Leadership in Groups: An Experimental Study

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Abstract

We describe groups which make collective decisions through neither markets, nor contracts, nor voting, nor any grant of authority. Instead uninformed agents choose to follow their informed leaders absent any obligation to do so. This apparently gloomy picture of unexceptional leaders and ignorant followers produces efficient results, that are not produced when all agents are informed. In many cases incentive and coordination problems are completely solved even though every agent has an incentive to free ride. We show evidence that agents make efficient decisions less often if they are fully informed. In our paper therefore efficiency requires an information failure.

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1 Introduction

Researchers in management and political science believe that leadership is important but economists rarely study it. In economic models of organizations, managers mainly fill gaps , acting as owner's agents or exercising residual authority over subordinates. These models have produced important insights but omit many aspects of leadership. In particular, effective leadership often includes encouraging and motivating subordinates to act in the interest of the organization which in some circumstances may differ from subordinates private interests. In a recent paper Komai and Stegeman (KS-2004) describe an organization which makes collective decisions through neither markets, nor contracts, nor voting, nor any grant of authority. Instead, rational agents choose to follow a leader even absent any obligation to do so. In equilibrium, this strategy alleviates incentives as well as coordination problems. In KS-2004, a leader with access to critical information leads by partially transmitting her information to her ignorant followers. Collectively, however, the followers benefit from their ignorance. In their model uninformed followers participate in projects that they would refuse to participate in if they were fully informed.

The model has contrarian applications. Many researchers focus on reducing the transaction costs by correcting information failures, but in this model efficiency requires an information failure. Their model also offers a contrarian view of leaders themselves. They have no special talents and are distinguished merely by occupying the leadership position. Leaders differ from their followers because only the leaders get access to critical information. This seemingly gloomy picture of unexceptional leaders and ignorant followers leads to happy results: in many cases incentive and coordination problems are completely solved and the unique non-degenerate equilibrium achieves the first best even though every agent has an incentive to free ride.

This paper uses laboratory experiments to test the KS result. The model underlying our experimental design is a simple version of the KS model. In our experiment, small groups engage in a collective decision making game which exhibits the familiar problems of free riding and coordination failure. As in KS-2004, we consider two treatments. In Treatment 1 all agents are informed about the private and collective returns and simultaneously make their decision. Treatment 2 is a leader-follower game in which the decision of one informed player is followed by uninformed others. We provide evidence that supports KS-2004: by depriving agents of the information required for profitable defections, this simple structure promotes cooperation. This remedy to the familiar problems of free-riding and coordination failure reverses the usual method of mechanism design. Our experiment suggests that instead of using contracts to align agent's incentives, given an exogenous information structure, we can leave contracts in the background and redesign agent's information. Instead of trying to improve information subject to monitoring and processing costs, keep critical data away from decision makers and by doing so promote cooperation.

2 Related Literature

Hermalin's (1998) studies a team leader, who like KS-2004 has private information about the return to effort. When the return is high, his leader-follower equilibrium produces more efficient outcomes than would full information because it improves the leader's incentive to work. Although KS-2004 rule out the transfer schemes that Hermalin uses to enhance efficiency, their leader-follower equilibrium guarantees qualitatively more surplus because (unlike in Hermalin's model) their leader does not fully reveal her information and this causes everyone to work harder not just the leader.

Vesterlund (2003) applies Hermalin's idea to a model of charitable contributions, but in her model a third party, a fund-raiser who moves first, chooses to publicly announce the leader's contribution. Andreoni (2004) builds on Vesterlund (2003) model by endogenizing the selection of the leader. In Andreoni's model agents with a low cost of contributing (e.g. the rich) step forward to accept this costly role. Vesterlund's and Andreoni's leaders, like Hermalin's fully reveal their information.

Potters et al (2004) have conducted a public good experiment in which a leader can increase contributions by improving information about the project's return. They consider an asymmetric information environment in which the leader has superior information about the project's return. They compare a scenario in which the leader's contribution is observed by her followers to a scenario where followers are completely uninformed and they show that followers who are able to extract information from the leader contribute more than those who are completely uninformed. Their experiment is different from ours, because in our experiment we compare a scenario in which followers are completely informed to a scenario where followers are uninformed but are able to partially extract information from the leader. That is, in Potters et al, contributions are improved by improving information while we improve contributions by taking information away from the subjects.

A rich literature describes many potential advantages to ignorance; the classic example is the provision of insurance. Ostrovsky and Schwarz (2004) extend the insurance story to a setting in which all agents are risk neutral and total surplus is fixed. In their model, individual students among a large population may have an incentive to secure jobs long before graduation, to protect themselves against bad academic performance; a concave mapping from performance to job-related rents induces a demand for insurance. In a game among schools who seek to maximize their students' rents, the schools insure their students by withholding some information about performance. In another recent study, Levy and Razin (2004) describe a game between two countries deciding how much to cooperate. The key feature is that a democracy must share with its rival all information possessed by its decision-maker, the public. This constraint allows democracies to cooperate where autocracies can not[1]. Morris and Shin (1998) describe a model of speculative attack and show that adding a small private error to each player's signal can reduce a continuum of equilibria to a single

[1]Levy and Razin model creates an explicit role for a leader. Each of their democracies has a leader who must decide whether to reveal information, while the public makes the decision. The leader and the bublic have common interests; The leader essentially decides through cheap talk, whether the public should make the decision in an informed or uninformed way, mindful that the rival will see the information also. The leader has no option that leads to partial revelation; the public is either completely informed or completely uninformed.

equilibrium. (Instead of introducing many small private errors, we eliminate equilibria, in essence, by introducing one large public error). Komai (2002) introduces the idea that partial revelation of a leader's information improves efficiency and can produce first best outcomes. She extends the analysis to a continuous action set. The closest antecedent to this paper is KS-2004: Our paper provides experimental evidence that is consistent with their theory.

Our paper is also related to the idea of information cascades, but unlike the many studies focusing of inefficiencies induces by cascades, we use the leader-follower relationship to improve efficiency.

The management literature includes myriad studies of leadership, much of it empirical and almost all of it eschewing the formal modeling familiar to economists. Such studies address what leaders do, how they do it, how they can do it better, how to adjust their environment so that they can do it better, and which personal attributes are important for leadership, in various settings (see Case 1995, and Dansereau and Yammarino, 1998). Economists have made relatively few contributions to this literature, but Rotemberg and Saloner (1993), for example present a model that compares the effectiveness of selfish and empathetic managers in different situations. A recent trend in management literature (e.g. Case (1995)) is to encourage managers to share information with employees, but this paper provides a reason to doubt that such policies are universally beneficial. Prendergast (1993) presents a quite different model with a related message. She shows that if managers rely on information provided by workers, then workers' incentive to conform implies that it may be best to insulate them from managers' other sources of information.

3 The Basic Model

The model underlying our experimental design is a simple version of the KS model. We consider a group with three players. Each player must decide whether to join a joint investment project. The main economic properties of the project are increasing but uncertain returns to participation, coupled with possibilities for free riding[2]. Each player has an endowment of 10 dollars and decides whether or not to participate (invest) in the project. Formally each player chooses an action from the set $A = \{I, N\}$, where I denotes investing and N denotes not investing in the project. If all players choose N then each earns a payoff of zero. If all choose I then each earn a random payoff x, which is the same for all players and is uniformly distributed on the interval $X = [-15, 15]$. Assume $0 \in X$. A project is good if $x > 0$ or bad if $x < 0$.

If the players fail to coordinate, some choosing N and others choosing I, then player i's payoff is $\pi(a_i, q; x)$, where $a_i \in A$ denotes player i's action, q denotes the fraction of players who participate, and $\pi : A \times [0,1] \times X \rightarrow \Re_+$ is twice-continuously differentiable. Non-investors keep their 10 dollar endowment plus a payoff of $\pi(N, q; x) = \dfrac{(4x+30)q}{6}$. Investors on the other hand, earn a payoff of $\pi(P, q; x) = (x + 10)q - 10$ (where -10 is their cost of participation). As in the KS model, this payoff structure satisfies certain characteristics such as:

a) no player is willing to participate by herself.

b) A player is willing to participate only if she learns something favorable about the return and believes that others also participate (because, $E[\pi(P, 1; x) - \pi(N, \frac{2}{3}; x)] < 0$ and $\pi(P, \frac{1}{3}; x) < 0$).

c) A player prefers to participate if she believes that the project's return takes its maximal value and that everyone else will participate (because, $\pi(P, 1; 10) - \pi(N, \frac{2}{3}; 10) > 0$).

d) If one player defects from full participation, for a good or neutral (i.e., $x = 0$) project, then she earns a positive payoff (because, $\pi(N, \frac{2}{3}; 10) > 0$). In other words, the defector can take a free ride , gaining something from others participation while sacrificing nothing herself. For bad projects , participation may hurt non-participants.

e) Higher participation increases the (positive or negative) return to participation

[2] We consider a joint investment project in our experiment but other examples of such projects could include adopting new procedures or software that improve a firm's efficiency, helping to prepare a bid, or cooperating with a restructuring plan. In the political context, "projects" could include supporting controversial legislation or working for a candidate.

(because$\dfrac{\partial[\pi(P,q+\frac{1}{3};x)-\pi(N,q;x)]}{\partial q}$).

f) Higher project quality (i.e., higher x) helps participants more than it hurts non-participants and increases the (positive or negative) return to participation (because, $\dfrac{\partial\pi(P,q;x)}{\partial x} > \max(0, \dfrac{\partial\pi(N,q;x)}{\partial x})$ for $q > 0$ and $\dfrac{\partial^2\pi(P,q;x)}{\partial x\partial q} \geq 0$).

g) Efficiency requires zero or full participation.

Given the payoff structure of the game, wellbeing is maximized if all of the group's members participate whenever $x > 0$.

4 Complete Information versus Incomplete Information

Consider a scenario where all players know x and simultaneously decide whether or not to participate in the project. In this scenario, we can characterize many symmetric Nash equilibria[3]. The threshold $\tau^C = 6$ is the lowest return at which each player is willing to participate if all others participate. If $6 < x < 15$, then the resulting subgame is a coordination game for which $q = 0$ and $q = 1$ are both Nash equilibria; if $x < 6$ then not participating is strictly dominant in the subgame.

The equilibria described above have two unattractive features. First, coordination failure implies missed opportunities for mutually beneficial and individually rational cooperation when $6 < x < 15$. Second, if players somewhat coordinate on the most efficient equilibrium, meaning that if they all participate for $x > 0$, they inefficiently fail to participate if $0 < x < 6$. This inefficiency is the typical consequence of free riding.

Summarizing: the complete information game exhibits failures of both coordination and cooperation.

Alternatively, consider a leader-follower game where only one player (a leader) has unique access to x. Whatever the interpretation, and regardless of whether the barriers to information flow are natural or artificially constructed, the point of this

[3]See Komai and Stegeman (2004) for a complete characterization of the equilibria.

section is that restricting access to x improves efficiency. In this scenario, there always exists a trivial equilibrium in which no one ever participates. Alternatively, a credible leader[4] can induce a productive equilibrium in which the leader participates when it is efficient to do so (whenever $x > 0$) and followers mimic the leader[5]. One key characteristic of the model is that the leader is not able to fully reveal her information to her followers and this allows the leader to lead the followers into participating for values of x that they would be unwilling to participate if they were fully informed.

5 The Experiment

The experiment is a simple three person investment game with three payoff scenarios- high (x=10), average (x=3), and low (x=-10)- each with equal probability of occurring (see Table 1).

Table 1: Payoff Scenarios

Scenario 1	Investors (each)	Non-investors (each)
All invest	20	_
Two invest	13	17
One invests	7	14
Nobody invests	_	10
Scenario 2	Investors (each)	Non-investors (each)
All invest	13	_
Two invest	9	15
One invests	5	12
Nobody invests	_	10
Scenario 3	Investors (each)	Non-investors (each)
All invest	0	_
Two invest	0	8
One invests	0	9
Nobody invests	_	10

Suppose all subjects know the payoff structure. In Scenario 1, the potential of

[4] Leader's credibility requires a simple condition: followers should find it worthwhile to participate when receiving the leader's participation signal. This condition is satisfied in our game because $E(x \mid x > 0) > 6$. This means that followers do not expect the leader to lead them into too many projects that they individually prefer to avoid.

[5] See Komai and Stegeman 2004 for the full characterization of the equilibrium.

coordination failure implies missed opportunities for mutually beneficial and individually rational cooperation. Even if players somehow coordinate on investing in Scenario 1, they inefficiently fail to cooperate in Scenario 2 because Scenario 2 represents the familiar free riding problem.

We consider two treatments: treatment A (the complete information treatment or CIT)- all group members know the return to investing and decide simultaneously, but separately, whether or not to invest; and treatment B (the incomplete information treatment or IIT)-one member of the group, the leader, knows the return to investing and decides first whether or not to invest. The other two members, the followers, know the possible scenarios and their likelihood. After observing the leader's decision they must decide simultaneously, but separately, whether or not to invest.

We ran four sessions of each treatment. In each session 15 subjects were recruited (by E-mail and posters) to a common room. Subjects were seated separately in 3 rows of 5 and were instructed not to communicate with one another. After signing a consent form, subjects received instructions, which were read aloud by the experimenter (see the appendix for copies of the instructions and other forms). Subjects were tested about the payoffs in the different scenarios. The experimenters monitored all the answers, corrected the mistakes and answered each subject's questions individually.

Each subject was identified by a randomly assigned 5 digit code number (written on a folder). Each session consisted on 10 rounds of the investment game. Subjects began each round with an endowment of 10 dollars. In each round a subject was randomly grouped with two other subjects. Groups were reformed after each round and no subject was grouped with the same two people more than one round. A group's investment scenario was randomly determined at the beginning of each round and varied from round to round. The scenario was the same for all group members but could be different across groups. At the end of each round each subject's individual earning was calculated and announced using their five digit code number. Subjects were informed that their final earnings would be those of only one round chosen at random (by the role of a die at the end of the game) and therefore they should make the best decision possible in each round.

At the end of the experiment subjects completed a survey form and left it in their folders. They were then called up by code numbers to receive their earnings in private.

6 Results

We conducted eight sessions of 15 subjects (4 of each treatment) at Saint Cloud State University. Table 2 reports summary statistics for subjects' socioeconomic characteristics. There is only one characteristic where subjects in the two treatment differ significantly. While subjects in general found the instructions clear, subjects in the CIT sessions were more likely to respond (on a five-point Likert scale) that they agreed or strongly agreed with the manipulation check statement "The instructions for the experiment were clear and easy to follow", than subjects in the IIT sessions ($\chi^2(3) = 9.12$, p-value = 0.028). This difference may reflect the fact that the CIT procedure involved one less step than the IIT procedure.

Table 3 reports by period the percentage of subjects in Scenario 2 who chose to invest for both the CIT and IIT. In every period, the rate of investment was higher in the IIT than in the CIT sessions (See Figure 1- All figures and tables are in the appendix). The Fisher Exact test (p-value reported in row 4 of Table 3) indicates that the difference is significantly higher in six of the nine periods where Scenario 2 was available, and overall[6]. The Epps-Singleton test rejects the null hypothesis that the earnings for subjects in the CIT sessions and the IIT sessions were drawn from the same distribution ($\chi^2(4) = 61.6$, p-value = 0.0000). This evidence supports KS-2004's theory that withholding information results in a higher rate of investing[7]. The investment rate in Scenario 1 did not differ significantly across treatments. That is the leader was not effective in the high return scenario because by playing the game

[6] In Scenario 1 and Scenario 3, subjects did not behave significantly different in the CIT and IIT treatments.

[7] One might argue that increased cooperation may also be a result of reciprocity. Potters et al (2004) show in a similar setting that leaders have no significant effect on total contributions and earnings when returns are commonly known. This supports the KS-2004 model even more strongly. That is, efficiency is improved because of an information failure.

repeatedly players learned to coordinate with or without the leader.

Since the game consists of 10 rounds, it is interesting to address the dynamics of subjects' investment decision. To do so, we estimate a random effects probit model controlling for the decision period. Variables included in the model are:

Scenario 1: *1 if the payoff structure is Scenario 1 and 0 otherwise,*

Scenario 2: *1 if the payoff structure is Scenario 2 and 0 otherwise,*

Period: *period number ($t \in \{1, 2, ..., 10\}$),*

CIT×Scenario 2×Period: *period number in which CIT subjects were in Scenario 2,*

IIT×Scenario 2×Period: *period number in which IIT subjects were in Scenario 2, and*

Scenario 2×Period: *period number in which subjects were in Scenario 2.*

Table 4 reports the result for both an unrestricted model and a restricted model constraining the invest rate across periods for Scenario 2 to be equal for CIT and IIT.

Expectedly, the probability of investing is significantly higher in Scenarios 1 and 2 than in Scenario 3, and higher in Scenario 1 than in Scenario 2. Where the difference between the treatments is observed is in the dynamics of the investing decision. The insignificant coefficient for **Period** indicates that the rate of investing is stable across periods when the investing decisions in Scenario 2 are controlled for. The interaction terms, however, show that subjects' investment behavior across periods significantly differs between the treatments. The significant and negative coefficient of **CIT×Scenario 2×Period** shows a steady decline in the investment rate in the CIT sessions. This pattern is consistent with what is commonly observed in public good (or VCM) games (see Leydard, 1995; and Davis and Holt, 1993). The insignificant coefficient for "**IIT×Scenario 2×Period** shows no significant decline in the investment rate in the IIT sessions. This pattern also supports the KS-2005's theory.

Our reported results may indicate only that the informed subjects in the IIT sessions invested in Scenario 2 on the foolish hope that the uninformed subjects would follow, while no subject invested in the CIT sessions. What is ultimately of greatest importance is not whether IIT sessions will increase the investment rate in Scenario

2, but instead whether or not they result in groups achieving their maximum group surplus. Where groups in the IIT sessions more likely to achieve their maximum group surplus? The answer is yes. Our results show that many groups achieved full cooperation and thus maximized their group surplus when information was partially withheld from them. Table 5 reports for Scenario 2 the number of groups with 0, 1, 2, and 3 members investing. Over one-third of the groups in the IIT sessions were able to fully cooperate and maximize their group surplus; not even one group in the CIT sessions were able to do so. Our results show that subjects in IIT sessions were able to extract a larger surplus than were their CIT counterparts. In Scenario 2 , average earnings for CIT subjects was $10.09; IIT subjects, however, earned $11.36 on average (means test t-statistic=5.69, p-value=0.000). CIT subjects extracted only 3 percent of the available surplus while IIT subjects extracted up to 45 percent[8].

7 Summary and Concluding Remarks

In our experiment groups engage in a collective decision making activity (i.e., a joint investment project) which exhibits the familiar problems of free riding and coordination failure. We show that it is possible to address important issues of organizational design without invoking contracts, prices, residual authority, or bargaining. Instead we provide evidence that the simple equilibrium rule of following the leader produces efficient behavior without monetary compensation or ex-post coercion.

Researchers often overlook the collective benefits that groups may derive from ignorance. In this paper, however, instead of trying to improve information, subject to monitoring and processing costs, we keep critical information away from decision-makers. Our leaders have no special skills or authority and yet are crucial for sustaining efficiency. Our leaders are distinguished merely by having superior information and, most importantly, are incapable of fully revealing their information to their ignorant followers. By depriving agents of the fine information required for profitable defections, we promote cooperation.

[8]When group members fully cooperate (all invest), earnings are $13 per member: as opposed to $10 per member when the group completely fails to cooperate (nobody invest).

The issue of following the leader is also addressed in Potters et al (2004). Potters et al compare a treatment in which followers are practically uninformed (informed Leaders and ignorant followers simultaneously make their decisions) to a treatment in which followers are able to extract some information from the leader (Followers make their decision after observing the leaders' action). They show that cooperation is improved in the latter treatment. That is, in Potters et al efficiency is improved as a result of information improvement.

In this paper, however, we test a more questionable hypothesis: can we improve cooperation by taking information away from the followers? To do this, we compare a treatment in which all subjects are informed (and simultaneously make their decision) to a treatment in which only one player, the leader, is informed (followers make their decision after observing the leaders' action). Another difference between our design and that of Potters et al is that our game not only captures the so called free riding problem but is also able to address the possible coordination failures in organizations.

Our simple experiment inevitably ignores many issues that are important for real groups and organizations. In reality leaders perform tasks beyond tasks that are explained by our simple design. Subordinates get information that are useful for leaders, agents play asymmetric roles in organizations, leaders can build reputations that enhance their credibility, etc. (Which issues are more important depends on the setting). All of these complications may affect our results. Yet, while we study only one slice of the complex reality of groups and organizations, this slice contains enough truth to improve our overall understanding of leadership.

8 Future Developments

One aspect of leadership that has been little studied (and is also suppressed in this paper) is that of leader credibility. An individual may have acquired the mantle of leader for any number of reasons; force of personality, support of the populous, information advantages, etc. But however the role of the leader is attained, the ability to effectively lead the collective to act depends on the leader being seen by her followers as credible.

Technically a leader is not credible if after observing her participation, the dominant strategy of followers is still not to participate. Loss of credibility can occur if the discrepancy between the leader's incentives and the incentives of the individual follower becomes too large. Intuitively the leader is not credible if the followers expect the leader to lead them into too many projects that they would individually prefer to avoid and they respond by ignoring the leader's signal. Leader's credibility may depend on social and/or strategic factors.

Leader's cost of participation and the group size are among the strategic factors that affect leader's credibility. Leaders and followers with different participation costs obviously differ in their willingness to participate (See Komai and Stegeman, 2004). Everything else equal, a leader whose participation cost is smaller than her followers does not represent her fellow group members and therefore endorses projects that are not necessarily beneficial for her followers. Leaders with higher participation costs on the other hand are more likely to be credible, because (in equilibrium) followers know that they are more selective when deciding which projects are worthwhile.

Credibility may also be a function of group size. Everything else equal, leaders of small groups are more likely to be credible because in small groups the benefits of free riding are relatively small. The leader of a large organization acquires so much leverage that the discrepancy between her incentives and the incentives of the individual follower becomes too large. This may reduce the leader's credibility because leaders of large organizations are more likely to endorse projects that are not desirable for the individual follower. Leaders' loss of credibility may thus be a previously unappreciated diseconomies of scale. One interesting aspect of our design is that it allows us to correct a leader's incentives and hence her credibility by affecting her impact via changing the group size.

Credibility may also be affected by social factors such as gender and race. Behavioral differences between men and women or Caucasians and minorities may also extend to leaders actions and their credibility.

We are in the process of evaluating factors that affect leader credibility which not only complement theories of leadership in groups and organizations but also have important policy implications in a variety of issues such as forming political alliance, reducing incentive conflicts in organizations and charitable fund-raising.

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9 Appendix

Table 2: Socioeconomic Characteristics

	Complete Information Treatment N=60	Incomplete Information Treatment N=60	p-value
Age (Std. Dev)	20.37 (2.19)	20.24 2.32	0.755^c
Male	53.3%	55.9%	
Caucasian	84.5%	76.3%	0.246^b
Employment			0.639^a
Full-time	21	26	
Part-time	37	32	
No job	1	1	
Econ/Bus. Major	39.7%	25.4%	0.100^b
Econ classes (Std. Dev.)	1.17 (1.30)	1.08 (1.68)	0.760^c
GPA			0.734^a
<2.00	2	3	
2.00-2.49	4	5	
2.50-2.99	18	11	
3.00-3.49	23	25	
3.50-4.00	12	12	
Anonymity	4.51 (0.77)	4.32 (0.86)	0.218^c
0	0	0	
2	0	1	
3	10	12	0.461
4	9	13	
5	40	33	
Clarity of Instructions	4.59 (0.72)	4.27 (0.83)	0.026^c
0	0	0	
2	2	1	
3	2	11	0.028^a
4	14	18	
5	41	29	

a- Chi-squared contingency table test

b- Proportions test c- means test

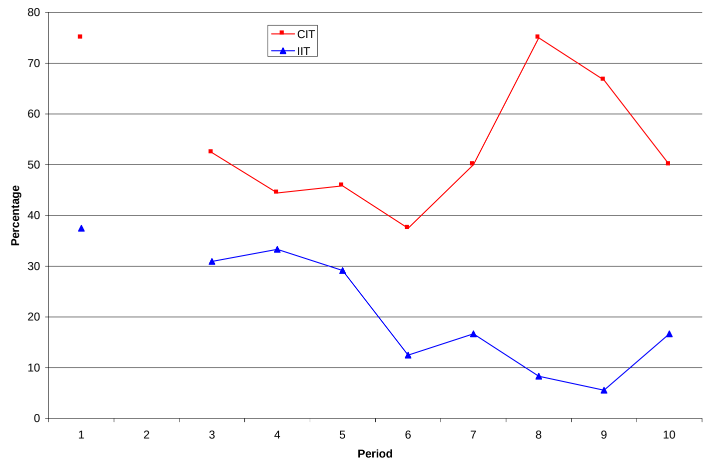

Figure 1: Scenario 2 Invest Rates- CIT vs. IIT

Table 3: Scenario 2 investment rates- CIT vs. IIT (%)

Period	1	2	3	4	5	6	7	8	9	10	Total
CIT	37.5	-	31.0	33.3	29.2	12.5	16.7	8.3	5.6	16.7	19.1
IIT	75.0	-	52.4	44.4	45.8	37.5	50.0	75.0	66.7	50.0	49.7
Fisher Exact test p-value	.009	-	.038	.367	.186	.047	.015	.000	.000	.000	.273

Table 4: Probit with Random Effects

Variable	Coefficients (Standard Error) Marginal Effect Unrestricted Model	Restricted Model
Scenario 1	2.450* (0.12) 0.83	2.508* (0.12) 0.83
Scenario 2	1.490* (0.02) 0.50	1.474* (0.20) 0.49
Period	-0.031 (0.02) -0.01	-0.031 (0.02) -0.01
CIT × Scenario 2 × Period	-0.136* (0.04) -0.05	____
IIT × Scenario 2 × Period	0.040 (0.04) 0.01	____
Scenario 2 × Period	____	-0.027 (0.03) 0.01
Constant	-1.471* (0.15)	-1.509* (0.15)
Rho	0.195* (0.15)	0.236* (0.15)
LLF	-552.2	-572.4
N	1200	1200

* -Significant at the 5% level, two-tailed test

** - Significant at the 10% level two-tailed test

Table 5: Group Cooperation in Scenario 2- Complete CIT vs. IIT

	Number choosing to invest 0 (%)	1 (%)	2 (%)	3 (%)	χ^2 test (p-value)
CIT	33 (48.5)	24 (35.5)	11 (16.2)	0 (0.0)	38.3 (0.00)
IIT	21 (30.9)	7 (10.3)	14 (20.6)	26 (38.2)	

Instructions for the CIT

This is an experiment about decision-making involving 15 participants. You must not talk to the other participants or communicate with them in any way during the experiment. If at any time you have questions, raise your hand and we come to you to answer them.

You have received a folder with a unique five digit code number. You will use this number to collect your earnings at the end of this session.

The experiment consists of 10 rounds. In each round you play an investment game. At the end of each round your earnings will be calculated and announced. You are given a record sheet on which you should record your decision and earnings at the end of each round. Your final earnings will be those of only one round, chosen at random (by the role of a die) at the end of the experiment. Since you don't know which round will determine your earnings, it is important that you make the best decision possible in each round. Your earnings will be paid to you in private at the end of the experiment.

At the end of the experiment you will receive a survey form. Please complete the questions. When you have completed the survey deposit it in the box at the front of the room. You will then be called up to receive your earnings and then you are free to go.

The game

In each round you will be randomly grouped with two other participants. Groups will be reformed each round. You will not be with the same two people more than one round.

At the beginning of each round you will each be given an endowment of $10. You must decide whether to invest or not invest your endowment in a joint investment project. The project's potential return is randomly determined at the beginning of each round and will vary from round to round. In each round three scenarios are equally likely to happen: Scenario 1 in which potential returns are high, Scenario 2 in which potential returns are average, and Scenario 3 in which potential returns are low. The potential return is the same for you and the other members of your group for that round. Potential returns, however, may vary among groups. The three scenarios are shown on the next page.

Scenario 1	Investors (each)	Non-investors (each)
All invest	20	_
Two invest	13	17
One invests	7	14
Nobody invests	_	10
Scenario 2	Investors (each)	Non-investors (each)
All invest	13	_
Two invest	9	15
One invests	5	12
Nobody invests	_	10
Scenario 3	Investors (each)	Non-investors (each)
All invest	0	_
Two invest	0	8
One invests	0	9
Nobody invests	_	10

Your earnings depend on your decision, the decisions of the others in your group, and the return to the project.

Before we start the game we will practice to make sure you understand the game and your potential earnings.

Instructions for IIT

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In each group one member is selected randomly and will be informed which scenario has been assigned to his/her group. The other two members will not know the scenario. At the beginning of the game you get a sheet of paper that tells you whether or not you are the informed member. The game is then played in two stages:

Stage 1: At this stage the informed member observes the scenario and decides whether or not to invest in the project. The uninformed members do not make a decision in this stage. They, however, should pretend that they are making a decision by drawing a circle. It is important not to show your identity to the others.

Stage 2: At this stage the uninformed members will be informed about the decision made by the first person and then will simultaneously decide whether or not to invest in the project. The first mover does nothing at this stage but should pretend that he/she is making a decision by drawing a circle on the paper.

Before we start the game we will practice to make sure you understand the game and your potential earnings.

Practice 1

Suppose you are in Scenario 1.

Scenario 1	Investors (each)	Non-investors (each)
All invest	20	_
Two invest	13	17
One invests	7	14
Nobody invests	_	10

Please answer the following questions:

1) What will you earn if all of you invest in the project?

2) What will you earn if nobody invests in the project?

3) What will you earn if you invest only by yourself?

4) What will you earn if you and one other member invest?

Practice 2

Suppose you are in Scenario 2.

Scenario 2	Investors (each)	Non-investors (each)
All invest	13	_
Two invest	9	15
One invests	5	12
Nobody invests	_	10

Please answer the following questions:

1) What will you earn if all of you invest in the project?

2) What will you earn if nobody invests in the project?

3) What will you earn if you invest only by yourself?

4) What will you earn if you and one other member invest?

Survey

ID#

1. AGE

2. What is your sex? (Circle one number.)

   00 Female 01 Male

3. Married? (Circle one number.)

   00 NO 01 YES

4. Children? (Circle one number.)

   00 NO 01 YES

5. Are you employed?

   00 No 01 Yes, Part time 02 Yes, Full time

6. Which of the following categories best describes you? (Circle one number.)

   01 Asian-American/Oriental

   02 Black/African-American

   03 White/Caucasian

   04 Hispanic-Black/Spanish-speaking Black

   05 Hispanic-White/Spanish-speaking White

   06 Native American/American Indian

   07 Other (Please specify)

7. Class (Circle one number)

   00 Freshman

   01 Sophomore

   02 Junior

   03 Senior

   04 Graduate Student

8. Major (Circle one number)

   00 Economics

   01 Other Busines

   02 Psychology

03 Sciences

04 Liberal Arts

05 Other

10. How many Economics classes have you taken at the university level? (Circle one)

00 None

01 One

02 Two

03 Three

04 Four

05 Five

06 Six

07 More than Six

11. What is your GPA?

00 below 2.00

01 2 to 2.49

02 2.5 to 2.99

03 3 to 3.49

04 above 3.5

12.The procedures followed in this experiment preserved your anonymity (5 is strongly agree and 1is strongly disagree).

1 2 3 4 5

13. The instructions for the experiment were clear and easy to follow.

1 2 3 4 5

Consent form

You are asked to participate in an experiment in economic decision-making. You were selected as a possible participant in this study because you volunteered. If you should decide to participate, the experiment will last approximately 2 hours. The experiment involves no risk to your person. You will be paid according to your decisions, and are free to earn as much money as you can.

The information you provide during the experiment, and the decisions you make will be recorded. The data will be kept confidential, and will not be revealed to anyone else.

Participation is voluntary, and although we ask that you complete the experiment, you may discontinue participation at any time if you wish at no penalty. Your decision whether or not to participate or withdraw will not prejudice your future relations (adversely affect your standing in) with the class from which you were recruited as a subject, its instructor, the persons conducting the research, the Department of Economics, or SCSU.

Participation and payment of your earnings requires that you provide either your SCSU Tech ID number or your Social Security number. This information is required by the SCSU administration and will be used by the administration for record keeping purposes only. The researchers conducting this experiment will not keep records of your name and Tech ID or Social Security number.

If, after your participation is completed, you have any questions regarding this experiment or you would like to receive a copy of the results contact either of the following professors:

Professor Philip Grossman, Tel: 320-308-4232, E-mail: pgrossman@stcloudstate.edu.

Mana Komai, Tel: 320-308-2072, E-mail: mkomai@stcloudstate.edu.

Your signature indicates that you have read the information provided above, have decided to participate, and have agreed to provide your SCSU Tech ID number or Social Security number. You may withdraw at any time without prejudice after signing this form should you choose to discontinue participation in this study.