piece of numbers. When the number achieves 100, the user can get 100 yuan as promised. So, this activity makes a huge number of people download the PDD and doing the activity, which means the users of PDD increase rapidly.

At the same time, PDD made the prices of their goods as low as possible and send users many discounts. So, as the users see that price of goods is much lower than the goods in other applications, they will use PDD to purchase goods, which makes the PDD gain revenue and also grow a stable consumer group.

However, the most possible process of PDD is that it will increase the price of goods slowly as it has a stable consumer group. Because it needs to make its revenue larger than its cost in the long term. So, U(PDD) is decreasing. As a result, PDD needs to increase the price and reduce the discount to make profits. In addition, as PDD accumulates its group of consumers, so the k will be larger or equal to 0.5, which is the same as Equation (3).

Therefore, at the last, the model will be suitable for PDD.

5. CONCLUSION

This paper explores the reason behind the varying extent of discounts of online shopping platforms using a grim trigger model. It also makes some future predictions.

The main finding of the reason why the companies reduce their extent of discount is that they have a stable target consumer group and have developed consumer loyalty. This means that even they do not make discounts, and their consumers will still use their application. Therefore, the profit to make more discount (relating to k) is less than before. Another reason is that the population is relatively fixed, so the number of people who do not use online shopping applications is decreasing. What is more, spending money on making discounts has an opportunity cost, which means that they should give up something to make a discount. Therefore, as the discounts are not as profitable as before, they should change into doing other things. For example, they can invest in other companies or put money in the technology and research to create new services and so on.

On the day of Double Eleven, companies need to make discounts and attract consumers. In this case, they need to decide whether to start a price war. According to the results, the companies choose to cooperate when k is larger or equal to 0.5. There will be a win-win when k is above 0.5.

Therefore, the result of this study can help firms to make a strategy about price making. Also, it is helpful to understand how a price market works and forecast firms' strategies.

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