

# The Spite Dilemma Experiment in Korea

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This paper investigates a choice behavior of Korean subjects for the provision of public goods using the voluntary contribution mechanism in Saijo and Nakamura (1995). Together with the data from Saijo and Nakamura (1995) and Saijo *et al.* (2007), we conclude that whereas Japanese subjects are more likely to behave spitefully, Korean and Chinese subjects are more likely to act cooperatively. We also analyze the behavior of Korean subjects after being categorized by department. Subjects from the economics department follow a pattern of a contribution not much different from the theoretical expectation, and subjects from the college of social sciences show a similar pattern. The subjects who act spitefully are from the department of agricultural economics.

*Keywords:* Voluntary contribution mechanism, Spite dilemma, China, Japan, Korea

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## I. Introduction

A subject makes a positive contribution to the public goods experiment when no contribution is predicted by the economic theory. If the marginal return from one unit of a contribution to the public good is less than one, then there is tension between individual rationality to maximize an individual payoff and social efficiency to collect enough resources for the public project.

Saijo and Nakamura (1995) design the voluntary contribution mechanism, where the marginal return from a contribution is greater than one, and the full contribution of an individual endowment is a unique dominant strategy. Although individual rationality and social efficiency do not conflict each other, the authors find that some Japanese subjects deviate from the theoretically predicted behavior necessary to maximize an individual payoff. They call this phenomenon the “spite” dilemma. According to Cason *et al.* (2004) and Saijo (2008), a spiteful strategy is to invest less than the full contribution that maximizes his/her individual payoff. Although a subject suffers loss in his/her payoff when he/she reduces his/her contribution for the public good, other subjects suffer greater losses in the payoff than the subject.

After Saijo and Nakamura (1995), many experimental studies have investigated how universal the spiteful behavior is. Brunton *et al.* (2001) and Saijo *et al.* (2007) conduct the same experiment for Canadian and Chinese subjects, respectively, but they could not confirm the spite dilemma. Cason *et al.* (2002) and Cason *et al.* (2004) design a two-stage game, where the first stage is for participation decision and the second for contribution decision. Cason *et al.* (2004) observe that evolutionary stable strategies do not appear among Japanese subjects and that this behavior pattern is due to spitefulness among subjects. Cason *et al.* (2002) compare the results between Japanese and American subjects and find that whereas American subjects are more likely to follow evolutionary stable strategies, Japanese subjects are more likely to behave spitefully.

In this paper, we conduct the public goods experiment with the same design and procedure as in Saijo and Nakamura (1995) and examine how the subjects in Korea behave compared with Japanese and Chinese subjects. The purpose of this paper is twofold. First, a comparison of behavior patterns among three countries will reveal how different the behavior patterns of the subjects in Korea, Japan, and China are even

though they are close to each other geographically and are similar in culture. Most experiments for the provision of the public goods have been conducted in Western countries; thus, a comparative analysis for three countries will shed light on the choice behavior of Asian countries. Second, we investigate in great detail the choice behavior of Korean subjects and discuss how the social context affects individual behavior. Although the number of observation is not large enough when subjects are categorized by department, our result shows that subjects' major can affect the choice behavior.

The rest of the paper is organized as follows. In Section 2, we describe the experimental design and procedures. We report our statistical results in Section 3 and the concluding remarks in Section 4.

## II. Experimental Design and Procedures

We use the same experimental design as in Saijo and Nakamura (1995). Under the voluntary contribution mechanism, subject  $i$  faces a decision to split his/her initial endowment ( $w_i$ ) into saving ( $x_i$ ) and contribution (or investment) ( $y_i$ ). Let  $y = \sum y_k$ , and  $g$  be the contribution function, which is assumed to be linear. Each subject consumes his/her saving and receives  $g(y)$  from the contribution. Subject  $i$ 's utility function is

$$u(x_i, y) = x_i + \alpha y,$$

where  $\alpha$  is the marginal return from one unit of a contribution. If  $1 > \alpha > 0$ , it is the low marginal return case represented by L, and for any subject, no contribution in any period is the unique subgame perfect equilibrium. However, if  $\alpha > 1$ , it is the high marginal return case represented by H, and contributing all endowments is the dominant strategy. For each subject, the initial endowment,  $w_i$ , is 10, and the number of subjects in a session,  $n$ , is 7.

The non-computerized laboratory experiment was conducted in Seoul National University (SNU). The format of our experiments was based on Saijo and Nakamura (1995). As in the experiments in China and Japan, communication among the subjects was prohibited, and we declared that the experiments would be stopped if communication among the subjects was observed. This never occurred in the Korean experiment. One session took approximately 70 min. The mean payoff per subject was \$15.35 (18,957 won at \$1 = 1,234.50 won in 3 June 2009).

Subjects were 56 undergraduate students of SNU recruited by the university internet board. Each subject participated only one session of the experiment. Eight groups were separated into two different sessions: (L, H) and (H, L). (L, H) represents a session where the low marginal return case is carried out first and then the high marginal return case is conducted. (H, L) represents a session in the opposite order. Each session was repeated four times.

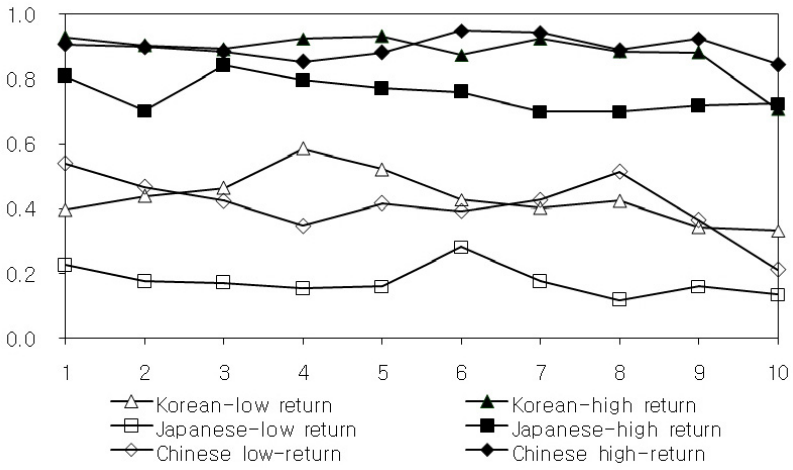
### III. Results

#### A. Cross-country Analysis

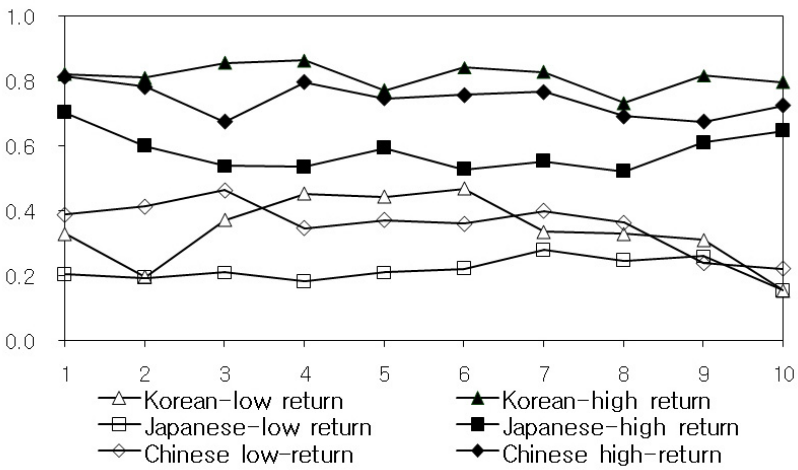
We analyze the contribution pattern in Korea and compare it with that in Japan (Saijo and Nakamura 1995) and China (Saijo *et al.* 2007). In both sessions of (L, H) and (H, L), Korean subjects contribute positive amounts in all marginal return cases. They start with approximately 35% of the endowment as a contribution in the initial period for the low marginal return case, and the amount of the contribution never falls below 20% of the endowment in all periods of the experiment. For the high marginal return case, 85% of the endowment is contributed on average per period. In addition, the level of the contribution is maintained without much fluctuation in all periods. We conduct the multivariate analysis to check the time effect on the contribution. The contribution patterns in both marginal return cases are maintained constantly throughout the experiment because we find that there is no significant time trend.

Figures 1 and 2 show an average contribution pattern in Korea, China, and Japan in the aggregate level. We can observe how differently the subjects of the three countries behave in the two marginal return cases. In (L, H) and (H, L) experiments, whereas Korean and Chinese subjects make a similar decision on the contribution in both marginal return cases, Japanese subjects behave differently. In particular, the average contribution of Japanese subjects in each period for both marginal return cases is mostly lower than that in their Chinese and Korean counterparts.

To provide statistical support for the observation, we conduct the nonparametric Wilcoxon rank-sum test to compare the contribution patterns for each pair of countries. Table 1 indicates that Japanese subjects contribute in a different pattern from Korean and Chinese subjects at the 1% significant level, except for one session.<sup>1</sup> Table 1 also



**FIGURE 1**  
AVERAGE CONTRIBUTION LEVEL IN (L, H) SESSION



**FIGURE 2**  
AVERAGE CONTRIBUTION LEVEL IN (H, L) SESSION

indicates that Korean and Chinese subjects show no significant difference in most sessions.

<sup>1</sup>The *p*-value of the low marginal return case between Korea and Japan in (H, L) session is 0.0513; thus, it is significant at the 10% level.

**TABLE 1**  
TESTS FOR DIFFERENCES IN CONTRIBUTIONS (WILCOXON RANK-SUM TEST)

	(L, H) Sessions		(H, L) Sessions	
	Low Return	High Return	Low Return	High Return
China-Japan	7.4412**	6.0688**	4.8634**	5.8236**
Korea-Japan	6.6697**	6.2785**	1.9489	8.4863**
Korea-China	0.3018	0.5717	-1.7710	2.6702**

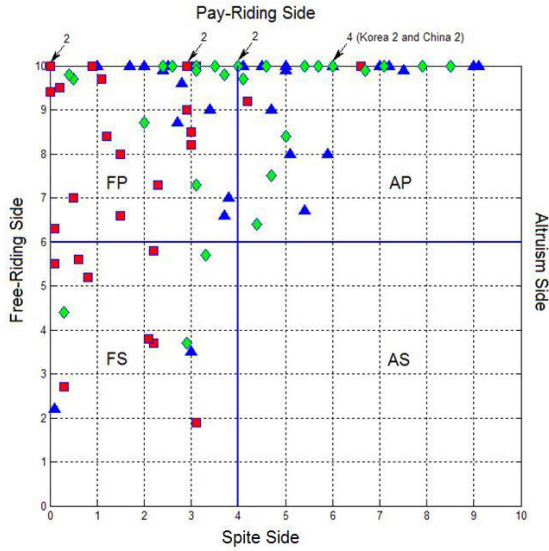
\*\* Significant at the 1% level.

Next, by conducting the fraction analysis as in Saijo and Nakamura (1995), we analyze how each subject of the three countries behaves in the two marginal return cases. Let  $a$  be the average contribution for the low marginal return case and  $b$  for the high marginal return case. Although the choice of two numbers 4 and 6 is arbitrary, we define four regions as

$$\begin{aligned}
 FP &= \{(a, b) \mid 0 \leq a < 4 \text{ and } 6 < b \leq 10\}, \\
 AP &= \{(a, b) \mid 4 \leq a < 10 \text{ and } 6 < b \leq 10\}, \\
 FS &= \{(a, b) \mid 0 \leq a < 4 \text{ and } 0 \leq b \leq 6\}, \text{ and} \\
 AS &= \{(a, b) \mid 4 \leq a < 10 \text{ and } 0 \leq b \leq 6\},
 \end{aligned}$$

where FP stands for the free-riding and pay-riding region, which is the theoretically expected region, AP for the altruistic and pay-riding region, FS for the free-riding and spiteful region, and AS for the altruistic and spiteful region. As shown in Figures 3 and 4, we observe that subjects in Korea and China are more likely to be located in the FP and AP regions, whereas subjects in Japan are more likely to be located in the FP and FS regions.<sup>2</sup> In particular, Korean and Chinese subjects are more frequently located in the AP region, and more Japanese subjects are located in the FS region. This implies that whereas subjects in Korea and China are more likely to cooperate in the low marginal return case, subjects in Japan are more likely to behave spitefully in the high marginal return case. To support this finding, we conduct a number of proportion tests. Table 2 indicates that Japanese subjects have a tendency to behave spitefully compared with Korean and Chinese subjects.

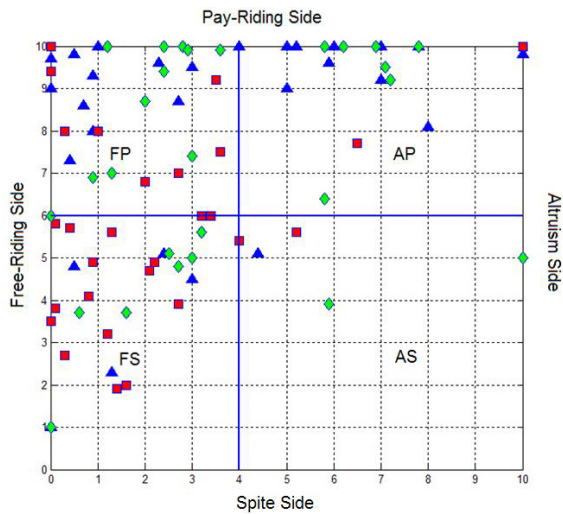
<sup>2</sup> In Figure 3, the numbers above the arrow indicate the number of subjects located in the same spot.



**FIGURE 3**

MEAN CONTRIBUTION DISTRIBUTION IN (L, H):

- ▲ INDICATES KOREAN SUBJECTS, ■ INDICATES JAPANESE SUBJECTS, AND
- ◆ INDICATES CHINESE SUBJECTS



**FIGURE 4**

MEAN CONTRIBUTION DISTRIBUTION IN (H, L):

- ▲ INDICATES KOREAN SUBJECTS, ■ INDICATES JAPANESE SUBJECTS, AND
- ◆ INDICATES CHINESE SUBJECTS

**TABLE 2**  
PROPORTION TESTS

	A vs. B	(L, H) Sessions	(H, L) Sessions
(1) $P_{AP,A} = P_{AP,B}$ <sup>a</sup>	China vs. Japan	3.7782**	1.8193**
vs.	Korea vs. Japan	3.7782**	2.8486**
$P_{AP,A} > P_{AP,B}$	Korea vs. China	0	1.1445
(2) $P_{FS,A} = P_{FS,B}$	China vs. Japan	-1.6817*	-2.1602*
vs.	Korea vs. Japan	-2.0935*	-1.3372
$P_{FS,A} < P_{FS,B}$	Korea vs. China	-0.4686	0.8467
(3) $P_{AP+FP,A} = P_{AP+FP,B}$	China vs. Japan	1.6817*	2.1381*
vs.	Korea vs. Japan	2.0935*	3.2404**
$P_{AP+FP,A} > P_{AP+FP,B}$	Korea vs. China	0.4686	1.1832
(4) $P_{FS+FP,A} = P_{FS+FP,B}$	China vs. Japan	-3.7782**	-1.9543*
vs.	Korea vs. Japan	-3.7782**	-2.3664
$P_{FS+FP,A} < P_{FS+FP,B}$	Korea vs. China	0	-0.8281

<sup>a</sup> $P_{ij}$  = proportions of subjects of country  $j$  in region  $i$ .

\*\* Significant at the 1% level, \* Significant at the 5% level.

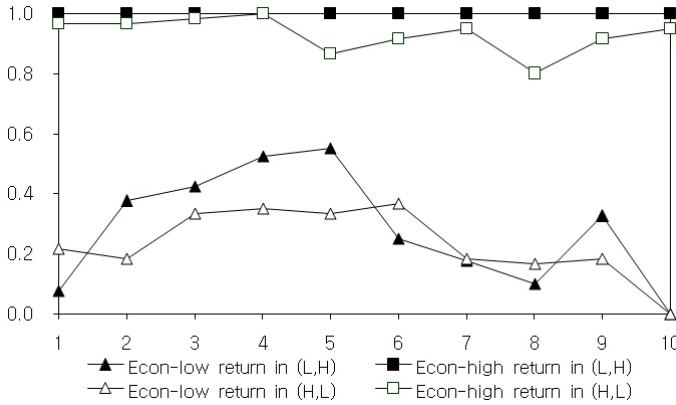
This result is striking because the three countries are close to each other geographically and are similar in culture. Although concluding that the behavior pattern from the limited subjects' pool can fully represent the characteristics of the behavior pattern in each country is difficult, the differences in the experiment can be considered evidence showing that we should consider the social context when analyzing human behavior.

### B. Choice Behavior in Korea

To investigate how the social context or the individual identity of subjects affects contribution patterns, we analyze the data of Korean subjects in greater detail. We categorize Korean subjects according to the departments where they belong, *i.e.*, economics (10), social sciences excluding economics (10), human sciences (4), natural sciences (3), engineering (11), agricultural and life sciences (9) including agricultural economics (7), arts (3), education (3), and ecology (3).<sup>3</sup> Although the total number of subjects is not large enough to provide statistically significant results, we find some interesting features from this categorization.

<sup>3</sup> Numbers in the parenthesis indicate the number of subjects in each category summed up for the two experiments.



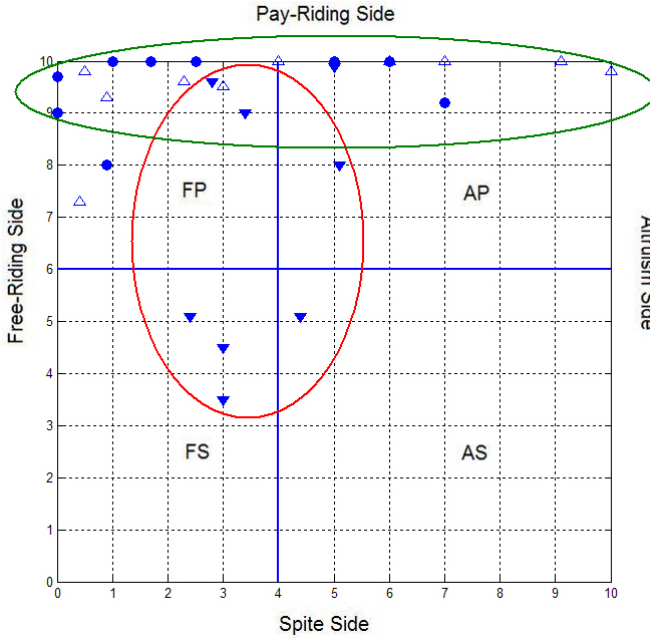


**FIGURE 5**  
AVERAGE CONTRIBUTION LEVEL OF ECONOMICS SUBJECTS

First, subjects from the economics department show the most familiar pattern of contribution, not much different from the theoretical prediction. Figure 5 shows the average contribution level in both experiments.

In the high marginal return case, all subjects from the economics department in (L, H) contribute their endowments fully to the public good for all periods, and in (H, L), they choose almost a full contribution in the initial period and maintain their level constant throughout all periods. The more interesting feature is found in the low marginal return case. Although the average level of a contribution is approximately 15% in the initial period, subjects never make a positive contribution in the last period without any exception. This pattern only occurs for the subjects from the economics department, it implies that they understand the structure of the experiment, where the last period is a one-shot game and the optimal strategy is free-riding. The contribution level for the subjects from the college of social science is close to that for the subjects from the economics department.

Another conspicuous feature is found in the subjects majoring in agricultural economics in the college of agricultural and life science. Although the department of agricultural economics belongs to a college different from the department of economics in SNU, it requires students to attend at least five economics classes in its curriculum. However, the contribution pattern of the subjects from the department of agricultural economics is different from that of the subjects from the college of social sciences including economics. Figure 6 shows the results from the frac-



**FIGURE 6**

MEAN CONTRIBUTION DISTRIBUTION:

● INDICATES ECONOMICS MAJOR, △ INDICATES SUBJECT IN COLLEGE OF SOCIAL SCIENCE EXCEPT ECONOMICS, AND ▼ INDICATES AGRICULTURAL AND LIFE SCIENCE MAJOR

tion analysis for the subjects of the three categories.

Whereas all subjects from the college of social sciences (including economics) never behave spitefully in any session, most subjects from the department of agricultural economics behave spitefully. Table 3 also indicates that the subjects from the department of agricultural economics make the lowest and the most spiteful contribution level among all categories in (H, L).

This is interesting because the subjects from the college of social sciences (including the department of economics) and the department of agricultural economics are very likely to be exposed to economics classes among all categories, and expecting them to show a similar behavioral pattern is natural. Despite the fact that the number of subjects is not large enough to draw a statistically significant conclusion, these findings imply that the social context or the individual identity of subjects can have an effect on the behavioral pattern.

**TABLE 3**  
AVERAGE CONTRIBUTION LEVEL AND NUMBER OF SPITEFUL SUBJECTS

	(H, L) Session						
	Economics	Social	Human	Natural	Engin- eering	Agricultural Economics	Educa- tion
Mean Contri- bution	9.3167	9.4125	7.6667	5	10	4.9500	6.8000
Number of Spiteful	0(6) <sup>a</sup>	0(8)	1(3)	1(2)	0(2)	4(4)	1(3)

<sup>a</sup> Numbers in the parenthesis indicate the number of subjects in the (H, L) session.

#### IV. Concluding Remarks

We conduct the public goods experiment using the voluntary contribution mechanism in Korea. Together with the data from previous experiments conducted in Saijo and Nakamura (1995) and Saijo *et al.* (2007), we conclude that whereas Japanese subjects are more likely behave spitefully, Korean and Chinese subjects are more likely to act cooperatively. In addition, subjects from the economics department follow a pattern of contribution not much different from the theoretical prediction, and most subjects are from the department of agricultural economics act spitefully. These findings reveal that although the subjects have many common characteristics, other differences in the social context, such as nationality or major, can be a driving force in leading to a different behavioral pattern. However, why subjects behave spitefully and how the social context affects human behavior remain unclear. Using a different experiment design and subject pool, we plan to investigate the motivation for the spiteful behavior in our future research.

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