

# The influence of group identity on the hold-up problem

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**Abstract:** *The hold-up problem plays an important role in the study of corporate boundaries and is also an important factor in the study of economics in organizations. It not only causes underinvestment, but also leads to the loss of corporate earnings and social welfare. The hold-up problem has been a hot topic for scholars since its introduction. However, most of the scholars' studies are based on the assumption of rational economic man and do not consider the factor of human beings' social preferences. In recent years, the development of behavioral experimental research methods has changed this situation. Many scholars have demonstrated that people's behavior deviates from the assumption of rational economic man because they have different social preferences. Therefore, this paper introduces a frontier theoretical perspective in the game study of the hold-up problem. Based on social identity theory, and speculates that group identity enhances the altruistic preference of individuals toward group members, and combines behavioral experiments with controlled laboratory experiments to obtain experimental data. The experimental results also support our speculation and provide an individual experimental basis for the theoretical study of the hold-up problem, which will help alleviate the hold-up problem in the future.*

**Keywords:** *hold-up; group identity; behavioral experiments*

## 1. Introduction

The hold-up problem is a well-known problem in economics that arises from contractual incompleteness. The problem is that when one or both parties to a transaction make a Relationship Specific Investment (RSI), the other party, due to contractual incompleteness, plunders the investor's returns ex post, thereby leaving the investor with insufficient ex ante incentives and resulting in a smaller final investment than the socially optimal one (Grossman and Hart, 1986). Goldberg was the first to introduce the concept of the hold-up problem in 1976, and the hold-up problem eventually evolved into an important branch of business theory. Due to the universality of the hold-up problem, there are also many studies on the hold-up problem in all walks of life. For example, the ethanol industry (weseen et al., 2014) and the natural gas industry (Nuryyev and Chu, 2014). Many experts and scholars have designed corresponding behavior experiments to study the solution and mitigation measures of the hold-up problem (Miller and Drake, 2016; Sloof et al., 2007). Morita and Servatka (2013) proved that group identity strengthens other concerned behaviors among group members through a large number of experimental studies on trust games. It can be inferred that group identity enhances the altruistic preference of players, which in turn helps to solve or alleviate the hold-up problem[1-2].

In order to understand the psychological basis between groups, social psychologists Tajfel and Turner (1978) put forward a theory of group identity, which described individual's self-understanding as derived from perceived membership of social groups. Early psychological experiments provided evidence for the main prediction of this theory, that is, ingroup members would produce preferences within groups at the expense of preferences among outgroup members. After these early studies, a large number of documents provide evidence for group identity, which proves that group identity can affect the choice of subjects in non-strategic and strategic environments. Chen and Li (2009) measured the influence of group identity on other related preferences of subjects in simple distribution games and a series of two-person continuous games.

Subjects' choice shows obvious preference in the following aspects: (1) distribution preference, which gives more to ingroup members than to outgroup members; (2) reciprocal preference, which rewards members in the group more frequently than those outside the group, but punishes them less

frequently. Therefore, Chen and Li's research provides strong evidence to prove that group identity will affect other people's preferences, this is the potential mechanism based on our speculation that group identity can alleviate the hold-up problem.

In recent years, with the development of behavioral experiments, behavioral management and other disciplines, it has become a major trend to study management problems by means of experiments. Therefore, this paper introduces the behavior experiment, based on the previous research results and the causes of the hold-up problem in reality, and combines the trust game with the ultimatum game to design the game experiment of the hold-up problem. Based on theoretical analysis, this paper uses z-Tree software to program and design behavior experiments from the aspects of conditions inside and outside the group, and takes the students of China Southwest Petroleum University as the experimental subjects to explore the influence of group identity on the behaviors of the subjects. Through the analysis of the experimental data, this paper explores and compares the behavior characteristics and social preferences of the subjects in the game of hold-up problem, tests the influence of group identity on the subjects' behavior, and provides a certain theoretical basis for the mechanism of avoiding the hold-up problem.

In this paper, an experimental bureau is designed to explore the influence of group identity on subjects' behavior, which mainly includes investment rate and offer. The experiment found that all the subjects showed bounded rational behavior more or less contrary to the traditional hypothesis of "rational economic man". Based on the theory of group identity, group identity enhances the altruistic preference of individuals for group members and has an impact on the hold-up problem.

The research on the subjects' behavior in the game experiment of the hold-up problem is of great significance to the proposal of the avoidance mechanism of the hold-up problem. It is difficult for traditional theory to predict people's behavior and preferences completely and accurately, but the behavior in the hold-up problem can be investigated comprehensively and clearly by using the method of behavior experiment. The practical significance of the experimental results also provides a theoretical reference for enterprises to choose partners and bargain, and reduces the possibility of being trapped. Although the designed experiment only simulates the hold-up problem in reality, it is difficult to consider and control various influencing factors in reality. However, it can still reflect the behavior in the hold-up problem to some extent[3-4].

## 2. Experimental design

All the experiments were conducted by using Z-tree software (Fischbacher, 2007), entered at Southwest Petroleum University (SWPU) in Chengdu, China, and all the subjects were recruited in the school. During October 2021, 10 experiments were conducted, with 6 participants each time, and each participant completed 50 rounds of experiments. Participants' income was replaced by the experimental currency unit (ECU), and the exchange rate of each unit was 0.004 yuan. And finally pay in RMB, each stage takes about 45 minutes to complete.

Before the experiment, the subjects need to complete the task of group assignment (Chen and Li, 2009) to create a group identity. Subjects will receive ten modern paintings, five of which are by the modern painter Klee and the other five are by the modern painter Kandinsky. Without telling the painters of each painting, all subjects independently choose the five paintings they like best. According to their painting preferences, subjects are divided into two groups, Klee Group and Kandinsky Group. There were 3 people in each group, the subjects didn't know the grouping results throughout the experiment, and the grouping remained unchanged throughout the experiment.

After the group assignment is completed, the experimenter provides and reads aloud the instructions of the hold-up game to all participants. Then, six subjects were randomly divided into three groups, with two people in each group, and repeated hold-up games were played between "the first mover" and "the second mover". Both the first mover and the second mover got the initial endowment of 100ECU. Before the computer randomly assigns roles to determine the benefits, participants use the method of strategic decision-making to submit decisions on each node as the first mover and the second mover. This strategic approach allows us to collect more results about investment decisions and the amount of return, which can be used to compare the behaviors of different experiments. After that, the computer randomly assigns roles and tracks all decisions through ID numbers to determine the interests of participants. Before the formal game, participants will have eight practice experiments to familiarize themselves with the experimental process.

The hold-up game has four decision-making screens. On the first two decision-making screens, participants need to decide whether to invest 60ECU to create a profit of 90ECU for the group if they are assigned as the first mover. The difference is that the first screen assumes that the opponent is from ingroup, while the second screen assumes that the opponent is from outgroup. In these two screens, if they choose not to invest, the game is over. If they choose to invest, they also need to decide the minimum offer they are willing to accept from the second mover (MWTA). On the last two decision-making screens, participants need to decide how much of the 90ECU will be returned to the first mover if assigned as the second mover (offer). The difference is that the third screen assumes that the opponent is from ingroup, while the fourth screen assumes that the opponent is from outgroup. When all participants submit their decisions, the computer will randomly assign roles to each pair of participants and calculate the income of each participant.

The benefits of the hold-up game are determined as follows. If the first mover chooses not to invest, the returns obtained by the first mover and the second mover are equal to their initial endowments (100ECU). If you decide to invest first, there are two possible outcomes. If the offer is lower than the MWTA, the income of the first mover is equal to 40ECU (the initial endowment of 100ECU minus 60ECU), and the income of the second mover is equal to the initial endowment of 100ECU. If the offer is greater than or equal to the MWTA, the income of the first mover is equal to the initial endowment of 100ECU minus 60ECU plus the offer, and the income of the second mover is equal to the initial endowment of 100ECU plus 90ECU minus the offer. Finally, on the results screen, participants will be informed of their benefits[5-8].

### 3. Hypotheses

Hypothesis: There is no difference in the investment rate and offer between the ingroup condition and the outgroup condition.

In the past, most scholars' research was based on the hypothesis of rational economic man. They thought that everyone could optimize all the opportunities, goals and means to achieve them through the principle of cost-benefit or avoiding disadvantages. Their economic behavior was conscious and rational, and there was no empirical and random decision-making, so group identity had no influence on people's behavior, in other words, there is no difference in the investment rate and offer between the ingroup condition and outgroup condition[9].

### 4. Conclusions

In order to test the hypothesis in the previous section, we conducted statistical analysis and T-test on the collected data, and the final result was quite different from the hypothesis. The Summary Statistics are shown in the table 1.

*Table 1: Summary Statistics*

	Ingroup	Outgroup	H <sub>0</sub> :Ingroup = Outgroup
Investment rate	78.3%	63.3%	p-value<0.001
Offer	60.9 ECU	56.9 ECU	p-value<0.001

Conclusion 1: There is a significant difference in the investment rate between the ingroup condition and outgroup condition.

The above figure shows the summary statistics of the two situations. A total of 60 subjects participated in the experiment and provided us with 60 sets of data. It is found by the t-test that  $p < 0.001$ , rejecting the original hypothesis, there is a significant difference between the investment rates of ingroup condition and outgroup condition. Among them, the investment rate of ingroup condition is 78.3%, while that of outgroup condition is 63.3%, and the investment rate of ingroup condition is higher than that of outgroup condition ( $78.3% > 63.3%$ ).

Conclusion 2: There is a significant difference in the offer between the ingroup condition and outgroup condition.

The above figure shows the summary statistics of the two situations. A total of 60 subjects participated in the experiment and provided us with 60 sets of data. It is found by the t-test that  $p < 0.001$ , rejecting the original hypothesis, there is a significant difference between the offer of ingroup condition and outgroup condition. Among them, the offer of ingroup condition is 60.9 ECU, while that of

outgroup condition is 56.9 ECU, and the offer of ingroup condition is higher than that of outgroup condition ( $60.9 > 56.9$ ).

In summary, there were significant differences in the investment rate and offer between the ingroup condition and outgroup condition. This also indicates that group identity enhances individuals' altruistic preference for ingroup members and has a significant effect on the hold-up problem.

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