Econ 828 Term Project:
How Much Is Too Much?
Beliefs About Perceived Inequality In A Coordination Game

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1 Introduction

Throughout history, there have been numerous examples of how excessive inequality lead people to do something about it at possibly great personal risks while at other times seemingly high inequality in a population was being tolerated. Of course, a lot of these differences can be explained by political systems and forms of government.

I would like to study the question when people perceive inequality as too great in a controlled lab environment. I am interested not only in discovering when "poor" participant are willing to take action over inequality but also when "rich" participants think they might be at risk. To achieve this, I am proposing a modified version of the classical stag hunt game spun into a story of a possible revolution.

First, any such revolution's success highly depends on cooperation among the poor. Additionally, inciting an uprising in the real world is very costly if others do not support it. For these reasons, the stag hunt game with a payoff dominant strategy (start a revolution) and a risk dominant strategy (do nothing) provides an excellent representation of the underlying problem. Furthermore, a revolution, successful or not, oftentimes results in a reduction of overall welfare, so in most cases, possible gains to revolutionaries outweigh losses to the rich.

In each stage of the game, players are randomly assigned to groups of three consisting of two poor and one rich participant. Tables that show payoffs dependent on outcomes for rich and poor players are shown to all participants. Based on these tables, each subject knows the earning potentials of other subjects and can see payoff differences between poor and rich players. These differences simulate inequality in the three-person society and vary with treatments.

Poor players decide whether they want to revolt or not. This measures their perception of inequality and whether they think it likely that others will support them. Rich players can decide to purchase insurance against unsuccessful uprisings. This measures what the rich person perceives as acceptable or non-acceptable levels of inequality.

This way, there is also some second-order reasoning involved. Risky revolting might not be worth it if I believe insurance has been purchased, but without insurance I might believe success is more likely. I expect to observe four categories of outcomes: (1) inequality is low, poor players choose not to revolt and the rich player does not purchase insurance, (2) inequality is slightly higher so that poor players face only moderate risk since the rich player is (correctly) assumed to not have insurance, (3) inequality is high enough for the rich player to buy insurance which makes a revolution, in expectation, too risky for poor players, and (4) inequality is extreme and the rich player purchases insurance in case a revolution fails but, most of the time, poor players can successfully coordinate on a revolution.

Finally, beliefs about perceived inequality and the likelihood that other players decide to revolt/buy insurance is measured. These beliefs are analysed for a total of six treatments (low/high risk)$\times$(low/medium/high inequality) and separated into whether the belief is a poor or a rich person's perspective (i.e. was the subject assigned the role of a poor or rich player in that round).

2 Literature Review

The stag hunt, being one of the oldest games in game theory, has been the subject of much discussion in experimental economics. Battalio et al. (2001) demonstrate the effect of varying differences between the payoff in the payoff-dominant and the risk-dominant strategies on participants' probability of playing either of the strategies. They find that the likelihood of a player playing the payoff-dominant strategy is decreasing in the size of the optimization premium (the difference between best and inferior response to the opponent's strategy).

Rankin et al. (2000) expand on this work and show that subjects' coordination in a *repeated* stag hunt game with varying payoffs always converges to the payoff-dominant equilibrium.

Additionally, adding negative externalities to a cooperation game has been shown to reduce the likelihood of successful cooperation. Engel and Zhurakhovska (2014) find that, if a negative externality to an outsider results from cooperation in a prisoners' dilemma, the two players in that game are less likely to cooperate. Specifically, framed in the context of an oligopoly, they conclude that the degree of cooperation is monotonically decreasing in the harm inflicted on the third party. The suggested rational explanation is one of guilt aversion: Subjects are less likely to increase their profits through cooperation if that additional profit also results in a loss to others, which they may feel guilty about.

So a stag hunt game in itself would not contribute to the literature significantly. However, to the best of my knowledge, a stag hunt with a (possible) negative externality to a third party who can influence the payoffs of the players in the coordination game in the specific context of inequality has not been investigated in an experiment yet. It remains to be seen if framing the game as one about inequality affects subjects' behavior or if the previously discussed, known results largely hold.

3 Theoretical Framework

3.1 Payoffs

The underlying model of the coordination game in this paper is that of a stag hunt with the added dimension of a third party whose decisions potentially affect the payoffs of the other two players who try to coordinate. In the context of inequality, the poor are the parties that play the traditional stag hunt game while the rich person has influence over the exact form of the game by deciding whether to purchase insurance. The resulting payoffs for poor players are shown in Table 1.

Table 1: General Payoffs of Poor

Under `no insurance` (n)

	revolt	do nothing
revolt	h_n, h_n	l_n, m_n
do nothing	m_n, l_n	m_n, m_n

Under `insurance` (i)

	revolt	do nothing
revolt	h_i, h_i	l_i, m_i
do nothing	m_i, l_i	m_i, m_i

Payoffs of poor players depending on the other poor player's decision and depending on whether the rich person opted for insurance.

In order to correctly represent the classical stag hunt game, it has to be the case that the high payoff for successfully coordinating on the payoff dominant strategy is greater than the medium payoff from playing the risk dominant strategy, which in turn is greater than the payoff from unsuccessfully playing the risky strategy. That is, $h_j > m_j > l_j$ in both the `no insurance` and the `insurance` case (i.e. $\forall j \in \{n, i\}$). Additionally, successful coordination on the risky action results in the same payoff regardless of the actions of the rich player ($h_n = h_i = h$) and not revolting is risk free not only within a game but also across the two different games resulting from the rich's decisions ($m_n = m_i = m$). Lastly, revolting unsuccessfully is worse if the rich player takes out insurance ($l_i < l_n$) and can be seen as the rich person "fighting back". These assumptions yield a simplified payoff table for poor players shown in Table 2.

Table 2: Simplified Payoffs of Poor

	revolt	do nothing
revolt	h, h	l_j, m
do nothing	m, l_j	m, m

Where $j \in \{i, n\}$ and $l_n > l_i$.

The decision made by the rich player is that of purchasing insurance against a possible revolution. His payoffs depend on whether a revolution was attempted and, if so, whether it was successful. Since a revolutions is only successful if both poor players decide to play the risky action of "revolt" , this case corresponds to the outcome with two revolutionaries. An outcome with only one revolutionary represents an unsuccessful revolution and zero revolutionaries means nobody tried to revolt.

If a revolutions is successful, having insurance has no effect on the rich's payoffs. That is, in terms of Table 3, $y_{2i} = y_{2n} = y_2$. Instead, insurance is only effective in the case of no or failed revolutions (here denoted by the subscript f): $y_{0i} = y_{1i} = y_{fi}$. This is better than the outcome y_{1n}, which represents an attempted but unsuccessful revolution and can be thought of as being damaging to the rich nonetheless. The best possible outcome for the rich player is not buying insurance and none of the poor attempting a revolution resulting in y_{0n}.[1] Purchasing insurance can therefore be thought of as costing $y_{0n} - y_{fi}$ and paying out $y_{fi} - y_{1n}$ in the case of a failed revolution attempt.

Table 3: Payoffs of Rich

General Form

number of revolutionaries	insurance	no insurance
0	y_{0i}	y_{0n}
1	y_{1i}	y_{1n}
2	y_{2i}	y_{2n}

Simplified Form

number of revolutionaries	insurance	no insurance
0	y_{fi}	y_{0n}
1	y_{fi}	y_{1n}
2	y_2	y_2

[1] In summary: $y_{0n} > y_{0i} = y_{1i} = y_{fi} > y_{1n} > y_{2i} = y_{2n} = y_2$

3.2 Decision Making Process

Given these payoffs, a rational poor player will choose to revolt conditional on beliefs about what the other poor player will do and whether the rich person will buy insurance. Let a poor player believe that the other poor player chooses to revolt with probability γ and that the rich player purchases insurance with probability δ. Then a payoff maximizing poor person will revolt if

$$\gamma h + (1-\gamma)\left[(1-\delta)l_n + \delta l_i\right] \geq m$$

A rich person will decide to purchase insurance based on his beliefs about how many poor players will choose to revolt. In the most general case, let a rich player believe that there are zero revolutionaries with probability α, one revolutionary with probability β and two revolutionaries with probability $1-\alpha-\beta$. Then, a rich player will purchase insurance if

$$(\alpha+\beta)y_{fi} + (1-\alpha-\beta)y_2 \geq \alpha y_{0n} + \beta y_{1n} + (1-\alpha-\beta)y_2$$

$$(\alpha+\beta)y_{fi} \geq \alpha y_{0n} + \beta y_{1n}$$

Assuming independent and identical poor players, $\alpha = (1-\gamma)^2$, $\beta = 2\gamma(1-\gamma)$ and $(1-\alpha-\beta) = \gamma^2$. Using this simplification, rich players buy insurance if

$$\left[(1-\gamma)^2 + 2\gamma(1-\gamma)\right] y_{fi} \geq (1-\gamma)^2 y_{0n} + 2\gamma(1-\gamma)y_{1n}$$

which simplifies to

$$\gamma \geq \frac{y_{0n} - y_{fi}}{y_{fi} + y_{0n} - 2y_{1n}} \equiv \gamma_1. \tag{I}$$

For the decision making process of poor players, this means that if their belief of the other poor player's probability of revolting satisfies condition (I), they believe that the rich player will purchase insurance for sure (i.e. $\delta = 1$). Considering these second order beliefs, given that $\gamma > \gamma_1$, the poor player chooses to revolt if

$$\begin{aligned} \gamma h + (1-\gamma) l_i &\geq m \\ \gamma &\geq \frac{m - l_i}{h - l_i} \equiv \gamma_2. \end{aligned} \tag{RI}$$

If the poor player believes the other poor player to be sufficiently unlikely to revolt so that the rich player does not purchase insurance (condition (I) is not satisfied and $\gamma < \gamma_1$), he will only revolt if

$$\begin{aligned} \gamma h + (1-\gamma) l_n &\geq m \\ \gamma &\geq \frac{m - l_n}{h - l_n} \equiv \gamma_3. \end{aligned} \tag{RN}$$

Combining conditions (I), (RI) and (RN), poor players will

1. revolt under insurance if $\gamma \geq \max(\gamma_1, \gamma_2)$
2. not revolt due to the presence of insurance if $\gamma_1 \leq \gamma < \gamma_2$
3. revolt under no insurance if $\gamma_3 \leq \gamma < \gamma_1$
4. not revolt under no insurance if $\gamma < \min(\gamma_1, \gamma_3)$

3.3 Possible Ranges of Outcomes

Since none of the conditions (I), (RI) and (RN) contradict each other directly, the ranges of γ described above can be arranged in various ways by choosing the payoffs of the rich and poor players appropriately. Depending on payoff, some of the cases above can be ruled out from occurring. Possible (rational) outcomes are

I. $0 \leq \gamma_3 < \gamma_1 < \gamma_2 \leq 1$

This is the only arrangement in which all four cases could potentially be observed. With low beliefs about the probability of revolution ($\gamma < \gamma_3$), the rich person does not purchase insurance and poor players do not risk revolting. For a slightly higher perceived probability ($\gamma_3 \leq \gamma < \gamma_1$), it is still not worth purchasing insurance for the rich player, but poor players still try to revolt. For $\gamma_1 \leq \gamma < \gamma_2$, the rich player buys insurance which in turn deters poor players from attempting a revolution as the consequences of failure are now graver than they were without insurance. If a revolution is believed to be likely ($\gamma \geq \gamma_2$), the rich player still purchases insurance on the off-chance that the revolution fails (if the revolution is successful, the outcome for the rich person is the same regardless of insurance) and poor players decide to revolt.

II. $0 \leq \gamma_3 < \gamma_2 < \gamma_1 \leq 1$

The rich player does not purchase insurance for values of γ below γ_1. If poor players also believe $\gamma < \gamma_3$, they will not revolt even in the absence of insurance. For $\gamma_3 \leq \gamma_1$, poor revolt without facing the rich's insurance. If the beliefs exceed γ_1, the rich player buys insurance and the poor revolt.

III. $0 \leq \gamma_2 < \gamma_3 < \gamma_1 \leq 1$

This case allows for identical outcomes as the one above since γ_2 is meaningless if $\gamma_2 < \gamma_1$.

IV. $0 \leq \gamma_1 < \gamma_3 < \gamma_2 \leq 1$

There will be no insurance as long as players believe the probability of one poor player to revolt to be less than γ_1. For values above γ_1, the rich player buys insurance which deters poor players from revolting as long as beliefs about γ are such that $\gamma < \gamma_2$. If the latter condition is not satisfied, the outcome will be a revolution under insurance.

V. $0 \leq \gamma_1 < \gamma_2 < \gamma_3 \leq 1$

This is, again, equivalent to the case above as γ_3 carries no meaning if $\gamma_3 > \gamma_1$.

VI. $0 \leq \gamma_2 < \gamma_1 < \gamma_3 \leq 1$

This last case only allows for two possible rational outcomes: No insurance and no revolution if $\gamma < \gamma_1$ or revolution in the presence of insurance if the opposite is believed to be true.

4 Experimental Design

The experiment follows a $2 \times 2 \times 3$ design. First, subjects are randomly assigned either the role of a poor or a rich player. Second, payoffs are designed to have either high or low variation in payoffs for each of the players. Lastly, payoffs are arranged such that the inequality between possible outcomes for poor and rich players is either high, medium or low.

In order to allow for all possible rational actions for poor players as discussed in section 3.2, payoffs are chosen such that they meet the requirements of case I. in section 3.3. These payoffs can be seen in Table 4.

Table 4: Payoff Treatments

Treatment		Payoffs						
Risk	Inequality	l_i	l_n	m	h	y_{1n}	y_{fi}	y_{on}
low	low	130	280	440	750	490	1100	1820
low	medium	130	280	440	750	980	2200	3640
low	high	130	280	440	750	1960	4400	7280
high	low	75	130	320	750	500	2250	4000
high	medium	75	130	320	750	1000	4500	8000
high	high	75	130	320	750	2000	9000	16000

Subjects are not informed about the existence of these six treatments. Instead, they only know that there are rich and poor players assigned randomly and that two poor players are randomly paired with one rich player into one group.

All players are shown the payoffs selected for the current round. The values from Table 4 are filled into Table 2 and into the right side of Table 3. All players see both tables. That way, poor players not only know the risk that they (and the other poor player) face but also how unequal their payoffs are relative to the rich player. Additionally, poor players can see how risky the rich player's possible payoffs are. Based on this information, poor players form beliefs about the the likelihood of the other poor player revolting and the rich player purchasing insurance (which determines which payoff table is relevant for poor players).

In a similar manner, rich players see their own payoffs and the range between highest and lowest possible outcome on top of how much more they can expect to earn relative to the two poor players in the group and how risky the latter's payoffs are.

Next, poor (rich) players choose whether to revolt (buy insurance). Additionally, rich players are asked to guess whether a revolution will be successful. They are told that guessing correctly is rewarded with 100 points. Afterwards, all players are informed about how many poor players decided to revolt[2] and if insurance was purchased, and all players are told their payoffs from that round.

At the end of a round, each subject is randomly assigned to the role of either a poor or rich player and is furthermore randomly assigned to a new group. Randomizing the order in which subjects play rich or poor players, are faced with high or low risk payoffs, and observe high, medium or low inequality, allows me to ignore any possible order effects.

At the conclusion of the experiment, subjects are paid for one randomly selected period. Monetary earnings are calculated as $\frac{1}{100}$ times the number of points earned in the selected round plus a show-up fee of $7.

[2]From this, poor players can infer if the other poor player revolted and learn about the likelihood of a revolution based on observed payoffs.

5 Analysis

The focus of this experiment is the subject's belief over the likelihood of successful coordination in response to observed inequality. In the case of poor players, these beliefs are directly observable: A subject should revolt if and only if the other poor player is believed to choose revolt. Therefore, observing a subject's frequency of choosing to revolt, directly represents their belief about the choice of the other poor player. In the case of rich players, this analysis is somewhat less straight-forward. Instead of directly observing the frequency of revolutions, the rich person only indicates whether he believes in a successful revolution. This, however, does not translate directly into γ as the probability of both poor players choosing to revolt is γ^2 as stated previously. Assuming that the rich player believes revolutions to be successful with probability τ, the variable of interest is $\sqrt{\tau} = \gamma$. In addition, it is possible to identify a range that the rational rich player must have believed the probability of a revolution to fall into. Using condition (I), it is possible to conclude that the rich player must think that $\gamma > \gamma_1$ if he purchased insurance while the opposite must be true if he did not purchase insurance. This range can be used to verify the validity of using $\sqrt{\tau}$ as the dependent variable in the analysis.

5.1 Regression Analysis

After observing γ and $\sqrt{\tau} = \gamma$ for each subject (the former for in cases when subjects were in the role of a poor player and the latter in the role of the rich player) and treatment,[3] the goal is to estimate how inequality affects a subject's belief over the probability of a revolution while controlling for risk in the payoffs. The second effect of interest is how perspective changes beliefs or the perception of inequality. This can be quantified as the effect of being

[3]Assigning the value 1 whenever a poor (rich) person chooses to revolt (buy insurance) and 0 otherwise, the probabilities are the means within a treatment for each subject. This results in six observations per subject.

assigned either role.

An appropriate dummy variable model is therefore

$$
\begin{aligned}
\gamma_{it} = b_0 &+ b_1 \mathbb{1}\{inequality_t = medium\} \\
&+ b_2 \mathbb{1}\{inequality_t = high\} \\
&+ b_3 \mathbb{1}\{role_t = rich\} \\
&+ b_4 \mathbb{1}\{risk_t = high\} + \kappa_i + \epsilon_{it}
\end{aligned}
$$

where b_0 is the average belief of a poor person playing the game in a low inequality and low risk setup. b_1 and b_2 identify the effects of of medium and high inequality, respectively. b_3 measures how a subject's perspective changes as he switches from the role of a poor player to that of a rich player. The dummy variable whose coefficient is b_4 controls for possible risk preferences and κ_i captures unobserved heterogeneity among subjects. For example, some subjects might be biased towards thinking that inequality is inherently bad and are therefore more likely to choose to revolt.

Preferably, this model would be estimated using OLS in order to identify linear effects. However, should predicted values of γ_{it} fall outside of $[0, 1]$, a more appropriate Tobit model would have to be used.

5.2 Initial Hypotheses

A strong positive effect of higher inequality should be observable. Since poor people need to coordinate on one actions, anything from history to social norms suggests that subjects believe that the other subject is more likely to revolt if inequality is greater. Therefore, a reasonable assumption would be that $0 < b_1 < b_2$.

Next, I would expect rich players to perceive inequality as less pressing than if they observed the same payoff possibilities as a poor person, meaning $b_3 < 0$. Though theory does not directly predict it, I would also expect b_3 to be smaller in magnitude than b_2.

Lastly, while the level of risk only serves as a control variable here, a brief discussion of its effect is in order. Risk, as measured in this experiment, only concerns the relative difference between the best and worst possible payoff for a poor player. It is therefore unclear if risk is perceived as the size of a possible loss ($m - l_i$ if insurance is purchased or $m - l_n$ otherwise) or the size of possible gains ($h - m$). The direction of this effect is therefore not clear. The reason risk is a treatment variable in this experiment, is not to measure risk preferences, but rather to control for any possible reaction to risk left after (technically) inducing risk-neutrality by choosing a random round for payment and by doing so to get the least polluted measure of the effect of inequality.

6 Simulation Exercise

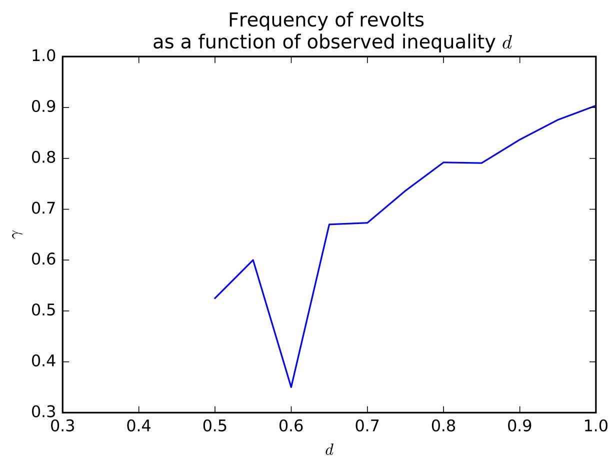
A crude implementation in a Monte Carlo simulation[4] of the basics of the model presented here verifies the relevance of the proposed research question. The simulation varies from the experiment in a few important aspects. First, “subjects” (or in this case class instances) do not switch between the roles of poor and rich players. Instead, any initial assignments persist throughout the simulation. Second, the six remaining treatments are not directly implemented. Instead, there is a (near) continuum of treatments. At the beginning of the simulation, 10,000 payoff tables are randomly generated. Of these 10,000, 1,707 satisfied condition the condition that $0 \leq \gamma_3 < \gamma_1 < \gamma_2 \leq 1$, which is necessary to rationally allow for all possible combinations of revolt $\times$ insurance.

Throughout 500 rounds, 30 subjects learned and formed beliefs about the probability of a revolution in response to a variable d, which measures, in very simple terms, the degree of

[4]The script underlying this simulation can be found at `https://github.com/timschulz91/econ828project/blob/master/Simulation.ipynb`

inequality and is defined as one minus the ratio of a poor person's payoff relative to that of a rich person if the status quo remained (i.e. nobody revolts and the rich person does not purchase insurance). That is $d = 1 - \frac{m}{y_{0n}}$. In each round, subjects were randomly assigned into groups of two poor and one rich player. Then, all players were informed about the degree of inequality d in response to which poor players predicted γ as a linear function of d and decided to revolt with that probability γ. Rich players were simulated to purchase insurance if they predicted (based on the Random Forest machine learning algorithm) at least one poor player to revolt. At the end of a round, all simulated players were informed about how many poor players revolted and whether insurance was purchased.

Figure 1: Simulation Graph



The results of the simulation can be seen in Figure 1. The graph depicts the observed frequency of poor players choosing to revolt in response to the simplified measure of inequality d. As predicted by theory, there is a generally positive relationship between inequality and a poor player's propensity to choose to revolt. The notable exception is the decrease for observations with $d \approx 0.6$. This, again, corresponds to theory in the sense that theory predicts a range in which inequality is high enough that rich players purchase insurance, which in turn deters poor players from revolting. Only once inequality keeps increasing, poor players can again coordinate on the risky action of revolting.

7 Conclusion

In conclusion, this experiment should be useful in answering several questions regarding inequality. The first question is the question already raised in the title: How much is too much? At what degree of inequality are poor people in a society willing to rise up against the status quo despite personal risk, known negative consequence for the rich, and known decline of overall welfare? The obvious null hypothesis here is that higher inequality increases the probability (and beliefs) of a revolution being successful.

Second, how is inequality perceived differently depending on whether a person is rich or poor? A simple hypothesis would be that rich people, on average, believe observed inequality to be less severe than poor people. This holds even though rich subjects are forced to anticipate what the poor will do, which makes them view inequality through the lens of a poor person. Another question that is interesting in this context is whether this distortion of perspective is increasing or decreasing in the degree of inequality.

Several possible extension to this experiment come to mind. The next step should be controlling for the type of payments to player. The way it is proposed in this experiment, players receive endowments of a certain number of points. This may be viewed as too arbitrary. Poor subjects may not consider the negative externality of their actions on rich subjects as significant since points are just handed out randomly. This view may change if points are earned instead. Poor players may be less likely to revolt if they think that the rich player worked for his points and, thus, may actually deserve the points. An experimental setup like this would also better represent reality[5] but it would add an additional treatment to this experiment which is already designed relatively complex as $2 \times 3 \times 3$.

Next, it may be necessary to further emphasize the risk of choosing to revolt. In the real world, revolutions do not normally lead to one of two outcomes, but the outcomes can vary

[5] Differences in income or wealth are earned/deserved in most cases (even though this could ultimately depend on political ideology).

significantly. Specifically, a successful revolution can still lead to less desirable conditions for the poor than those that were in place before the revolution in the sense that too much of the overall welfare has been destroyed. To capture this, one modification to the experiment would be to make payoffs for the action revolt completely random (beyond merely being dependent on other players' actions) in some kind of lottery.

Lastly, it may be worth controlling for the context. This experiment specifically aims to reveal information about people's perception of inequality. However, subjects in the experiment may make decisions based on their attitude towards inequality as well as profit maximization. Administering the same experiment but taken out of the context of inequality and the roles of rich and poor could provide a baseline case that describes the behaviour of people who are solely driven by the principle of maximization.

References

[1] Battalio, R., Samuelson, L., and Van Huyck, J. (1957), "Optimization Incentives and Coordination Failure in Laboratory Stag Hunt Games", *Econometrica*, Vol. 69-3, pp. 749–764.

[2] Engel, C., and Zhurakhovska, L. (2014), "Conditional Cooperation With Negative Externalities – An Experiment", *Journal of Economic Behavior & Organization*, 108, pp. 252–260.

[3] Rakin, F., Van Huyck, J., and Battalio, R. (2000), "Strategic Similarity and Emergent Conventions: Evidence from Similar Stag Hunt Games", *Games and Economic Behavior*, 32, pp. 315–337.

Appendix

Instructions

Welcome to the experiment and thank you for participating!

If you follow these instructions, you can earn a considerable amount of money paid out in cash at the end of the experiment. Your earnings will depend on decisions you make during the course of this experiment and also on decisions that other participants make.

During the experiment, you must remain seated and are not allowed to communicate with other people in the room in any way. Please turn of any electronic devices and direct your attention solely at these instructions and the computer screen in front of you. If you have questions at any time, please raise your hand and an experimenter will come and answer your questions privately.

The Experiment

This experiment consists of 30 rounds plus 5 practice rounds in the beginning. Once the reading of these instructions concludes, the first practice round begins.

In each round, you will be randomly assigned into a group with two other participants. The computer will randomly decide whether you are rich or poor. Each group consists of two poor and one rich person. For example, if you are determined to be poor, one other participant in your group will be poor as well while the third participant will be rich. If you are determined to be rich, both of the other two participants in your group are poor.

In the beginning of a round, you will receive a number of points.

If you are poor, you have the choice to revolt against the rich person or to not revolt and receive your points. A revolution can only be successful if both poor people decide to revolt. This means, if you decide to revolt, but the other poor participant in your group does not, your revolution will fail. In this case, you will lose points. Additionally, the number of points you lose depends on whether the rich participant purchases insurance against an attempted revolution (more on that later). If you revolt but fail, you lose more points if the rich participant has insurance. You do not lose as many points if your revolution fails when the rich participant does not have insurance. If the revolution is successful, both poor participants will receive additional points (on top of the points you were given at the beginning of the round).

If you are rich, you have the choice to purchase insurance or not to purchase insurance. If you do not purchase insurance and neither of the poor participants in the group decides to revolt, you keep all the points you were given at the beginning of the round. If you do not purchase insurance, and one of the two poor participants chooses to revolt, you lose some of your points. If you decide to purchase insurance, you lose some points (the price of the insurance) but you do not lose as many points as you would without insurance if one of the poor participants revolts. With insurance, you will keep the same amount of points (after paying some points for the insurance) in the case of none or one of the poor participants choosing to revolt. That is, you are insured against failed revolutions. If both poor participants decide to revolt, you will lose all your points and the outcome is the same whether you bought insurance or not.

All participants are shown the number of points they and all other participants would keep for all possible outcomes. Poor participants see how many points they would keep depending on whether the other poor participant decides to revolt and whether the rich participant has insurance. Poor participants also see how many points the rich participant keeps in each outcome. Likewise, if you are rich, you will see all possible payoffs for yourself and for the two poor participants in your group.

Here is an example:

You are **poor** this round.

You have 200 points. The rich participant has 500 points.

This table shows how many points you will keep at the end of the round depending on what the other poor participant and the rich participant do.

The rich participant has...

... no insurance			... insurance		
You...	The other poor participant...		You...	The other poor participant...	
	revolts	does not revolt		revolts	does not revolt
revolt	300, 300	100, 200	revolt	300, 300	0, 200
do not revolt	200, 100	200, 200	do not revolt	200, 0	200, 200

For example, if the rich participant purchases insurance and the other poor participant does not revolt but you do revolt, you will keep 0 of your 200 points (you lose 200 points). Alternatively, if the rich participant does not have insurance and both you and the other poor participant decide to revolt, you will receive an additional 100 points for a total of 300. In general, depending on the outcome, the first number in each cell shows the number of point you will have at the end of the round should that outcome occur. The second number shows the number of points that the other poor participant would end the round with.

This table shows how many points a rich participant (who is given 500 points) will have at the end of the round depending on his or her decision to buy insurance and your and the other poor participant's decision to revolt or not to revolt.

number of revolutionaries	insurance	no insurance
0	300	500
1	300	200
2	0	0

For example, if nobody decides to revolt and the rich participant does not purchase insurance, he or she will keep all 500 points. If you but not the other poor participant (or the other way around) decide to revolt, so that only one participant in total is revolting, the rich participant will keep 300 points with insurance or 200 points without insurance. If both you and the other participant revolt, it does not matter if the rich participant has insurance and he or she will lose all of his or her points.

Lastly, if you are the rich participant, you will be asked to indicate whether you believe that a revolution will be successful this round (meaning both poor participants decide to revolt). You will be asked this at the same time when you are asked whether you would like to buy insurance.

At the end of each round, all players are informed about the number of revolutionaries and whether the rich participant purchased insurance. This way, if you are a poor player that round and you revolted but the total number of revolutionaries is only 1, you know that the other poor player did not revolt. Next, you are informed about how many point you keep from that round. This concludes a round and participants are randomly reassigned for the next round.

Your Payment

Every participant will receive a $7 show-up payment.

Additionally, you will be paid for one randomly chosen round. You will be paid in cash and receive $1 per 100 points you kept at the end of the randomly selected round. If you were rich in this round, you will also receive a $1 bonus if you correctly guessed how many of the poor participants revolted.

All your decisions and the resulting payments are confidential and we do not record your name.

This concludes the instructions. If you have any questions, please raise your hand. Thank you for participating in this experiment!