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Master Thesis

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The Impact of Different Antitrust Laws on the Actions of Cartels

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Abstract

Title: The Impact of Different Antitrust Laws on the Actions of Cartels

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The issues about antitrust laws are getting much attention nowadays. And many countries over the world adopt leniency policies to control the actions of cartels. We used a game-theoretical model to discuss the equilibrium of cartels under different antitrust laws. And we modify the model of Blum et al. (2008) to analyze the equilibriums of firms under the different mechanisms of leniency policies. We find out that the value of fine will affect the existence of a cartel, and the recognitions of legitimacies for cartels are important as well. When the antitrust authorities ask firms to propose appliances in advance to let the cartels be legal, firms would incline not to become a cartel. It's quite different from the other mechanism which firms can confess to the antitrust authorities after they've already become a cartel.

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CHAPTER 1. Introduction

Much literature discussed about the antitrust laws which are not all the same among the countries. The USA is the pioneer to set the antitrust law. After that, so many other countries passed legislation of antitrust laws, one after another. Antitrust law is also called competition law. It's often used to keep the market from unfair competition or stop firms forming a private cartel. A cartel is a formal agreement among competing firms. Firms get together to set their business strategies in order to raise their benefit. In this way, firms can definitely expand their magnitude and get abnormal profit by reducing competition. But these actions can be harmful for the social welfare. In order to regulate or forbid collusion (also called cartel agreement), the antitrust authorities would set their own antitrust laws in view of their own circumstances. Leniency policy is a new policy that has been applied in recent years.

In this paper, we used a game-theoretical model to analyze the equilibrium belonging to cartel. It isn't always bad for social welfare when there are cartels in society. Sometimes, cartels may be good for the whole society. Hence, the antitrust authorities have to find their own solutions to raise the whole social welfare.

In Europe commission (EC), if firms have collusive agreement and become a cartel, they will be forbidden by the Cartel office unless the actions of collusion are helpful for production or distribution of goods. At the same time, cartels should improve the development of technique and economy and ensure that consumer's welfare is guaranteed definitely. That is to say, firms won't be punished if the collusion is beneficial for consumers' welfare as well as the whole social welfare. And it wouldn't be necessary to submit an appliance in advance in the most European countries. This kind of mechanism in Europe is much similar with the United States. Antitrust division has a power of prosecutorial discretion which means they can process the cases as they want. Hence there would be case selection. If the antitrust

authorities think the cartels are harmless to the society, they may ignore and drop the cases. The reason is that they think they don't have enough resource to handle all the cases. In Taiwan, antitrust authority is called Fair Trade Commission. Collusion won't be allowed basically, but under some particular circumstances, firms can also exempt from the Fair trade Act. The most obvious difference between American law (or EC's law) and Taiwanese law is that firms must submit appliance in advance no matter what situations in Taiwan. If not, cartels are always illegal without registration. Even if the collusion is beneficial to the whole social welfare, it's surely unacceptable in Taiwan.

In order to control the actions of cartels, the antitrust authorities introduce a mechanism to influence the strategies that firms would take. Antitrust law has a kind of reward program which we call leniency policy or leniency program. Leniency policy was introduced for the first time by the United States in 1978 that allowed firms to be the whistle blowers and to have a reduction of fine payment under some specific conditions. Sometimes the whistle blowers can exempt from all the punishment. At first, only a few firms applied for this leniency program because it wasn't very transparent and it brought some kind of uncertainties. Consequently, it was revised significantly in 1993. Leniency policy is really a key factor for the cartel office to affect the actions of firms. So the legislations of this kind of laws become much more and more important.

Consequently, we discuss whether the equilibrium derived from the game-theoretical model, fit the antitrust law or not. And we will measure the welfare from the standpoint of the whole society.

At the end of this section, let's introduce the framework of this article: section 1 is the introduction that we talk about the history of Antitrust Law and leniency policies, section 2 is the literature review, section 3 is the basic model that we used to

analyze the equilibriums, section 4 is the part about the stable equilibrium of firms' strategies, and section 5 is the conclusion that we got.

CHAPTER 2. Literature Review

We spend some time to know some papers over the past. Motta and Polo (2003) studied and concluded that the government should let the confessors or the whistle blowers have the full immunity to all the other firms under the model is the equilibrium. And they also put emphasis on that a leniency program may encourage pro-collusive effect as the Antitrust Authority is short of resources. Hence, they leniency program is the second best and should be implemented as the authority has sufficient resources. Ellis and Wilson (2003) assumed that there are three ways firms can choose: comply with the collusion rules and become a cartel, comply with the leniency policy, squeal to the Antitrust Authority and be detected by other forms under a probability or not be detected fortunately. The studies showed that firms may squeal to the cartel office because they want to beat the competitors by lowering their profit and raise their cost which caused by the fines. And this is a strategic advantage for the firms to squeal. They also thought the concentration of market is an important element to affect cartel. When the market is under less concentration, leniency policy may destabilize the cartel. On the contrary, leniency programs make firms become stronger cartels when they don't induce firms to confess to the Antitrust Authority. Firms have the mechanism of self-stabilization. Spagnolo (2004) thought that under dynamic analysis, leniency policy would be useful if the cartel office create incentives for firms to cheat on partners. So the incentive is the super high reward for the first one to squeal. And the reward is from the fines paid by all other parties. When leniency policy is implemented in reality, may also destabilize and deter cartel by (a) protecting the squealers from fines; (b) protecting them from the others agents' punishment; (c) increasing the riskiness of being a cartel. Compare to the view of Motta and Polo (2003), the difference between them is that leniency is affective only because of immunity by the view of Motta and Polo (2003). Aubert et al. (2006) discussed about

the leniency policy with some brand new view. They compared the impact of reduced fines and positive reward, and argue that rewarding individuals, including employees of firms, may be more effective to deter cartel than traditional leniency policy. Chavda and Jegers (2007) used an oligopoly model to analyze the policy. At first glance, we usually think fines deter the cartel in reason of sapping the benefit and raise the risk involved in illicit behavior. However, their study showed that fines tend to increase the stability of an agreement. If the impunity is granted for firms, cheating is the most profit way. To fight with the collusive behavior, Antitrust Authorities all over the world use combinations of fines and fine exemptions. That is the effectiveness of leniency policy. Blum et al. (2008) challenged the contemporary view that standard leniency privilege is incentive- compatible to increase competition. They thought leniency policy is a preemptive strike for firms against competitors when cartels become unstable. The defectors may have more economical privilege in the future. Accordingly, if the leniency policy would lead to more competition in the market, the policy should be welcomed by the national cartel offices. Brisset and Thomas (2004) discussed about the impact of leniency policy on incentives within cartels. And they wanted to find a way to encourage the cartel members to confess and implicate their co-conspirators with hard evidence about their collusive agreement. They developed a simple model of cartel behavior under a first-price sealed-bid procurement auction and found whether an effective leniency program can prevent the internal coordination of cartel members. Somehow, they found out that the rules of the actual European program present some inefficiency. For example, any member who reports the cartel before any investigation can has a full exemption from fine. Besides, they also showed that how the leniency program could become an effective tool for the prevention of anti-competitive behavior by rewarding firms that provide hard evidence of the cartel's existence. Then the leniency programs can create private

incentives to play inefficient firms against efficient ones. Ishibashi and Shimizu (2010) used a model of quantity competition to analyze the leniency policy in antitrust laws. They concluded that an amnesty to the second or later candidates of a leniency program is useless if colluding firms can choose the most profitable collusion. And their result implied that the design of a leniency policy depends on which kinds of market structure are prevalent in the countries. Bigoni et al. (2012) thought there are more countries using leniency policy to control the actions of collusion. And they studied how fine, leniency programs and rewards for whistleblowers affect cartel formation and prices from an actual experience. But their effects on cartel formation and prices are hard to observe. In their experiment, traditional antitrust law enforcement without leniency policy has a significant deterrence effect that fewer cartels form. But without leniency, surviving cartels' prices grow, which means the overall prices do not fall. Leniency can help fix this problem. Leniency programs further increase cartel deterrence, but also stabilize surviving cartels relative to a laissez-faire regime. So when fines are used as rewards for self-reporting agents, prices fall significantly and antitrust enforcement improves welfare. Hinloopen (2003) analyzed with a dynamic model to know the cartel members' incentives to report the existence of the cartel to antitrust authorities under leniency programs. And the model incorporates detection probabilities that can differ in each period. It takes time for antitrust authorities to detect a cartel and then to provide enough hard proof for it to be dismantled. The author concluded increasing the reduction in fine payment in return for reporting an illegal cartel and increasing the per-period detection probability in any future period enhances the efficiency.

In this paper, we would discuss about the impact of different antitrust laws on firms. For example, the antitrust authorities ask firms hand in their appliance beforehand to be legal. Or after-the-fact policy which means cartels can be legal as

they are good for the whole society even they don't tell the antitrust authorities first. Blum et al. (2008) only categorized the games corresponded the areas in the figures, but we directly solved Bayesian Nash Equilibriums of the cartel game. And furthermore, we discussed the degree of difficulty to form cartels under different national antitrust laws.

CHAPTER 3. The Basic Model

We based on the model of Blum et al. (2008) and we did some reformation. Let's set a model of a cartel with two suppliers in the market, player 1 and player 2. The two suppliers are two firms competing with each other. We assume the firms as homogeneous under the general condition, which means the two firms have the same condition of abilities. There are two kinds of situation for firms to react. Firms can comply, which means the two firms adhere to their cartel agreement. Still, firms can defect, which means one or both of them would squeal to the antitrust authorities.

As for the antitrust authorities, they must want the leniency policy to be useful and be attractive for any party to defect. So, leniency privilege must be known for every player. Moreover, antitrust authorities would prefer to take side of the whole society to maximize social welfare.

Let's begin to introduce the meaning of parameters: We assume the market reward is π[1], the cartel surplus is c, the fine for a proven cartel is f, and the leniency reduction is w. The first mover has an additional advantage, a, it can be regard as an improved cost structure or getting an increased market share. If leniency privilege is not only for the first mover but also granted to the subsequent confessing parties, the authority may offer the confessors a reward, z, instead of w. As we can see, z applies to the second confessor in the model, and $z \in [0, w]$. And note that z is non-negative because it would reduce the fine, f. And p is the probability of a confession being processed by the antitrust authority which might be less than 1 because of work overloaded. $p \in (0,1)$.

And the normal form of the game is presented in Table 1.

[1] The market reward of oligopoly is π, and c is the cartel surplus (net effort to sustain the cartel). Total payoff of a firm is $\pi + c$ When the market is Monopoly, the total advantage of a firms is $2(\pi + c)$.

Table 1. Normal form of the cartel game

		Player 2: Comply	Player 2: Defect
Player 1	Comply	(1') A_1, A_2	(3') C_1, C_2
	Defect	(2') B_1, B_2	(4') D_1, D_2

If the equilibrium is (1'), it means there is a stable cartel. If the equilibrium is (2') or (3'), it means one part of them defects and be the crown witness. If the equilibrium is (4'), which means that there would be a price war and cartel fine.

In Table 1, the definitions of the symbols are as below:

$$A_1 \equiv \pi + c$$

$$A_2 \equiv \pi + c$$

$$B_1 = p(a + w - f - c) + \pi + c$$

$$B_2 = p(z - f - c) + \pi + c$$

$$C_1 = p(z - f - c) + \pi + c$$

$$C_2 = p(a + w - f - c) + \pi + c$$

$$D_1 = p^2(f + c - a - z) + p(a + w + z - 2f - 2c) + \pi + c$$

$$D_2 = p^2(f + c - a - z) + p(a + w + z - 2f - 2c) + \pi + c$$

We will show how to calculate the value of B_1, B_2, and D_1. When we want to

calculate the expected values, we also have to take the probability of a confession not being processed, $1-p$, into consideration. Let's take B_1 as an example first. As player 1 goes to the authority to confess the truth of collusion, it has a probability of p to get the value $\pi+a-f+w$. And if the confession is ignored by the authority, it's like the same situation that the firm never confesses to the cartel office. So the firms will get the payoff $\pi+c$ with a probability $1-p$. Hence, if we want to obtain the expected value of B_1, we have to calculate as the following equations. B_2 is obtained by the same method, firm 1 has a probability of p to get the value of $\pi-f+z$ and probability of $1-p$ to get $\pi+c$. As for D_1, it's a little more complicated. We have to consider about the reaction of firm 2. Both of the two firms confess to the antitrust authority. So when firm 1 thinks the probability whether it's squeal be processed or not, it still have to think about if the opposite's confession be taken or not. So the equation is calculated as follows.

$$B_1 : p(\pi+a-f+w)+(1-p)(\pi+c)=p(a+w-f-c)+\pi+c$$

$$B_2 : p(\pi-f+z)+(1-p)(\pi+c)=p(z-f-c)+\pi+c$$

$$D_1 : p[p(\pi-f+w)+(1-p)(\pi+a-f+w)]+(1-p)[p(\pi-f+z)+(1-p)(\pi+c)]$$
$$=p^2(f+c-a-z)+p(a-2f+w+z-2c)+\pi+c$$

$B_1=C_2$, $B_2=C_1$, $D_1=D_2$

We didn't only care about the equilibrium payoff of two firms, but also put emphasis on the consumers' surplus. That's because we take the stance of the social welfare. And we will discuss it in the later section.

CHAPTER 4. Stable Equilibrium of Firms

In this section, we're going to introduce the equilibrium, and Bayesian Nash equilibrium is used to analyze the model. Meanwhile, to avoid the complexity to blur the discussion, we based on the results of pure strategy. And the conditions of equilibrium are listed in Table 2.

And we also specifically introduce different types of games to explain the equilibrium payoff and have an interpretation. And we can see this part in the appendix.

Table 2. The Bayesian Nash equilibrium of model

Equilibrium	Condition of Equilibrium
$^{(1')}(A_1, A_2)$	$f \geq w + a - c$
$^{(2')}(B_1, B_2)$	$f \in [\frac{w}{1-p} + a - c - \frac{pz}{1-p}, w + a - c]$
$^{(3')}(C_1, C_2)$	$f \in [\frac{w}{1-p} + a - c - \frac{pz}{1-p}, w + a - c]$
$^{(4')}(D_1, D_2)$	$f \leq \frac{w}{1-p} + a - c - \frac{pz}{1-p}$

We take the equilibrium (1') as an example to show how the values of payoff came out. As (A_1, A_2) is an Bayesian Nash Equilibrium, two conditions must be fulfilled at the same time, that is $A_1 \geq B_1$ and $A_2 \geq C_2$. And we show the computational processes as following sentences. $A_1 \geq B_1$ means $\pi + c \geq p(a + w - f - c) + \pi + c$. Then we can get $p(a + w - f - c) \geq 0$. Finally we can simplify it as $f \geq w + a - c$. And the rest equilibriums are similarly derived with the same method.

After we knew how to derive the condition of equilibriums, let's draw figures to portray the areas of the Bayesian Nash equilibriums. Let w be the horizontal axis and f be the vertical axis. Figure 1 shows the equilibriums as $a > c$. We have

two lines to distinguish the areas of the Bayesian Nash equilibriums, line L_1 and L_2.

L_1: $f = w + a - c$

L_2: $f = \frac{w}{1-p} + a - c - \frac{pz}{1-p}$.

And the point $e(=(z, z+a-c))$ is the intersection of two lines, under $a > c$. Here we show the Figure 1 as below:

Figure 1. $a > c$

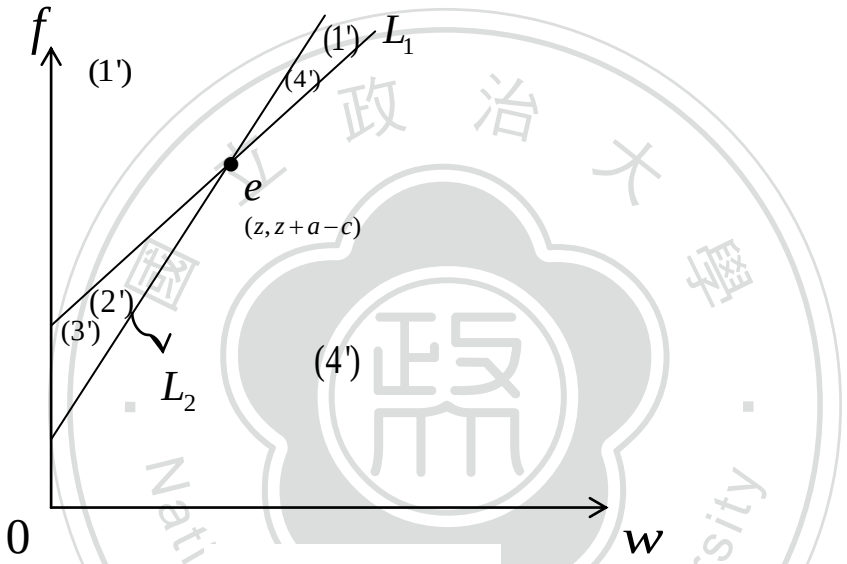

Figure 1. $a > c$

Let's talk about another situation under different condition. And Figure 2 is the situation when $a < c$ and $a - c = -z$. Because of $a - c = -z$, the horizontal axis value of e is zero. There are also tow lines, L_1 and L_2, to distinguish the equilibrium areas. And e is $(z, 0)$. Under $a - c = -z$, there is no equilibrium area for (2') and (3'). That is to say, there is no circumstance for two firms that one firm complies with the cartel agreement and the other one defects. Here we show the Figure 2 as below.

Figure 2. $a - c = -z$

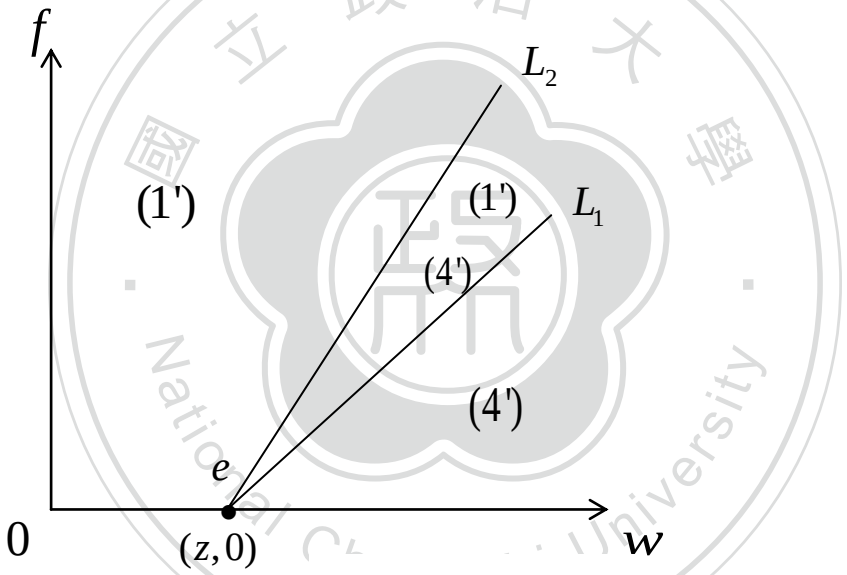

Figure 2. $a - c = -z$

The third situation is the condition when $a - c < -z$. And it will be shown in Figure 3. And the intersection of two lines, e, lies below the horizontal axis because of $a - c < -z$.

Figure 3. $a-c<-z$

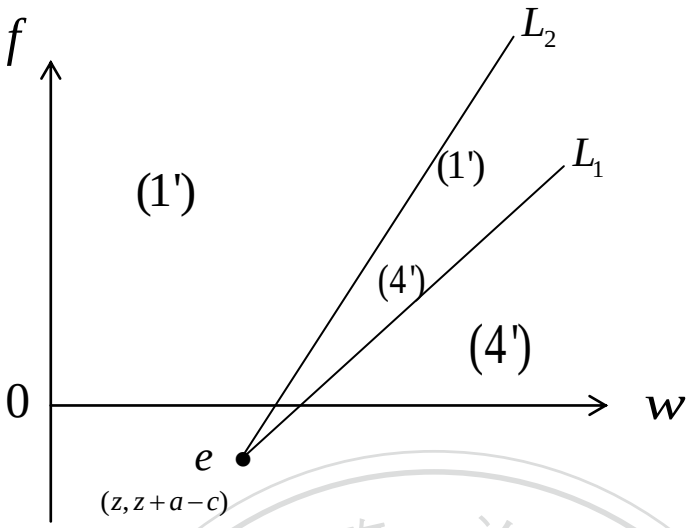

Figure 3 $a-c<-z$

And what we want to focus on is the two firms' stable equilibrium. When f is large, it's easier to exist the equilibrium of being a cartel because of firms don't want to take any risk of being punished；On the contrary, when f is small enough, the equilibrium of both two firms' defecting strategies would happen more likely. The Bayesian Nash equilibriums may be summarized as the first two propositions in the following.

【Proposition 1】When $f \geq \max[w+a-c,(w-pz)/(1-p)+a-c]$, (1') is an unique Bayesian Nash equilibrium for two firms to be a cartel.

【Proposition 2】When $f \in [w+a-c,(w-pz)/(1-p)+a-c]$, there are two equilibrium (1') and (4') in this area.

When the two (1') and (4') are the equilibriums at the same time, we call that coordinate game. Generally speaking, it depends on the value of A_1 and D_1 to know which one is easier to be the equilibrium. As $f<[(1-p)(a+z)+w]/(2-p)-c$, then $D_1 > A_1$, (4') would be the equilibrium more

easily. On the contrary, it's more likely to exist the equilibrium (1').

【Proposition 3】When $a-c \le -z$, it won't exist the equilibrium of (2') and (3').

If firms are aware of their own benefit is too small for them to confess to the authority, they have no incentive to defect. Hence, there are no equilibrium of (2') and (3'). And it is shown in Figure 2.

Besides, the legitimacies of cartels in Taiwan and in America (as well as European countries) are different. In Taiwan, if firms don't apply to the authorities, the actions of collusion would be recognized as illegal definitely. But in America or in Europe, the legitimacy depends on the effect after the firms have already formed the cartels. Therefore, we have to compare the two different mechanisms under the same condition. We assume that collusion is the most efficient strategy first, which means the value of two firms' welfare plus consumers' welfare would be the highest of four possible equilibrium values. Under the American or European laws, even the firms don't apply to the cartel offices in advance, the probability of being processed by the cartel offices, p, would still be regarded as zero. However in Taiwan, if firms don't apply for the permission of cartels to the authorities beforehand, p would be definitely 1. When $p=0$, firms' equilibrium payoffs become $\pi+c$ under the antitrust laws of America or Europe. So there is no limitation for firms of being a cartel at all; When $p=1$, it must fulfill the condition that $f \ge w+a-c$ at least to form cartels. Hence, comparing the two kinds of different mechanisms, cartels are easier to exist in America (or in Europe) than in Taiwan. And here above is proposition 4.

【Proposition 4】It's easier to exist cartels in America or Europe than in Taiwan.

CHAPTER 5. Conclusion

Blum's paper only discussed about the equilibrium areas of different regimes of the cartel games, but we made some extensions. In this paper, we used a game-theoretical model to analyze the equilibriums of two firms' strategies in a cartel. And the amount of fine payment is the key factor to affect two firms' equilibrium. Different countries would have different p , which means the probability of a confession being processed by the antitrust authority. And that is issue what we are focus on.

The actions of firms being a cartel would be allowed if it is good for the whole society. That is to say, the antitrust authorities will not interfere too much to forbid cartels all the time. However in Taiwan, antitrust authorities will not permit a cartel absolutely if firms do not make applications in advance. The conclusion is that cartels are easier to appear in America (or Europe) than in Taiwan. Hence, how to enact the antitrust laws becomes a very important issue to the cartel office.

This paper is surely to provide a point of view for antitrust authorities to set the policies of leniency programs. And it may arouse more people to study about this issue in the future and then the antitrust authorities would control the actions of cartels more effectively. Maybe in the future, we can make a extension that leniency reduction is a proportion of fine payment, which means $w = sf$, $s \in [0,1]$. To see what would happen in this kind of situation.

Appendix

There are three kinds of games we would define, i.e. prisoners' dilemma game, chicken game, and coordinate game (assurance game). For the row player, it has to fulfill the condition $B_1 > A_1 > D_1 > C_1$, and we can separate the condition as $B_1 > A_1$, $A_1 > D_1$, and $D_1 > C_1$ at the same time. For chicken game, row player's value must achieve $B_1 > A_1 > C_1 > D_1$, and we can separate it as $B_1 > A_1$, $A_1 > D_1$, and $D_1 < C_1$. As for coordinate game, the payoff of row player must fulfill $A_1 > D_1 > C_1$ and $A_1 > B_1$. And we can regard them as three conditions, $A_1 > D_1$, $D_1 > C_1$, and $A_1 > B_1$. We show it in the following Table 3:

Table 3. Type of games and payoffs

Type of game	Player 1	player2
Prisoners' dilemma	$B_1 > A_1 > D_1 > C_1$	$C_2 > A_2 > D_2 > B$
Chicken game	$B_1 > A_1 > C_1 > D_1$	$C_2 > A_2 > B_2 > D$
Coordinate game	$A_1 > D_1 > C_1$ and $A_1 > B_1$	$A_2 > D_2 > B$ and $A_2 > C_2$

Blum et al. (2008) use a figure with horizontal axis and vertical axis to portray these three games and the situation. As they take the probability of a confession being processed by the antitrust authority, p, into consideration, we think there are something that we can modify and make an improvement. The way that Blum put the probability into the formulae is too simple.

According to the conditions, we will portray the three kinds of game. We set the conditions of the figures under $a > c$ and $a(1-p) > z$. $B_1 = A_1$ is forming the condition of the line L_1, $D_1 = C_1$ represents L_2, and $A_1 = D_1$ represents L_3.

We will explain how would the condition, $a(1-p) > z$, come out next.

$$L_2 - L_1 = \frac{pz}{1-p} < 0$$

$$L_3 - L_1 = \frac{a + (p-1)z}{p-2} < 0$$

$$L_2 - L_3 = \frac{a(1-p) - z}{2 - 3p + p^2}$$

It's ambiguous whether the value $a(1-p)-z$ exceeds zero or not, so we can discuss this under the different conditions. And we take the conditions $a(1-p) > z$ as an example.

Figure 4 portray the equilibrium area of the three kinds of game. θ_1 is the area of prisoners' dilemma game. And the equilibrium area of prisoners' dilemma game must fulfill $B_1 > A_1$, $D_1 > C_1$, and $A_1 > D_1$. θ_2 is the equilibrium area of chicken game, and the conditions are $B_1 > A_1$, $D_1 < C_1$, and $A_1 > D_1$. The last one is the coordinate game, the equilibrium of this game must fulfill $B_1 < A_1$, $D_1 > C_1$, and $A_1 > D_1$. We get θ_3 is the equilibrium area of coordinate game.

And we can do further discussion under the condition that $a(1-p) < z$ or $a(1-p) = z$. When the conditions are different, the distribution of the equilibrium won't be the same.

Figure 4. Different regimes of the cartel game

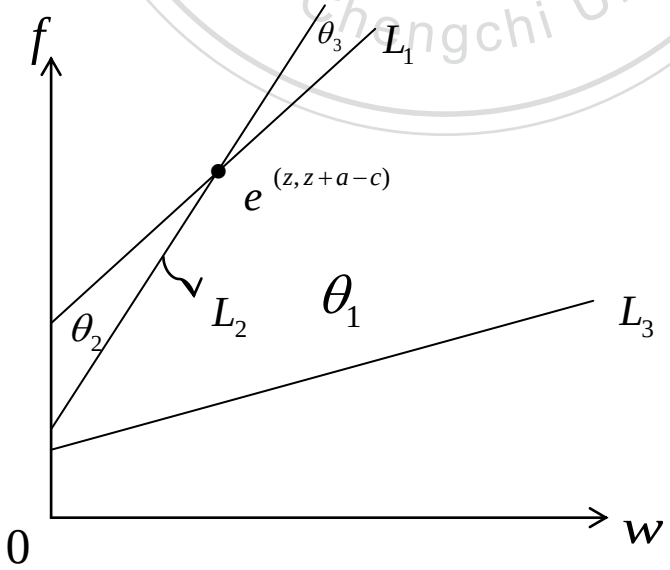

Figure 4 Different regimes of the cartel game

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不同國家的反托拉斯法對於卡特爾行為的影響

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論文提要:

反托拉斯法在近期以來已受到越來越多的關注與重視,而為了全球經濟的穩定與公平,近年來有越來越多的國家採用反托拉斯法裡面的寬恕政策來控制企業壟斷的行為。本文利用賽局理論的模型來分析在不同國家的反托拉斯法之下會產生的均衡對應為何,並且我們以 Blum et al. (2008) 的模型加以修改來分析在不同寬恕政策的機制之下,對於廠商們壟斷行為的可能影響。我們研究發現,對於壟斷行為的罰款金額大小會影響壟斷行為的存在與否,而各個國家對於壟斷行為的合法性認定也會是一個非常重要的因素,我們研究得出的結果是,當一個國家的主管機關要求廠商一定要事先提出壟斷行為(卡特爾聯盟)申請,才能夠使聯合行為合法的時候,廠商們會傾向決定不要採取聯合壟斷的行為。

關鍵詞: 反托拉斯、卡特爾、寬恕政策、貝氏 Nash 均衡