Insufficient Consumption of Vaccines in China from Behavioral Economics Perspective

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ABSTRACT

The COVID-19 outbreak began in January 2020. China began to provide free vaccination in early 2021. Although vaccines have been recognized by many countries, according to surveys, some Chinese people still choose not to get vaccinated because of concerns about the safety and effectiveness of vaccines. This paper aims to analyze the insufficient consumption behavior of Chinese people for this vaccine from the perspective of economics. The data are mainly derived from the questionnaires conducted by some scholars, and some are represented in a form of statistical charts. This paper focuses on the embodiment of behavioral economics for people's consumption behavior and combines it with people's consumption behavior for vaccines during the epidemic, and aims to analyze the causes and effects of inadequate vaccine consumption through the existing problems of Public Good. This research shows that insufficient consumption behavior is closely related to behavioral economics, and people's decisions can be explained and predicted by game theory.

Keywords: Behavioral economics; Vaccine; Game theory; Public good; Irrational consumer

1. INTRODUCTION

The purpose of this paper is to analyze the inadequate consumption of vaccines in China from the perspective of behavioral economics. Most of the previous studies are about the investigation of people's reluctance to be vaccinated, but few of the papers are about the connection between vaccination and economic knowledge. This paper aims to make the public understand that people's consumption behavior of vaccines actually involves a lot of economic considerations, and such inadequate consumption is the embodiment of a social Dilemma. The research methods used are mainly data analysis, and the concepts of public good, externality, public good Game and Prisoner's Dilemma are used to explain the causes and effects of inadequate consumption. This paper is divided into three parts. The first part aims to show the theoretical basis, including the definition of neoclassical economics, behavioral economics, and game theory. The second part utilizes the collected data to illustrate the current consumption of vaccines in China and the influencing factors. The last part presents the analysis of the causes and influence of irrational consumption of vaccines.

2. THEORETICAL BASIS

Neoclassical economists assume individuals are rational and self-interested. A rational and selfish consumers will make the best decisions for themselves, regardless of emotional, morality and other factors, and spend the lowest price to achieve their needs. Moreover, they only care about their own profits, the impact of their decisions on others is not considered. Given all possible choices, a decision-maker will always choose to maximize his or her objective function[1].

Behavioral economics is the combination of psychology and economics that investigates what happens in markets in which some of the agents display human limitations and complications. Economics, like behavioral psychology, is a science of behavior, albeit highly organized human behavior. The value of economic concepts for behavioral psychology rests on their empirical validity when tested in the laboratory with individual subjects and their uniqueness when compared to established behavioral concepts[2].

Game theory studies the choice of interactions between economic actors and the results produced according to the preferences of those actors. Game theory is a branch of applied mathematics that analyzes

situations in which parties (players) make interdependent decisions. This interdependence leads each actor to consider the possible decisions or strategies of other actors when making a choice.

Behavioral economics reflects the real person's decision, and game theory usually utilizes experiments to survey players' actions, thus, they are suitable for analyzing the consumption behavior of people.

3. THE CURRENT SITUATION OF VACCINE CONSUMPTION IN CHINA AND INFLUENCING FACTORS

3.1. The Current Situation of Vaccine Consumption in China

A questionnaire survey was conducted among the general public of four age groups nationwide under the principle of informed consent. Results: A total of 309 val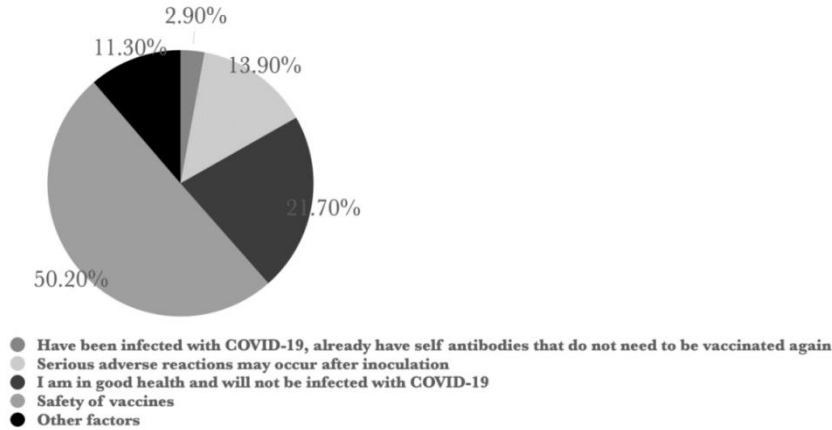id questionnaires were collected, the effective rate was 96.87%. In the survey, 76.7% of the respondents said they need to be vaccinated against COVID-19, while 23.3% said they do not need to be vaccinated[3].

Wenzhou citizens were randomly selected as the survey objects. A total of 756 people were surveyed in this study, and 753 valid questionnaires were collected, with a response rate of 99.6%. In the case of emergency use of COVID-19 vaccine, 88.31% of respondents were willing to receive the vaccine[4].

The experiments mentioned above all adopted a simple random sampling method to ensure the randomness of samples and better reflect the public response. Thus, even though there is a strong public will to be vaccinated, a small number of people still refuse to be vaccinated.

3.2. The Causes of Insufficient Consumption on Vaccines

- Have been infected with COVID-19, already have self antibodies that do not need to be vaccinated again
- Serious adverse reactions may occur after inoculation
- I am in good health and will not be infected with COVID-19
- Safety of vaccines
- Other factors

Figure 1 . Reasons of Chinese people refuse to get vaccinated

- There are no COVID-19 cases in the region and no vaccinations are required
- Doubts about the effectiveness of the COVID-19 vaccine
- Worries about the side effects of the COVID-19 vaccine
- Vaccine protection is short, only six to nine months
- Community health service centers are not convenient for vaccination
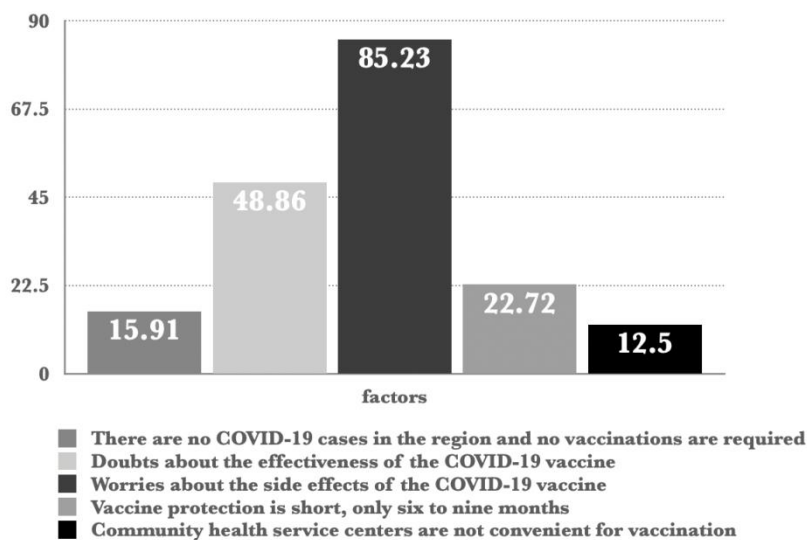
Figure 2 . Reasons of Wenzhou people refuse to get vaccinated

According to Figure 1, among those who did not get vaccinated, the majority of them were worried about vaccine safety, followed by those who thought they would not be infected with coronavirus[3].

According to Figure 2, among those Wenzhou people who are against vaccination, those who are worried about the side effects of the vaccine account for the most, followed by those who doubt the effectiveness of the vaccine, and the least reason is that they feel the community health service is not convenient[4].

Thus, much of the opposition to vaccination stems from doubts about the vaccine itself, including its safety and effectiveness.

4. ANALYZE THE INFLUENCE AND CAUSES OF INSUFFICIENT CONSUMPTION OF VACCINES

4.1. Influence of Chinese People's Insufficient Consumption of Vaccines

Nanshan Zhong said the realization of herd immunity is related to the effectiveness of the vaccine and the transmission coefficient of the virus. China's vaccine is about 70 percent effective, so China needs more than 80 percent of the population to be vaccinated to have an effective herd immunity[5]. In such conditions, less than 20% to reach others inoculated is effective, if there is more than 20% of people have negative reasons rather than for vaccine immunization vaccines, reach more than 80% of people vaccinated, even if some people vaccinated but for the interests of the collective or did not reach the most optimal positive outcome.

4.2. Causes of Chinese People's Insufficient Consumption Behavior of Vaccines

Through the survey data, the opposition mainly comes from the people's suspicion of the vaccine itself, even if the vaccine has been approved by professional authorities, but because some people who had been vaccinated had adverse reactions, people still don't believe in vaccines or don't know about vaccines because of their own psychology or by other people. Like people in real life, we are not extremely rational and prosocial. When thinking about the cost and benefit of consuming such goods or the impact on society, we will inevitably be affected by various factors and make irrational consumption behaviors. People tend to pay more attention to immediate benefits and costs than long-term benefits and costs. Those who don't get vaccinated notice the immediate downside of getting vaccinated -- the chance of having adverse reactions -- while ignoring the long-term benefit of improving their immunity; People, who have not been infected with COVID-19 and don't think they're going to get it, don't think it's necessary to get vaccinated are looking at the immediate benefit of not getting the shot, and underestimate the immediate risk, but don't take into account that not getting the shot means they have no immunity to the virus.

The Vaccine is a public good, non-rival and non-excludable, your consumption does not reduce the opportunity of others to consume, and your consumption will benefit not only yourself but also others, this benefit is not exclusive. Unlike Ordinary good, which is both rival and excludable, your consumption will reduce the chances that someone else will own it, and it is competitive since only the owner can enjoy it. Because the consumption of vaccines will bring benefits to the third parties, other than the consumers and producers, it will cause positive externalities, so even if more consumption will bring more benefits, the problem of free rider will lead to a decline in consumption. The biggest problem of Public good is that it is non-excludable, so individuals have no incentive to make the purchase, because they can enjoy the benefits even if they do not buy. Those who can enjoy it without buying it are free Riders. In this case, China opted for free vaccinations so that consumers would not be deterred from spending because of the monetary factors. However, people may still consume them insufficiently, based on concerns about the safety of vaccines and other factors. This is because real people's choices are influenced by various factors, such as psychological factors and social factors, and are not fully rational individuals. Neoclassical economics assumes that rational and interested consumers will only try to complete their desire at the minimum cost. It is beneficial to receive the vaccine without spending any money, so The Rational consumer will definitely choose to consume, but that's not the same consideration as people in real life. Those people who don't want to consume, if someone else gets vaccinated, they're less likely to get the virus, so if you meet someone who's vaccinated, you're certainly not going to get the virus yourself, so you can still experience the benefits of getting vaccinated even if you don't get vaccinated.

This results in a social dilemma. The efficient effect of vaccination should be achieved only when more than 80% of the people are vaccinated, but everyone has an incentive to not inoculate. In an N-person dilemma, one's actions are not necessarily revealed to others— anonymity becomes possible and an in- dividual can free-ride without others noticing her or his actions[6], so those who doubt about the vaccine will definitely choose don't get vaccinated. They satisfy their own desires, but the overall benefit is reduced. Just like the prisoner's Dilemma in game theory and public good Game. When everyone cooperates, the collective interest will be expanded, but everyone has an incentive to cheat. When others cooperate and they cheat, they can get higher profits.

In a public Good Game, assuming that each person has N dollars, they can put any price from 0 to N into the group account. All the money in the group account is multiplied by MPCR (Marginal per capita Return), and the final calculated money is added to each person's account. The final income includes the remaining money put into the group account and the amount of money in group account that is finally obtained after the calculation.

The income for player a is:

$$y_a = E_a - C_a + (mpcr) \times (\sum C_b) \quad \text{(player a is included in group b)}$$

In the equation mentioned above, Y represents income, E represents the initial money received by each person, and C represents the money put into the group account.

B' move

Figure 3 . Payoff matrix of prisoner's dilemma

If four people play this game, each of them has 10 dollars, MPCR =0.3, and all of them put their money entirely into the group account, then each of them gets 0+0.3×$40=$12, and the specific total income is $48. However, if one of them chooses not to cooperate and keeps all the 10 dollars, then there are only 30 dollars in the group account, and the other three people get 0+0.3×$30=$9, while the person who does not cooperate gets $10+0.3×$30=$19, and the total income of the group is $45. When everyone cooperates, individual and collective interests will increase, but when someone does not cooperate, the noncooperative people's interests will increase. Everyone has the incentive to cheat, even if cooperation can achieve win-win results.
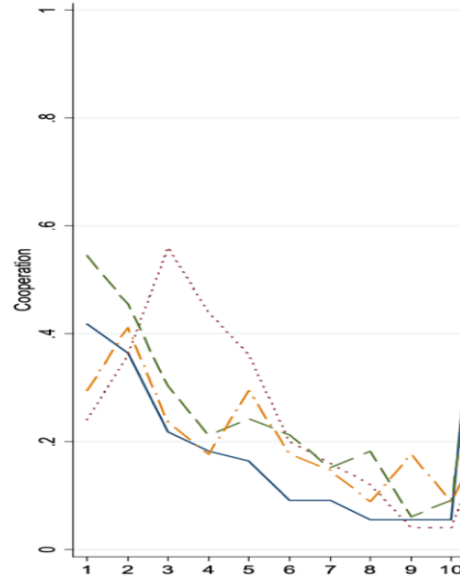

Figure 4 . Cooperation by Round

In the Prisoner's Dilemma, the payoff matrix (figure 3) shows all possible outcomes of player A and B's decisions. According to the rule of Prisoner's Dilemma, d>a>b>c, neoclassical economists believe both players prefer mutual cooperation, but they will end up achieving a mutual defection. This is because no matter what the other player's decision is, choosing Y is always a preferable option for people. From a behavioral economist's point of view, every player has their strategy, but according to figure 4, the proportion of the time that cooperators face defectors keeps rising, so the incentive to cooperate becomes weaker and weaker[7].

5. CONCLUSION

Consumer's behavior is influenced by many factors that make it impossible for people to be rational consumers. People who refuse to vaccinate are primarily concerned about the safety of vaccines and may pursue their own interests at the expense of the collective benefit, but people are not socially isolated and can be influenced by the reactions of others who have already been vaccinated. Social Dilemma is a situation in which cooperation can maximize collective interests, but some people always want to avoid cooperation in order to seek for his own interest. The best explanation for this dilemma is public good game and Prisoner's Dilemma. This paper utilizes true events to show that insufficient consumption behavior can be explained and predicted by the theories in behavioral economics. There are also many drawbacks to this paper. The paper does not give a solution to this social dilemma, but only analyze the current situation. In future papers, the way to alleviate the social dilemma that arose by vaccine consumption is a good topic to continue research.

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