

# Research and Path Design of the Problem of Postgraduate Entrance Examination and Hot Seat Occupancy from the Perspective of Information Economics

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**Abstract:** In recent years, the expansion of colleges and universities and the further improvement of the talent market have led to a sharp increase in the number of postgraduate entrance examination, which forms the contradiction between supply and demand with the limited number of teaching infrastructure allocation in the short term, and most colleges and universities have formed a common phenomenon of "postgraduate entrance examination". The situation of postgraduate students is becoming more and more serious, so how to make corresponding measures to alleviate this phenomenon is of important strategic significance. This paper takes the perspective of information economy, mainly using game theory and Nash equilibrium to analyze the causes of the phenomenon, and uses Pareto improvement to put forward feasible suggestions to improve the phenomenon. It is hoped that the current phenomenon of postgraduate entrance examination occupancy can be alleviated, so that more resources can be fully utilized.

**Keywords:** Postgraduate entrance examination, Information economics, Game theory, Nash equilibrium, Pareto improvement.

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## 1. Introduction

With the expansion of colleges and higher universities and the number of postgraduate entrance examination increasing year by year, the pressure of candidates is increasing. In order to obtain limited learning resources, the phenomenon of "postgraduate entrance examination fever" is increasingly prominent. Occupying a seat in advance in the study room or the library to put books or schoolbags and other items on the desk in advance, in order to occupy the seat learning resources [1]. Seating is originally public resources, low cost or no cost, students win resources without considering the interests of the masses. Invalid occupancy not only wastes public resources, but also affects the opportunity of others to take the postgraduate entrance examination, and its harm is self-evident. For the problem of postgraduate occupation, many scholars have studied, the cause of the phenomenon is different. Shen Mei (2021) has proposed the following four factors: the unbalanced seat supply, the better library learning environment and atmosphere, the increased pressure of students' postgraduate entrance examination, the influence of herd mentality, and the imperfect school management system [2]. Hao Yong (2021) explored and analyzed the atmosphere of seat occupancy in university libraries, and summarized three causes: students' weak public awareness, the management system is not perfect, and the insufficient library seating resources [3]. Luo Xiaoyun(2013) of Fuzhou university city seven colleges through questionnaire research, from students self-study frequency, whether, the attitude to the problem of results analysis, the following reasons: gradually prevalent the herd psychology, the lack of relevant public consciousness, gradually increasing employment pressure, limited hardware resources in colleges and universities [4]. Scholars mostly analyze the phenomenon of seat occupancy from the subjective and objective perspectives,

which plays a guiding role in solving the problem.

In view of the phenomenon of seat occupancy, all scholars have also put forward corresponding solutions. Wang Guojian(2020) has proposed the construction of the reservation selection system, which can be selected in multiple forms, such as PC terminal network seat selection, mobile terminal network seat selection, Wechat seat selection, site seat selection, etc., and set the off-seat template function [5]. Hu Yuewen, Zhang Rufang rubidium francium (2018) of the library selection system analysis and innovation, respectively build students and school, students, login interface, booking, creative points, sign-in management, friendship reminder, statistical ranking, librarian and other functions, school has login interface, information query, etc [6]. Through the investigation and analysis of learning space, Xiong Taichun(2013) put forward the innovative management of learning space, including scientific planning of the spatial layout of the library, introducing appropriate management system, strengthening the binding force of institutional measures, and effectively promoting the self-management of readers [7]. Based on the research of previous scholars, this paper will find another way to analyze the game theory of the reasons for the emergence of "postgraduate seat occupation fever" and the phenomenon of the occupied area, and draw the optimal solution of the Nash equilibrium, and improve Pareto according to the above analysis. Finally, we put forward reasonable solutions, hoping to provide help to various universities.

## 2. Theoretical Background

### 2.1. Game Theory Analysis

"Game theory", also known as "countermeasure theory", is one of the standard analysis tools of economics, and is now widely used in various disciplines. Game theory considers the

predictive and actual behavior of individuals in the game and studies their optimization strategies. The ostensibly different interactions may exhibit similar excitation structures, so they are special cases of the same game.

The classification of games is also different according to different benchmarks. It is generally believed that games can be mainly divided into cooperative games and non-cooperative games. The difference between a cooperative game and a non-cooperative game is whether there is a binding agreement between the interacting parties. If any, it is a cooperative game, and if not, it is a non-cooperative game. The game theory discussed by economists generally refers to non-cooperative game. Because cooperative game theory is more complex than non-cooperative game theory, its theoretical maturity is far less mature than non-cooperative game theory.

### 2.2. Nash Equilibrium

"Nash equilibrium", also known as "non-cooperative game equilibrium", is an important term of game theory. In the process of a game, regardless of the other party's strategy choice, the other party will choose a certain strategy, and the strategy is called the dominant strategy. This combination becomes a Nash equilibrium if any participant is also optimal by the strategy of the other participants.

We characterize the Nash equilibrium problem. Suppose that with N players, each player's  $v \in \{1, \dots, N\}$  decision variable is  $x^v \in \mathbb{R}^{n_v}$ ,  $x = (x^1, \dots, x^N)^T \in \mathbb{R}^n$ ,  $n = n_1 + \dots + n_N$ . To emphasize the decision variables of the v-th player in the vector x, we also note the x as  $x = (x^v, x^{-v})^T$ ,  $x^{-v}$  represents all the remaining decision variables outside of  $x^v$ . It should be emphasized that  $x = (x^v, x^{-v})^T = (x^1, \dots, x^N)^T$  is only notation different. Similarly,  $n^{-v} = n - n^v$ . Let  $\Theta^v: \mathbb{R}^n \rightarrow \mathbb{R}$  is the utility function of the v-th game. It is assumed that  $\Theta^v(x)$  is continuous and differentiable and  $\Theta^v(x) = \Theta^v(x^v, x^{-v})$  is with respect to the decision variables that are strongly convex [8]. For any game player v,  $x^v \subseteq \mathbb{R}^{n_v}$  is its decision set and is non-empty closed convex. Let  $X = \prod_{v=1}^N X^v$  be the Cartesian product of all player decision sets, then  $x^* \in X$  is an effective decision of a Nash equilibrium or a solution of a Nash equilibrium, if a component  $x^{*,v}$  is an optimization problem:

$$\min \Theta^v(x^v, x^{-v}) \quad (x^v \in X^v)$$
's solution.

### 2.3. Pareto Improvement

The "Pareto Improvement" is based on the Pareto optimum. Pareto improvements can be achieved when resources are idle or when markets fail. When the resources are idle, some people can profit from it, but they do not harm the interests of others. In the case of market failure, a correct policy can reduce the welfare loss and thus make the whole society benefit.

Generally speaking, when Pareto optimal is reached, the following three conditions are met simultaneously: 1. Exchange optimal: Even in trading, individuals cannot get greater benefit from it. At this time, the marginal substitution rate of any two consumers is the same, and the utility of both consumers is maximized; 2. Production is optimal: the marginal technical substitution rate of the two production factors is equal at the boundary of production possibilities; the product mix is optimal: the combination of products produced by the economy must reflect the consumer preference. The marginal substitution rate between any two products must

then be the same as the marginal product conversion rate of any producer between the two commodities.

## 3. Game Theory Analysis of the Reasons for Postgraduate Entrance Examination

### 3.1. Basic Assumptions

To simplify the occupancy game model, this article makes the following basic assumptions: (1) there is only one seat in the study room; (2) two students in the model, Xiao Li and Xiao Zhang, and they are all rational people; (3) they all have two choices: not occupied and not occupied; (4) the choice of both people will increase the likelihood of a conflict, and may leave them without seats, therefore, the profit value of each person is 1; (5) if only one person chooses to occupy a seat, then you don't have to carry a lot of review materials looking for seats everywhere every day, therefore, its profit value is 6; and those who choose not to take up their seats will look around for seats, wasted a lot of time and energy, let its profit value be -4; (6) if both people choose not to occupy a seat, will save a lot of time and energy, and both people have the chance to find a seat to learn, therefore, the profit value of each person is 3.

### 3.2. Game Theory analysis

Based on the assumption, there are two cases, when Xiao Zhang also chose not to take a seat, and the seat will be 1. Therefore, the optimal strategy combination formed by Xiao Zhang's strategy is (seat, seat), and the revenue combination is (6,1).

Two-man strategy finite games in game theory standard models, usually represented by a game matrix. Among them, Xiao Li Yi strategy is on the left, Xiao Zhang strategy is on the top, the number in the matrix indicates the benefits of two people. The matrix is as follows:

Table 1. Income matrix

Xiao Li/Xiao Zhang	Occupying a seat	Not occupying a seat
Occupying a seat	(6, 1)	(6, -4)
Not occupying a seat	(-4, 6)	(-4, -4)

As shown in the table, from small see big, it is because each student will choose their own optimal strategy —— occupy seat, it leads to the phenomenon of "postgraduate entrance examination seat fever".

## 4. Game Theory Analysis of The Occupied Areas

### 4.1. Basic Hypotheses

In order to simplify the seat holder game model, this paper makes the following basic assumptions: (1) assume that A first action books occupy the seat; (2) two students A and B, who are rational people, will seek to maximize the benefits; (3) A and B use seats will profit 2, and the cost of taking the book seat is 1. If the two parties quarrel, the profit is -4; if B does not quarrel but curse him in mind, then B's profit is -3; (4) only one seat.

## 4.2. Game Theory Analysis

Fully information dynamic games can be solved by reverse induction. In the final stage, A chooses to fight or not to fight. A gets -3 for arguing, minus 1 for not arguing. As a rational person, A chooses not to quarrel in the last stage and leaves silently but is secretly unhappy. A quarrel will bring huge losses to both sides, and this loss is greater than the benefits itself. In the second stage of the game, if B chooses to grab a seat or not to grab a seat, he brings benefits 0 units. If B grabs a seat, A will choose not to quarrel in the next stage. B's income at this time is -1, which is less than the profit without grabbing a seat. Therefore, B will choose not to grab seats in the second stage. In the first stage of the game, the income of A choosing not to occupy a seat is 0. B who chooses to occupy a seat will choose not to grab in the next stage, and the income of A will be 1, which is greater than the income when it does not occupy a seat. Therefore, A chooses the seat. Therefore, the sub-game refined equilibrium obtained by the reverse regression method is {(occupy, no quarrel but dark scold), no rob}, and the equilibrium payment is (1, 0).

The above game theory analysis reasonably explains that when the seat searcher finds that a seat has been occupied but no one, it will not go strong, but will leave, but this causes a relative waste of resources.

## 5. Analysis of the Influence of Seat Occupancy Phenomenon

### 5.1. Low Utilization Rate of Library Seats

When student A took up the seat in advance by means of books, schoolbags and other items, he got the right to use the seat, while other students lost the right to use it. If student A does not perform the seat and the real study, it will delay the learning opportunity of other students. As a public resource in the university library, every student has the opportunity to enjoy the learning and education, and the phenomenon of seat occupancy leads to the ineffective waste of the library vacancy, which makes the public resources cannot be maximized [9].

### 5.2. Disturb the Normal Learning Order

The seat holder occupies the use of the seat when he puts the book on his desk, and when others come to pick the seat, he has two options, either leave the choice to find the next seat, or put the book aside and sit in the position to study. The former delays the time to study for the students, the latter may bring contradictions and quarrels, the result is to destroy the good learning atmosphere, disturb the normal learning order.

### 5.3. Cause Potential Safety Risks

If students use valuables to occupy seats, there may be a risk of missing items. Moreover, during the postgraduate entrance examination, students are under great pressure and easy to become emotional. They may have conflicts, quarrels, or even physical conflicts because of the seat occupation problem, which will have certain safety risks, which is contrary to the direction of building a harmonious campus [10].

### 5.4. Increase the Workload of Librarians

If the student's belongings are not taken away in time, the librarian needs to clean them up. In the event of arguments or even physical conflict, librarians need to adjust. The more prominent the phenomenon is, the more problems librarians

will face and need to solve.

## 6. Pareto Improvement for Postgraduate Entrance Examination

Economics studies fairness and efficiency. If there is an adjustment policy for a certain plan that allows the original plan to benefit at least one without losing anyone, then this adjustment strategy becomes a Pareto improvement. Occupying a seat is a vicious competition, will cause unfair to other students and postgraduate entrance examination classroom use low efficiency, in order to improve this situation, this paper puts forward the following rationalization suggestions.

### 6.1. Cultivate College Students' Habits of Self-Discipline and Self-Management

Most college students are adults who have correct views of right and wrong and values. School organizations can post warning posts in eye-catching places such as self-study rooms and libraries to warn students not to occupy the space. Colleges can also initiate relevant notices, lectures and so on to strengthen the prohibition of students. Students should also learn to put themselves in other places' shoes, know how to understand the hard work of other postgraduate students, supervise each other, protect their own learning rights and interests, and gradually form the habit of self-discipline and self-management.

### 6.2. Increase Investment in Infrastructure

An important reason for the "seat heat" is the limitation of seat resources, imagine if there are enough seats, and how to occupy the seat? Considering this, the school can set up more self-study rooms, such as classrooms or offices that are not used for a long time. With sufficient funds, it can also build more self-study buildings to provide learning venues for more students studying for the postgraduate entrance examination.

### 6.3. Strengthen the System Management of The Study Room Seats

The reasonable management system and implementation mode of study room are also related to the allocation of study room seats. The management organization of study room should strengthen the system management of study room seats. For example, if an appointment method is set, the students who cannot arrive at the seat within the specified time should abate, and the students who fail to abate will record the default. Those who default more than twice can not make an appointment again this week. At the same time, we should also set the departure time, for example, half an hour can not return within half an hour, there will be a default record. Under such measures, it will greatly reduce the waste of resources, and give more positions to the students who really need to study.

### 6.4. Improve the Learning Conditions of The Dormitory

Dormitory is a place for students to rest, usually stay time is also the longest place outside the classroom. A good dormitory environment can drive all the dormitory members to study together, and can better consolidate the knowledge in the discussion and communication. In the case of limited study room resources, we should cherish the opportunity of dormitory learning, so that they can get more learning time.

However, not all the dormitory students are willing to learn, and the dormitory also has the function of rest, which requires us to make good dormitory rules, what time to rest, what time to study. In this way, we can both have a good rest, but also can make full use of the dormitory to study.

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