# Section 11: The Fallacy of Game Theory

The conclusion that cartels cannot be successful in reality may make some think of the “Game Theory” that prevailed in economics after the World War II, because one of the most classical games “the Prisoners’ Dilemma” is said to be able to explain the failure of cartels.

However, the explanation power of game theory is in fact so poor that it is not a useful scientific economic theory. In view of the seriously misleading of game theory, in this section, the most classic game of the prisoners’ dilemma will be analyzed in detail and the fallacy of it will be pointed out.

There are two versions of the prisoners’ dilemma that are illustrated in the payoff matrix of Table 16-1. The former one the original version of the game, and the latter one is the extension used to explain cartels. Only the former version will be analyzed in detail, because the same logic applies to the latter one.

\*\* Months of Imprisonment \*\*

||| Don’t confess | Confess |

| Panel (a)| Don’t confess |－1，－1|－36，0|

|| Confess |0，－36|－24，－24|

\*\* Rank-ordered payoffs \*\*

||| Small output | Large output |

| Panel (b)| Small output |3，3|1，4|

|| Large output |4，1|2，2|

<div align="center">

Table 16-1

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The story of the prisoners’ dilemma is as follows. The police have apprehended two men, accomplices in a crime, but the evidence against them is weak. Lacking a confession, the authorities will be able to impose only a minor penalty. But if either prisoner confesses, conviction on a major count is guaranteed. Isolating the prisoners from one another, the district attorney offers to let either one go free in return for his turning state’s evidence - provided that the other does not also do so. (If both confess, each will receive a reduced punishment.)

In Panel (a) of Table 16-1, each prisoner has the strategy options Confess or Don’t Confess. The rows represent possible strategies of one prisoner, while the columns represent those of the other prisoner. In each cell, the paired numbers are the payoffs: the first number is the payoff to the Row player, the second the payoff to the Column player.

If both choose not to confess, the payoff of each is -1 (one month in jail) in the upper-left cell. If both choose to confess, the payoff of each is -24 (two years in jail) in the lower-right cell. If the row player chooses not to confess, while the column player to confess, the payoff of the former is -36 (three years in jail) and that of the latter is 0 (go free) in the upper-right cell. The combination of options in the lower-left cell is the opposite.

How to find the equilibrium of the prisoners’ dilemma?

Firstly, from the perspective of the row player, if the column player has chosen not to confess, which means he can only choose between the two left cells, of course he should choose to confess because -1＜0. If the column player has chosen to confess, which means he can only choose between the two right cells, he should also choose to confess because -36＜-24. In other words, no matter how the column player chooses, the optimum for the row player is always “Confess”.

Secondly, from the perspective of the column player, he does not need to consider the possibility that the row player chooses not to confess, which means he can only choose between the two lower cells, of course he should choose to confess because -36＜-24. In other words, both choose to confess and receive two years in jail of punishment, which is the lower-right cell.

However, the optimum for the two prisoners as a whole should be the upper-left cell, which means both choose not to confess, because the sum of their payoffs is -2, which is the highest among these four cells. By the contrast, the sum of the payoffs in the lower-right cell is -48, the lowest among the four cells, not only worse than that in the upper-left cell, but also worse than the sum of the payoffs (-36) in the upper-right or lower-left cell. The “dilemma” here is that each does better confessing, regardless of what his accomplice does – even though they could gain by both refusing to confess. Everyone tries to seek the best result in line with the postulate of self-interest or rationality, but finally they get the worst result for the whole that seems to be irrational. The prisoners’ dilemma is famous for explaining such a paradox of individual rationality leading to collective irrationality.

This prisoners’ dilemma is believed to be widely used to explain many phenomena in reality. For example, why are cartels difficult to be successful? Another example is why Coca-Cola and Pepsi both compete to spend huge amounts of money on advertising, which is thought to be also a prisoners’ dilemma. If both do not advertise, they will have the same publicity, so have the same market share, and save a lot of cost on advertisement, which is good for both. Why do they still compete to advertise? If one of them advertises and the other does not, the publicity of the one advertising will far exceed that of the other, thus taking away most of the market share. Therefore, no one dares not to advertise.

Still another example of prisoners’ dilemma is the arms race between the United States and the Soviet Union. During the cold war, both spent huge amounts of money to expand the armaments, especially on nuclear weapons. Once a war broke out, the nuclear weapons would only destroy each other, so no one dared to start a war, and the world was peaceful. However, if neither had nuclear weapons, neither would have the military power to start a war, the world would be still peaceful. In the former situation, both had to burden huge military expenditures, which is obviously much worse than the later situation where neither had nuclear weapons. Why should both choose arms race? If one of them had nuclear weapons while the other did not, the military power of the one with nuclear weapons will overwhelm that of the other who would have to submit to the rival in international and even internal affairs. Therefore, no one dared not to have no nuclear weapons.

However, there are serious mistakes in the prisoners’ dilemma, which will be pointed out, and then the above phenomena believed to be explained by it will be also refuted one by one.

There is an implicit supposition about constraint in the prisoners’ dilemma: the two prisoners cannot communicate with each other to collude not to confess so as to reach the collective optimum of upper-left cell (also known as “cooperative solution” in the game theory). But why? What is the constraint? Obviously, it is the transaction cost of cooperation for the two prisoners must be too high! They were separated physically, but why do they not bribe the guardian?

Thus, the real question is: why are the two prisoners unwilling to pay a high enough price to avoid falling into the worst lower-right cell where both confess? The answer is obvious: because the price is higher than the cost of the punishment (two years in jail). In other words, the payoffs of the so-called optimum of the upper-left cell are completely wrong in only calculating the benefit of cooperation (both choose not to confess) without the cost of cooperation. By converting the bribe paid to the guardian into the time spent in jail, the cost of cooperation could be taken into account. The payoffs in the upper-left cell must be worse than -24, otherwise the two prisoners would have chosen to bribe the guardian to reach this so-called optimal solution (equilibrium).

In this book, we have pointed out from the very beginning that there are full of mistakes in MSE, often due to the ignorance of the important constraint of transaction cost. Although game theory is a “new” theory that emerged after the World War II, it makes the same “old” mistake of ignoring the constraint of transaction cost. In fact, individual rationality will not lead to collective irrationality. Any conclusions that are out of line with the postulate of self-interest or rationality are sure to be wrong in ignoring a certain constraint, usually transaction cost.

Actually, in reality, any cell in the prisoners’ dilemma can be optimum or equilibrium, as long as the constraints are appropriate. For example, the upper-right or lower-left cell may seem to be disequilibrium, but if one of the two prisoners is the gang leader, while the other is his subordinate, with the transaction cost of cooperation low enough, they will naturally choose to protect the leader by sacrificing the subordinate.

Some game theorists may argue that it has already changed the game rules, so the prisoners’ dilemma is no longer applicable. However, when faced with different constraints, game theorists create a new game by modifying the game rules, which is precisely a typical example of ad hoc theory.

Next, we will make a more specific criticism one by one on the phenomena that are said to be explained by the prisoners’ dilemma.

Firstly, the arms race between the United States and the Soviet Union. In reality, both have been negotiating to reduce the number of nuclear weapons, but the results are far from satisfactory, which implies how high the transaction cost of cooperation is. Just imagine: if there is a super power over the two countries (such as world government or God) which can greatly reduce the transaction cost of negotiations, the option that both do not have nuclear weapons will certainly be chosen. A simple fact is: all local governments in a nation are absolutely not allowed to have their own armies! One reason for it is that the national defense is a public good provided by the central government is the least cost. There is also another important reason is that when there is a super-power of the central government over the local governments, it is a consensus that all local governments should not engage in armament, and the transaction cost of cooperation basically falls to zero! However, when the central government is weak (for example, during the period of the last years of a dynasty in ancient China), it is very common for a local government to have its own army that is called “warlord”. The change of phenomenon caused by the change of constraint strongly proves that it is the key that whether there is a super power over the game players to reduce the transaction cost of their cooperation.

Secondly, the explanation of cartels by the prisoners’ dilemma is also wrong. As has been analyzed in the previous section, the key to the failure of cartels lies not in deception or non-cooperation, but in the fact that only a cartel agreement cannot really establish the entry threshold. What is more, the members or players are motivated to cheat or not choose to cooperate, which simply means that human is self-interested. It is a tautology to explain the phenomenon directly with this postulate of economics. By contrast, whether the cartel agreement can establish the entry threshold is an objective fact that can be observed and tested, so at least it is a refutable explanation and is therefore scientific.

It is precisely the problem of game theory. It just repeats the postulate of self-interest with some new terms and seemingly interesting stories, but the essence of it is a tautology. In addition, the above criticism on the prisoners’ dilemma shows that it does not take the key constraints into account, but only imagines the constraints and constantly changes the type of games if the constraints change, which is a typical mistake of ad hoc theory.

Finally, there is the case of Coca-Cola and Pepsi which compete to advertise, which is even more serious mistake to use the prisoners’ dilemma to explain. Is Coca-Cola advertises only against Pepsi? The game theorists have obviously made the serious mistake of defining monopoly by the number of producers in the market again! In fact, if Coca-Cola and Pepsi do not advertise, their market shares will definitely not be the same as they both advertise, but will plummet! Regardless of the fact that there are other beverage companies which are substitutes for Coke or Pepsi, even if there are not, there are still numerous competitors outside the market. If Coca-Cola and Pepsi do not advertise, both will become anonymous. Without the entry threshold established by brands, the competitors outside the market will flood in and quickly take away all the shares from them.

Through the above analysis on game theory, we hope readers can have a deeper understanding of scientific economics which is different from the engineering theory such as the production function in MSE, or the mathematical theorem such as the Nash equilibrium in game theory.

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[^1]: This table is an except from “Price Theory and Its Application”, P281.