Enlightenment of prisoner's dilemma on book sales management system

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Absrtact: prisoner's dilemmas is a representative example of game theory in game analysis. It reveals why two perfectly rational individuals may not cooperate, even if it is in their best interests to do so. Taking the price competition between British bookstores as an example, this paper expounds the Enlightenment of relevant game theory on the construction of modern book sales management system through the game theory of management economics such as prisoner's dilemma.

Key words: Prisoner's dilemma; Book sales; Economic management; Nash equilibrium

In Britain, the price competition between bookstores has been suppressed for more than 90 years by the book real price agreement in 1900, which was originally formulated to prevent price war. But in October, 1991, waterstone reduced the price of books in 85 bookstores he owned. According to Richard, executive chairman of WatertownAccording to Barker, the reason for the price reduction of about 40 books by 25% is that his main competitor, Dillon, has adopted the price reduction behavior.

The chairman of the union of British printers believes that the price reduction is a great regret and will crowd out many sellers who operate at low profits. There is no doubt that such price reduction is contrary to the public interest of all physical bookstores. But from another perspective, it reduces the price of books purchased by consumers from physical bookstores, which is beneficial to consumers.

Now let's take the sales system war caused by the price reduction of Dilong company as an example to analyze under what circumstances this would be a good strategy?Under what circumstances would this be a mistake?So let's talk about the Enlightenment of prisoner's dilemma to the modern book sales system.

1. The game meaning of prisoner's dilemma

Prisoner's dilemmas is a representative example of game theory in game analysis. It reveals why two completely rational individuals may not cooperate, even if it is in their best interests to do so. It was originally built by Merrill flood and Melvin Dresher when they worked at Rand in 1950. AlbertW. Tucker, Albert W. Tucker, formalized this game in the form of imprisonment penalty reward and named it prisoner's dilemma.

Prisoner's dilemma game can be used as a model of many cooperative behaviors in reality. In informal usage, the term "prisoner's dilemma" can be applied to cases that do not strictly conform to the formal standards of classical or repeated games: for example, two entities can obtain huge benefits from cooperation or suffer losses due to cooperation failure, but find it difficult or expensive (not impossible) to coordinate their activities.

2. Prisoner's dilemma strategy

For example, two prisoners are kept in separate rooms and cannot communicate with each other. The details are shown in Figure 1 below.

A/B	Prisoner B remains silent (cooperate)	Prisoner B Betrayed (betray)
Prisoner A remains silent (cooperate)	Each person serves one year in prison	Prisoner A: 3 years Prisoner B: Acquittal release
Prisoner A Betrayed (betray)	Prisoner A: Released Prisoner B: 3 years	Each person serves 2 years in prison

Figure 1: strategies for prisoner's dilemma

Suppose that both prisoners understand the essence of the game, are not loyal to each other, and have no chance to get revenge or reward outside the game. No matter what the other party decides, every prisoner who betrays the other party will get a higher reward ("Treason"). Reasoning involves a dilemma: B is either cooperating or defecting. If B cooperates, a should mutiny, because it is better to be released than to serve a year in prison. If B mutinies, a should also mutiny, because serving two years is better than serving three years. So anyway, a should rebel. Parallel reasoning shows that B should choose treason.

Because no matter what the other party's choice is, betrayal always brings better returns than cooperation, so this is a dominant strategy. Mutual betrayal is the only strong Nash equilibrium point in the game (that is, each participant can only make his situation worse by unilaterally changing his strategy). Therefore, the dilemma is that although mutual cooperation produces better results than mutual betrayal,

it is not a rational result, because from the perspective of self-interest, the choice of cooperation is irrational.

3. Extensive form

The structure of the traditional prisoner's dilemma can be summarized from its original prisoner's environment. Suppose two players are represented in red and blue, and each player chooses "cooperation" or "betrayal".

If two players cooperate, they will both receive a reward r for cooperation. If both participants mutiny, they will be punished P. If the blue side mutinies and the red side cooperates, the blue side will get the temptation to return T, while the red side will lose s by the "deceived person". Similarly, if the blue side cooperates and the red side mutinies, the blue side will get the loss s of the deceived person, and the red side will be tempted to pay t.

This can be represented by a standard form of game, as shown in Figure 2.

Figure 2: game of standard form of prisoner's dilemma

4. The problems of book sales management caused by prisoner's dilemma in this case

Imagine that Dilong and all bookstores understand the essence of the game, are not loyal to each other, and have no chance to get revenge or reward outside the game. No matter what the other party decides, each bookstore will get a higher reward ("Treason") for betraying the book price agreement.

Reasoning involves a dilemma: bookstores either cooperate or mutiny. If most bookstores cooperate, only Dillon will mutiny, because the profits brought by the orders obtained from the price reduction will be better than observing the book price agreement. If Dillon defected, other companies should also defecte, because reducing prices is better than losing orders and making no profits. So in any case, there will be bookstores (represented by Dilong bookstores in this case) who will rebel.

Parallel reasoning shows that other bookstores should choose treason, so the price reduction treatment will crowd out many sellers who operate at low profits. Such price reduction will lose the profits of all bookstores, which is contrary to the interests of the public (all bookstores).

Because no matter what the other party's choice is, betrayal always brings better returns than cooperation, so this is a dominant strategy. Mutual betrayal is the only strong Nash equilibrium point in the game (that is, each participant can only make his situation worse by unilaterally changing his strategy). Therefore, the dilemma is that although mutual cooperation produces better results than mutual betrayal, it is not a rational result, because from the perspective of self-interest, the choice of cooperation is irrational.

Prisoner's dilemma is called "E. coli" in social psychology. It is widely used to study the problems of oligopoly competition and collective action to produce collective interests.

This example is an example of the prisoner's dilemma. Sometimes cooperative behavior does appear in the business environment. For example, in Britain, the price competition between bookstores has been suppressed for more than 90 years by the book real price agreement in 1900, which was originally formulated to prevent price war. Because this will increase the profits of the whole industry.

If this agreement is not enforced, bookstore members who join this agreement will fall into a (multi player) prisoner's dilemma.

"Cooperation" usually means keeping the price at the lowest level agreed in advance. "Betrayal" means selling below the lowest price level and immediately obtaining business (and profits) from other Bookstore members. Antitrust authorities hope that potential Bookstore members will betray each other and ensure that consumers get the lowest possible price.

When the illegal price reduction of physical bookstores is legal in the UK, competing bookstores must decide whether to abide by the agreement. The profits brought by the price reduction of Dilong company partly depend on the practices of other bookstores (waterstone company). Similarly, the sales profits of other bookstores (waterstone) are also affected by the price reduction of Dillon.

If Dillon and waterstone both choose to reduce prices within a given time period, the sales impact of price reduction will be offset. If the order remains unchanged, the profit will be reduced due to the price reduction. If these two companies reduce prices and increase orders, other companies will gain losses due to the reduction of orders by these two companies. However, if Dilong reduces prices and other companies choose not to reduce prices, Dilong can obtain huge orders and benefits through price advantage. Since the best strategy depends on the choice of other companies, there is no dominant strategy here, which makes it slightly different from the prisoner's dilemma. But the results are similar. If the price cuts of the two companies are less than the equilibrium state, they will be in a better position.

Repeated prisoner's dilemma game is the theoretical basis of human cooperation and trust. The game can be used to model the transactions between bookstores that need trust, and the cooperative behavior in the group can also be modeled by the repeated game model

of multiple participants.

A more general game set is asymmetric. As in the prisoner's dilemma, the best result is cooperation, while betrayal is motivated. Unlike the symmetrical prisoner's dilemma, one player has more losses or gains than another.

Participants who get unequal profits in repeated games may seek to maximize profits, but the premise is that both players must get equal profits. This may lead to a stable equilibrium strategy, that is, the weak participant will betray every X Games, while the other participant will always keep cooperating. Such behavior may depend on social norms that experiment around fairness.

For the one-time prisoner's dilemma game, the best strategy is simply betrayal; As explained earlier, no matter what the opponent's action may be, this is true. However, in the repeated prisoner's dilemma game, the best strategy depends on the strategies of possible opponents and how they respond to betrayal and cooperation.

In society, the main business entity of bookstore company needs to deal with for a long time. If Dilong company wants to reduce the price, it needs to consider the feelings of other companies and do not make other bookstores unhappy without authorization. The probability of psychological suggestion to Delong is to consider trust and cooperation first (observing the book price agreement). If the other party's response is distrust and betrayal (reduce the price first), then it should adopt the method of tooth for tooth and eye for eye.

When Dillon company lowers the price alone (betrays) due to some factors that do not comply with the book price agreement, other companies will also react similarly (betrays), which leads to a price war. The book commodity loses its price protection and causes damage to its own economy (the result of common betrayal). Then it is very likely that all members will reach a Book real price agreement again (the result of repeated game is to find that the common cooperation benefits the most).

In the book price war, although it is not a game between two rivals, each of them has a large market share, and the consequences of each subject's behavior are greatly affected by the opponent's behavior. Therefore, the situation is probably the same. If this prospect is clear and both sides cooperate to set relatively high prices, then both sides can obtain higher profits because of avoiding price war. But often these alliances are in the "prisoner's dilemma" driven by interests, and win-win will come to naught. The various price alliances are always very short-lived. That's why.

Not every time a person's "rational choice" can maximize self-interest, it may put you in a "prisoner's dilemma". A large number of examples show that in the "prisoner's dilemma", the first party often has some advantages.

5. Enlightenment of prisoner's dilemma on book sales management system

The problems brought by the prisoner's dilemma above to the book sales management tell us: in the game, if each player (including each bookstore) selfishly seeks to maximize their personal interests and believes that others are the same as themselves, it is easy to lead to a situation of both defeat and injury.

Therefore, the following methods can be used to solve the prisoner's dilemma of modern book sales.

Bookstores recommend maintaining a good relationship with the alliance.

The fundamental reason why bookstores in prisoner's dilemma choose a bad choice to maximize their own interests is that they do not trust each other enough. A relationship with a high degree of trust is more likely to break the fatalism of prisoners' dilemma.

(2) Frankly inform all participants of the cost of non cooperation.

If you and the other party have not established a good relationship in the past, you need to try to form an alliance with the other party, tell the other party the benefits of observing the agreement for each other, and what irreparable losses will be caused by non cooperation.

(3) Establish a third-party contract keeping alliance in advance, and establishExternal force.

adoptExternal forceTo agree which sanctions and negative effects the betraying party will be subject to.

(4) The repeated game is relative to the single game, that is to say, after one game, the two "Prisoners" have to continue to have other relationships and play another game.

Introduce "repeated game" to ensure that the agreement can take effect. For example, you can threaten each other, or if someone betrays, they will be severely punished by other parties. In this way, because the game side is bound to continue to have other relationships, the prisoner's dilemma is naturally solved. Prisoner's dilemma can be found everywhere in daily life. We must not be limited to the present, but should expand the single game, so as to obtain absolute trust between each other and achieve the best results, as shown in Figure 3.
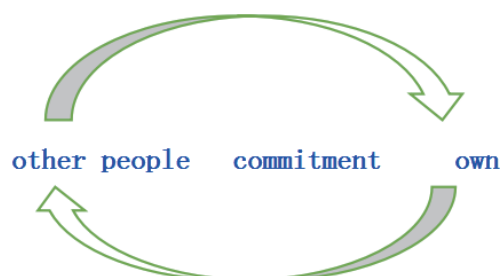

Figure 3: game players' mutual trust system diagram

Conclusion: therefore, it is necessary to guide all book sales entities to correctly handle the relationship between short-term interests, long-term interests and fundamental interests; We should give full play to the role of social organizations such as book intermediate industry alliances and industry associations, actively build a trust community of bookstores, publishers and distributors with good cooperation, and create a good selling price atmosphere for physical bookstores understood by the whole society.

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