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COMMUNICATION AND COORDINATION IN THE LABORATORY COLLECTIVE RESISTANCE GAME[1]

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ABSTRACT

This paper presents a laboratory collective resistance (CR) game to study how different forms of non-binding communication among responders can help coordinate their collective resistance against a leader who transgresses against them. Contrary to the predictions of analysis based on purely self-regarding preferences, we find that non-binding communication about intended resistance increases the incidence of no transgression even in the one-shot laboratory CR game. In particular, we find that the incidence of no transgression increases from 7 percent with no communication up to 25-37 percent depending on whether communication occurs before or after the leader's transgression decision. Responders' messages are different when the leaders can observe them, and the leaders use the observed messages to target specific responders for transgression.

Key words: Communication, Cheap Talk, Collective Resistance, Laboratory Experiment, Social Preferences

JEL Classification: C92, D74

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1. Communication, Collective Resistance, and Leader Transgression

This paper introduces the laboratory collective resistance (hereafter CR) game to investigate how communication between "responders" can facilitate their collective resistance against a leader who transgresses against their rights or personal interests. Our main goal is to introduce and evaluate the hypothesis that when social preferences are important in motivating the behavior of some of the "beneficiaries" of transgression in the laboratory CR game, communication between responders can facilitate collective resistance and deter leader transgression. This can occur even when an analysis based on pure-self interest predicts that communication should not affect the incidence of transgression in this game.

A recent theme in both political economy (e.g., Weingast, 1995, 1997; Acemoglu et al., 2004) and organizational economics (e.g., Williamson, 1985; Miller, 1992) is that opportunistic transgression by the leader—for example, confiscation of citizens' assets, or unilateral alteration of fiscal arrangements between the headquarter and divisions—can have significant negative effects on societies and organizations. Furthermore, several recent contributions on the political economy of leader transgression emphasize that the extent to which the subordinates can solve the coordination problem they face is crucial in determining whether transgression will take place. In his influential work, Weingast (1995, 1997, 2005) demonstrates how the state can use a "divide-and-conquer" strategy to prevent coordinated resistance, by sharing some of the confiscated surplus with a subset of subordinates. Acemoglu et al. (2004) also emphasize the importance of the divide-and-conquer strategy, and derive further predictions regarding the conditions under which the ruler can use this strategy to extract surplus from subjects.

Our experiment is based on the game-theoretic model of divide-and-conquer transgression developed by Weingast (1995, 1997) (which he originally refers to as the

Sovereign-Constituency Transgression game). We first start with the Basic CR game illustrated in Figure 1 (Weingast, 1997). This game captures the following ideas. First, successful transgression allows the leader to extract surplus from the responders and increases the leader's *private* payoff, even though it reduces *total* surplus because some of the surplus is destroyed in the process. In the Figure 1 payoffs, for example, successful transgression against both responders reduces each responder's payoff by 6 (so 12 in total) but only increases the leader's payoff by 6, since the transgression destroys half of the confiscated surplus. Second, challenging is costly to the responders regardless of whether or not it succeeds, and the responders face a coordination problem in deciding whether to challenge the leader. In particular, the leader will be deposed of power if and only if *both* responders incur the cost to challenge him. Third, multiple equilibria exist in the top "transgression subgame" in which the leader transgresses against both responders. Both responders challenging the leader and both responders acquiescing are possible equilibria, so this subgame is an assurance (also known as a "stag hunt") game under standard money-maximizing preferences.

In the bottom "no transgression" subgame, acquiesce is a dominant strategy for both responders. Because both (challenge, challenge) and (acquiesce, acquiesce) are Nash equilibria in the transgression subgame, the overall Basic CR game has two subgame perfect equilibrium. In one equilibrium, the leader expects that the responders will both acquiesce in the transgression subgame, and he will transgress. In the other equilibrium, the leader expects that the responders can succeed in coordinating on the "challenge" Nash equilibrium in the transgression subgame, and he will not transgress. Importantly, in this Basic CR game, the surplus-maximizing outcome without transgression can be supported as an equilibrium.[2]

[2] Besides the two pure-strategy subgame perfect equilibria, there is also another subgame perfect equilibrium in which the two responders acquiesce with probability 5/6 in the transgression subgame and always acquiesce in the

As Weingast points out, besides transgressing against both responders, the leader can also use a divide-and-conquer strategy. Figure 2 illustrates the Divide-and Conquer CR game (hereafter we shall refer to this game as the CR game, and the Figure 1 game without the Divide-and Conquer (hereafter DAC) option as the Basic CR game). In this example, when the leader transgresses against only one responder he shares 1 of the 3 units of the confiscated surplus with the other responder as an attempt to gain her support. Importantly, when the leader can use a DAC strategy, *the outcome of* "*no transgression against any responder*" *cannot be supported as part of an equilibrium in this game*. To see why, first note that if the leader expects that a transgression against both responders will be met with coordinated challenge, then he will refrain from such transgression. However, when the leader transgresses against only one responder, the *beneficiary* of the transgression will not challenge the transgression because supporting the transgression increases his material payoff. Knowing this, the *victim* will not incur the cost to challenge the leader. Hence, successful resistance against DAC transgression will never occur.

These observations imply that this game has three (pure strategy) equilibria. In one equilibrium, the leader transgresses against both responders, expecting that this transgression will not be met by coordinated resistance. In each of the other two equilibria, the leader practices DAC transgression against one of the responders, expecting that no responder will challenge him.[3] Furthermore, because the beneficiary has no incentive to challenge the transgression,

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no transgression subgame, and the leader transgresses against the responders. Because allowing for the possibility of mixed-strategy equilibrium does not change the key implications of the Basic CR game and the Divide-and Conquer CR game, we shall focus on pure-strategy equilibria in the text.

[3] The conclusion that responders will not challenge a DAC transgression, so that no transgression cannot be supported as an equilibrium, always holds whenever agents seek to maximize a utility function that only depends on and is increasing in their own monetary payoff. Moreover, given the chosen parameter values, introducing simple inequity aversion, such as that captured in Fehr and Schmidt's (1999) well-known model, does not affect the beneficiaries' dominant strategy to acquiesce in this DAC CR game. A beneficiary challenging a transgression reduces the disutility from earning more than the transgression victim. But he also reduces his material payoff and increases his disutility from earning more than the leader when the resistance succeeds. Therefore, acquiescing remains a dominant strategy for the beneficiary. Furthermore, one can show that this implies that a leader with

allowing for non-binding communication between the beneficiary and the victim in the one-shot CR game will not change the conclusion that collective resistance against DAC transgression will not occur in equilibrium. Hence, such communication will not change the prediction that no transgression cannot be supported as an equilibrium.[4]

This conclusion, however, can change significantly if a possibility exists that the beneficiary *may* be motivated by concerns other than narrow self-interest. Recent contributions on social preferences (see, for example, Fehr and Fischbacher, 2004; Gintis, et al., 2005 and the references cited there) emphasize that some individuals may be *altruistic punishers*, who are willing to incur the cost to punish a violation of social norms, even when they are not directly hurt by such violations, and even when there is no significant scope for repeated interactions.[5] In the CR game, suppose the beneficiary is an altruistic punisher and regards transgression by the leader as socially unacceptable, and therefore is willing to incur personal costs to engage in altruistic punishment against the leader.[6] If the victim knows that the beneficiary is willing to do so, then the victim will also incur the cost to resist transgression. These observations suggest that

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inequity aversion still prefers DAC transgression to no transgression. Therefore, incorporating inequity aversion does not change the conclusion that "no transgression against any responder" cannot be supported as part of an equilibrium. Inequity aversion could change the set of equilibria for other payoff parameters, however, such as the lower leader payoffs used in Weingast's (1997) original version of the game.

[4] A small number of laboratory studies have investigated how a first-mover can expropriate surplus from a responder, such as the Peasant-Dictator game studied by Van Huyck et al. (1995) and the Power-to-Take game studied by Bosman and Van Winden (2002). However, in these studies there is only a single responder (which can be an individual or a team of individuals), so the issue of DAC transgression and coordinated resistance between two responders does not arise.

[5] For example, Fehr and Fischbacher (2004) consider a one-shot dictator game in which A allocates a fixed amount between herself and B. A third party, whose material payoff is not affected by the proposed allocation by A, then can choose whether to incur the cost to punish A for making an unfair allocation. They find that most third parties punished dictators who took more than half of the surplus.

[6] Different considerations may be responsible for why some beneficiaries may consider the divide-and-conquer transgression to be undesirable even though it increases their material payoffs. A beneficiary may identify with the welfare of the victim, or he may have concerns about social welfare (Charness and Rabin, 2002) and disapproves the transgression because it reduces total surplus. Our experiment is not designed to differentiate between these different social motivations in affecting behavior in the CR game. As a first attempt to study the role of social preferences in collective resistance and transgression, we aim at finding out empirically whether and how communication can affect behavior in the CR game when the pure self-interest model predicts that it should not. If communication does affect behavior, then this result and our findings will provide justification for further work aiming at understanding the relative importance of different motivations in affecting behavior in the CR game.

some successful collective resistance against DAC transgression can actually occur in equilibrium when social preferences are present. Furthermore, non-binding communication, by providing the opportunity for the responders to signal their "types" to others, can alter behavior and deter transgression.

Motivated by these observations, this study investigates the effects of various *restrictive* communication on the one-shot CR games.[7] Responder subjects could send binary messages that indicate their intended actions among available options in the CR game.

In our experiment, we first investigate whether *Ex Post Communication* may facilitate collective resistance. In this treatment, after they observe the choice made by the leader but before they make their actual choices, the responders indicate to each other their intended choices in non-binding communication. The leader does not observe these messages.

We also investigate the effect of *Public Ex Ante Communication* on resistance and transgression. In this treatment, the responders indicated to each other an intended play for every subgame, and these intentions were observed by the leader prior to the leader's decision.[8] While responders only communicate their intended choices in the subgame actually chosen by the leader in the Ex Post Communication, Public Ex Ante Communication allows the responders to observe the intentions communicated in all subgames before the leader's choice. Furthermore, Public Ex Ante Communication also allows for the possibility that observing the communicated intentions may affect the leader's behavior. We also consider the case of *Private Ex Ante*

[7] We focus on one-shot game to abstract from the possibility that the prospect of repeated interactions may motivate the beneficiary to resist DAC transgression. Of course, reputational considerations associated with repeated interactions can be important in deterring leader transgression. This idea has been emphasized by many scholars (see, for example, Weingast, 1997; and Gibbons, 2001). Van Huyck et al. (2001) report a laboratory study of confiscation with repeated interactions between a dictator and a single citizen. (This is compared to the case where the dictator can commit to a particular allocation in Van Huyck et al., 1995.) In Cason and Mui (in preparation) we investigate how different kinds of repeated interactions affect the incidence of transgression and resistance.

[8] Note that these intentions were not binding, however, so ex ante communication does not elicit actual decisions using the strategy method.

Communication, which differs from Public Ex Ante Communication in only one way: the intentions expressed by the responders are not observed by the leader. A comparison of Private and Public Ex Ante Communication shows that whether the leader can base his transgression decision on the responders' intentions turns out to be critical in affecting the efficacy of communication.

2. Experimental Design

This study consists of 36 independent sessions across five different treatments, as summarized in Table 1, involving the participation of 324 separate human subjects who participated in the sessions conducted at two universities. All subjects were inexperienced in the sense that they participated in only one session of this study, although some had participated in other economics experiments that were completely unrelated to this research project.

The No Communication treatments serve as baselines to evaluate the impacts of alternative forms of communication. In the Basic CR game, even without communication, transgressions were almost uniformly met with coordinated resistance and so transgressions did not occur after the first few periods. Therefore we chose to concentrate the data collection for various communication treatments on the (Divide-and-Conquer) CR game.

The experiment instructions employed neutral terminology. For example, "Person 1" chose "earnings square" A, B, C or D—which was the transgression decision—and then "Persons 2 and 3" simultaneously selected either X or Y—which was the challenge decision. (Ex Post Communication instructions are in the appendix.) In the communication treatments the responders send a restrictive message to the other responder in their group: an "intended" choice (either X or Y), prior to committing to an actual challenge or acquiesce decision.

As explained in the previous section, the communication treatments differ in both the timing and in who observes the messages that are exchanged. In the *Ex Post* and the *Private Ex Ante* Communication treatments, only the two responders who are exchanging the messages observe the message content. In the *Public Ex Ante* treatment, the leader also observes the messages. In the Ex Post treatment, the responders first learn the transgression choice of the leader and then exchange messages for only the subgame chosen by the leader. In the Ex Ante treatments, the responders indicate an intended choice for all four possible transgression subgames. These binary messages were exchanged simultaneously; that is, a responder did not learn the other responder's message(s) until completely specifying all of her message(s).

Each session had nine participants, but two sessions were always conducted simultaneously so 18 subjects were present in the lab for each data collection period. The instructions emphasized that subjects were randomly re-grouped each period. The regrouping occurred separately within the two groups of nine subjects in the lab, although this was not mentioned in the instructions. Subject roles remained fixed: leaders always remained leaders, and responders always remained responders. All sessions were planned for 50 periods, but some of the Ex Ante Communication sessions did not complete all 50 periods because they ran slowly and the time period allocated for the session expired.

Subjects' earnings were designated in "experimental francs." They were paid for all periods, and their cumulative francs balance was converted to either Australian or U.S. dollars at exchange rates that resulted in earnings that considerably exceeded their opportunity costs. The per-person earnings typically ranged between US$25 and US$40 for the Purdue sessions and between A$30 and A$60 for the Monash sessions.[9] Exchange rates were chosen before

[9] The exchange rate between U.S. and Australian dollars was approximately 1 AUD = 0.75 USD when the experiment was conducted.

beginning data collection based on the time required to complete pilot sessions. Sessions without communication ran more quickly—some as short at 75 minutes including instructions—while those with communication typically required 1.5 to 2.5 hours. We employed more generous conversion rates for the longer sessions to compensate subjects for the longer time in the lab.

3. Results

3.1 Basic Collective Resistance Game

In the Basic CR game (cf Figure 1) the leader can only transgress against both responders or transgress against neither, and so no transgression can be supported as an equilibrium. While leaders transgress about 30 percent of the time during the first 10 periods, they quickly learn that this is unprofitable. The responders play an assurance (stag hunt) game in the transgression against both subgame, but they clearly coordinate to both challenge despite the existence of multiple equilibria. Responders challenge 126 out of 128 times they face transgression, successfully resisting 62 of the 64 transgressions. Only 14 out of the 360 leader choices in the final 30 periods were for transgression.[10]

3.2 Divide- and-Conquer Collective Resistance Game without Communication

Adding the divide- and-conquer (DAC) option to the CR game (cf Figure 2) changes the set of equilibria compared to the Basic CR game, and under purely self-regarding preferences the outcome of no transgression cannot be supported as an equilibrium when DAC is possible. Furthermore, even if some beneficiaries are altruistic punishers, collective resistance may be unlikely to occur without mechanisms that allow responders to signal their types to one another. This leads to the following hypothesis:

[10] This result is also not surprising, since challenge is a best response for this subgame whenever a responder believes that the other responder will challenge with a probability that exceeds 1/6. See Battalio et al. (2001) for a thorough experimental analysis of stag hunt games with differing optimization incentives.

H_1: The no transgression outcome occurs less frequently in the DAC CR game than in the Basic CR game.

The data clearly provide strong support for this hypothesis. The no transgression rate is high and rises across periods in the Basic CR game, and is much lower and declines across periods in the DAC CR game. During the final half of the sessions, the no transgression rate is above 90 percent in the Basic CR game and is less than 10 percent in the DAC CR game. The differences in these rates are highly statistically significant for any time period (Mann-Whitney $U=0$ for sample sizes $n=8$, $m=4$; p-value<0.01).

Leaders most frequently choose the DAC option in this game without communication, and they select this strategy at a rate that rises smoothly from 73 percent in periods 1-10 to 94 percent in periods 41-50.[11] Transgressions against both responders are frequently resisted, as in the Basic CR game.[12] Figure 3 shows that successful resistance to DAC transgressions is much less common. Recall that the beneficiary of a DAC transgression who is self-regarding has a dominant strategy to acquiesce. The beneficiary's challenge rate begins below 25 percent and falls over time. Victims challenge at a higher rate, but their challenges are usually unsuccessful and so this rate also falls over time. In the final 10 periods the rate of successful joint resistance falls below 4 percent, and after period 20 the expected payoff for the leader of a DAC transgression exceeds the payoff of 6 for no transgression.

[11] Social preferences that reflect positive concern for the responders' payoffs or for efficiency do not seem to play a significant role in affecting leaders' behavior in this DAC CR game, since they chose the no transgression option rarely during the initial periods of the experiment. Across all treatments (including communication) for the DAC CR game, 73 out of 96 leaders (76 percent) chose no transgression zero or one time during the first 5 periods of their session. Only 10 out of 96 leaders (10 percent) chose no transgression 3 or more times in these initial 5 periods. It is worth noting that for the payoff parameters implemented in this CR game, even if the leader has the kind of inequity aversion posited by Fehr and Schmidt, she always prefers DAC transgression to no transgression for any parameters (suitably restricted by Fehr and Schmidt) regarding her aversion to advantageous and disadvantageous inequity as long as she expects that the responders will not resist.

[12] In the DAC CR game without communication, responders challenge 109 out of 134 transgressions against both (81 percent), and successful joint resistance occurs in 43 out of 67 of these transgressions (64 percent). The expected payoff for the leader from a transgression against both is therefore 4.3.

3.3 Communication in the Divide-and-Conquer Collective Resistance Game

As discussed in the introduction, if some beneficiaries are altruistic punishers, even restrictive cheap talk could change outcomes in the DAC CR game because it provides opportunities for the responders to signal their types. Our treatments add communication in three different ways to thoroughly explore the following principal research hypotheses:

H_2: Communication increases the frequency of the no transgression outcome in the DAC CR game.

H_3: Communication increases responder resistance in the DAC subgames.

Figure 4 presents the time series of rates that the leader chooses no transgression for all four treatments with the DAC transgression option available. As noted above, this rate is low and declines over time in the treatment without communication. By contrast, the rates rise over time or remain relatively stable for the communication treatments, and leaders choose no transgression at the highest rate in the Private Ex Ante Communication treatment. The no transgression rate does not appear to be higher in the Public Ex Ante Communication treatment, however, so the figure provides some initial qualitative support for hypothesis H_2 only for two of the three communication treatments.

This figure obscures substantial variation in transgression rates across sessions. Table 2 displays the rates that leaders chose no transgression after period 20 for the 36 individual sessions. The No Communication treatment has many of the lowest rates of no transgression, while the Ex Post and Private Ex Ante Communication treatments have some of the highest rates of no transgression. Nevertheless, these two communication treatments also have sessions with no (or virtually no) leader choices of no transgression. The bottom of Table 2 indicates that the lower transgression rate in these communication treatments led to modestly higher efficiency.

Ex Post Communication

Hypotheses H_2 and H_3 receive statistical support for the Ex Post Communication treatment. A Mann-Whitney test indicates that Ex Post Communication increases the frequency relative to the No Communication baseline (U=10, n=m=8; p-value=0.01), supporting Hypothesis H_2.[13] Figure 3 shows that successful joint resistance in the DAC subgame averages only 7 percent in periods 21-50 with no communication. The data (not shown in Figure 3) indicate, however, that successful joint resistance does not fall substantially over time with Ex Post Communication, and is over twice as high (15 percent) in periods 21-50. This increase in resistance is marginally statistically significant (Mann-Whitney U=19, n=m=8; p-value=0.086), providing some support for Hypothesis H_3.

Although these results indicate that Ex Post Communication does matter, it only leads to a modest reduction in transgression. This is perhaps because subjects often fail to follow through on the "intended" choices indicated in their cheap talk. In the Ex Post Communication treatment, victims of DAC transgressions indicate an intention to challenge about 70 to 75 percent of the time during later periods, but they only actually challenge in about 30 to 35 percent of the periods. Beneficiaries of DAC transgressions indicate an intention to challenge about 30 to 35 percent of the time, but they only actually challenge in about 17 percent of the periods.

Table 3 indicates, however, that communication helps coordinate successful resistance. Rows 2 and 3 show that victims and beneficiaries are both much more likely to challenge DAC transgression when the beneficiary's cheap talk message was an intention to challenge. The

[13] A drawback of this nonparametric test is that it discards an enormous amount of data when collapsing all the information for each session into a single summary statistic. Therefore, to complement the nonparametric tests reported in the text we also conducted random effects probit models of the leaders' transgression decisions that use all the data. These models provide similar conclusions to the Mann-Whitney tests, and so to conserve space we do not report them in detail. The individual leader subjects are the random effects, and the models include a time trend and site dummies to account for any possible systematic variation across subject pools. A dummy variable indicates that Ex Post Communication significantly increases the likelihood of the no transgression (t=1.93; one-tailed p-value=0.027) relative to No Communication.

highest challenge and successful resistance rates occur when both responders indicate resistance (row 3). The lowest rates occur when neither responder indicates resistance, as shown in row 4.

Table 4 presents statistical support for the conclusion that both victims and beneficiaries choose to challenge a DAC transgression when the beneficiary of the transgression or (especially) when both responders indicate that they intend to challenge. The likelihood of actual resistance for both victims and beneficiaries, estimated using these fixed effects logit models, is always significantly higher when both responders indicate an intention to resist. Intended resistance by the beneficiary alone also usually increases the actual resistance probability.

Ex Ante Communication

Returning to Table 2, note that Public Ex Ante Communication does not increase the no transgression rate relative to the No Communication baseline (Mann-Whitney U=26, n=m=8; *ns*). By contrast, no transgression is most frequent overall in the Private Ex Ante Communication treatment, although this treatment also has the greatest variation across sessions. Therefore, the increase in no transgression (relative to the no communication baseline) is marginally insignificant (U=20, n=m=8; p-value=0.102).[14] Pooling over all 24 sessions that featured any communication, this test does reject the null hypothesis that communication does not increase the rate of no transgression (Z=1.747, n=8, m=24; p-value=0.040).

Although the data provide mixed support for Hypothesis H_2 in the Ex Ante Communication treatments, this support is not accompanied by corresponding support for Hypothesis H_3. Responder resistance in the DAC subgames is not systematically higher with either Ex Ante Communication treatment in the later periods 21-50 (insignificant Mann-Whitney

[14] Random effects probit models (described in the previous footnote) provide similar conclusions. Dummy variables indicate that the Public Ex Ante Communication treatment is not significantly different from the No Communication baseline (t=0.22; *ns*), and the Private Ex Ante Communication treatment are at the margin of traditional significance levels (t=1.56; one-tailed p-value=0.059).

U statistics that range from 22 to 43). Nevertheless, examination of session level data does indicate a strong relationship between the early (periods 1-20) rates of successful joint resistance in a session and late (periods 21-50) leader choices of no transgression in that session. Across the 24 communication sessions, the Spearman rank correlation coefficient of 0.82 between these measures is highly significant. The four sessions with the highest early resistance had an average late no transgression rate of 0.75, while the ten sessions with the lowest early resistance had an average late no transgression rate of 0.06.

One original motivation for studying Public Ex Ante Communication was based on a conjecture that it would provide an opportunity for altruistic punishers to signal their types to others, and if this leads to a higher incidence of indicated joint resistance observed by the leader, it would deter the leader from transgression.[15] The Private Ex Ante Communication treatment serves as a useful comparison for examining how the observability of the intentions by the leader may change behavior. Our conjecture that Public Ex Ante Communication may deter transgression turned out to be wrong, and a comparison between the Public and Private Ex Ante Communication treatments shows why. When the intentions are observed by the leader, responders are reluctant to indicate an intention to challenge as a beneficiary. This undermines the effectiveness of Public Ex Ante Communication in deterring transgression.

Tables 3 and 4 provide strong evidence that coordinated resistance to a DAC transgression is much more successful when the beneficiary indicates an intention to challenge.

[15] Another motivation, for both Ex Ante Communication treatments, was to examine whether intentions communicated for subgames not chosen by the leader may still provide a responder with useful information about the type of the other responder, and hence may affect resistance behavior. We explored how the intentions for other subgames not chosen influence resistance rates in the subgame actually chosen by the leader. The results were mixed. For example, we included indicator variables for victim and beneficiary intended resistance in the DAC transgression subgame not chosen in alternative specifications for the logit resistance models shown in Table 4. If the actual victim had indicated an intention to resist as a beneficiary in the other DAC transgression (not chosen by the leader) in which the actual beneficiary is a victim, the point estimates always suggest that the actual beneficiary is more likely to resist. This increase in resistance likelihood, however, is only marginally significant in some cases.

In the Ex Ante Communication treatments the rate of successful joint resistance is less than 4 percent when only the victim or neither responder indicated an intention to resist, but it is as high as 29 to 39 percent when only the beneficiary or both responders indicated an intention to resist. This suggests that leaders might use the Public Ex Ante messages to identify *which* responder they could successfully transgress against. Figure 5 provides support for this conjecture. It displays the five most common messages observed by the leader for DAC subgames for this treatment. The Type B and Type D cases are situations in which both responders indicate an intention to challenge a transgression against a particular responder (denoted X), while transgressions against the other responder (here denoted Y) do not have coordinated resistance indicated in the intentions. In both of these cases, transgressions against Y are more than ten times more frequent than transgressions against X.[16] Also note that leaders are much more likely to transgress against neither responder when both responders indicate an intention to challenge both DAC transgressions (Type E). This figure shows that indicating an intention to challenge a DAC transgression as a beneficiary was quite risky; if the other responder did not also indicate a challenge as a beneficiary, this responder was likely to be the victim of a DAC transgression. Therefore, even if a beneficiary is an altruistic punisher, he/she may be reluctant to indicate an intention to challenge in the Public Ex Ante Communication treatment.

A comparison of the public and private ex ante messages reveals that responders apparently understood how the public messages influenced the leader's transgression decision, and their messages differ significantly when the leaders can observe them. Responders indicated an intention to resist as a beneficiary 51 percent of the time in the Private Ex Ante treatment, but

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[16] A fixed effects logit model (not shown) of the leaders' decision regarding which responder to transgress against, conditional on choosing the DAC transgression, indicates a significantly greater propensity to transgress against Y in the Type B (*t*-statistic=4.46) and Type D (*t*-statistic=6.29) cases in which joint resistance to a transgression against X is indicated in the cheap talk.

only 22 percent of the time in the Public Ex Ante treatment (Mann-Whitney U=7.5, n=m=8; p-value<0.02). The combination of responders' reluctance to indicate resistance as a beneficiary and leaders' ability to target "weak" responders led to a substantially lower number of DAC transgressions in those cases where resistance was most likely—when both responders indicate intended resistance: 28 in Public Ex Ante versus 232 in Private Ex Ante (cf Table 3, row 3).[17] To summarize these observations for the Public Ex Ante treatment: (1) the leader uses the responders' communicated intentions to pick a vulnerable target for DAC transgression; (2) this makes responders reluctant to indicate an intention to challenge as a beneficiary and lowers the rate that both responders indicate joint resistance; and (3) the leader practices DAC transgression most frequently in the subgame where it is likely to be successful—i.e., when the beneficiary does not indicate an intention to resist. This behavioral pattern led to less successful joint resistance, and undermined the effectiveness of Public Ex Ante Communication in deterring transgression.

4. Concluding Remarks

This paper presents a laboratory collective resistance game to investigate the relationship between leader transgression and collective resistance, as well as how different forms of non-binding, restrictive communication between responders may affect the incidence of leader transgression and responders' collective resistance. We find that consistent with Weingast's (1995, 1997) prediction, in the baseline DAC CR game without communication, transgression almost always occurs, and it mainly takes the form of DAC transgression. However, while an

[17] In the Public Ex Ante treatment, the unconditional rate that both responders indicate resistance to a DAC transgression is 17.3 percent. In contrast, in DAC transgressions actually chosen by the leader, the rate that both responders indicate resistance is only 3.2 percent. This provides further evidence that the leaders are targeting the weak responder and avoid practicing transgression in which both responders indicate an intention to challenge.

analysis based on purely self-regarding preferences predicts that non-binding communication should have no effect on the incidence of no transgression, we find that in this one-shot laboratory DAC CR game, the incidence of no transgression increases from 7 percent with no communication to 9-37 percent in these three communication treatments. Compared to the no communication benchmark, Ex Post Communication significantly increases the incidence of no transgression.

Our results suggest the need for further research that investigates the under-explored question of how heterogeneities in preferences among responders may change the nature of the coordination problems faced by responders when deciding whether to resist leader transgression, and how mechanisms that take into account the importance of social preferences can facilitate collective resistance against the abuse of power by political and organizational leaders. As a first step to investigate whether social preferences and communication matter in collective resistance, we chose to study restrictive communication because it is easier to implement and control, and the simplicity of the messages makes it easier to quantify the messages and their impacts on behavior. Since restrictive communication only has a modest effect on the incidence of transgression, in future studies, we plan to investigate how rich communication, in which responders can send free-form “chat” messages to others (e.g., Cooper and Kagel, 2005; Charness and Dufwenberg, 2006), may have stronger effect in the CR game. Rich communication can potentially have stronger effects because responders can go beyond merely indicating their intended actions, but can also offer justifications for their intentions, and to engage in debate regarding what constitutes appropriate behavior in collective resistance. Such studies will also enable us to examine the content of the messages sent by the responders to gain more direct insights about their motivations.

Table 1: Experimental Design

	No Communication	*Ex Post* Communication	*Public Ex Ante* Communication	*Private Ex Ante* Communication
Basic (Simultaneous Transgression)	4 Sessions (36 Subjects) 2 at Monash Univ., 2 at Purdue Univ.			
Divide and Conquer (DAC) Transgression Possible	8 Sessions (72 Subjects) 6 at Monash Univ., 2 at Purdue Univ.	8 Sessions (72 Subjects) 6 at Monash Univ., 2 at Purdue Univ.	8 Sessions (72 Subjects) 6 at Monash Univ., 2 at Purdue Univ.	8 Sessions (72 Subjects) 4 at Monash Univ., 4 at Purdue Univ.

Note: Fifty periods were conducted in all sessions except in the Public Ex Ante treatment. Two of those sessions completed only 44 periods, and two sessions completed only 29 periods.

Table 2: Rates for Independent Sessions that Leaders Transgressed Against Neither Responder

	Basic CR Game (No DAC)	No Communication (with DAC)	Ex Post Communication	Public Ex Ante Communication	Private Ex Ante Communication
(sessions ordered highest to lowest)	0.99	0.33	0.62	0.20	1.00
	0.98	0.10	0.43	0.18	0.71
	0.97	0.09	0.34	0.13	0.67
	0.91	0.06	0.22	0.08	0.48
		0.02	0.13	0.07	0.06
		0.00	0.12	0.03	0.01
		0.00	0.07	0.00	0.01
		0.00	0.03	0.00	0.00
Treatment Average	0.96	0.07	0.25	0.09	0.37
Average Efficiency[a]	98.6%	84.0%	86.4%	84.7%	89.0%

Note: The early periods 1-20 are excluded from these calculations.
[a]Efficiency is defined as the percentage of the maximum aggregate surplus (which corresponds to no transgression) realized by subjects.

Table 3: Challenge and Successful Resistance for Different Cheap Talk Messages

	Ex Post Communication			Public Ex Ante Communication			Private Ex Ante Communication		
Cheap Talk:	Victim Challenge	Beneficiary Challenge	Successful Joint Resistance	Victim Challenge	Beneficiary Challenge	Successful Joint Resistance	Victim Challenge	Beneficiary Challenge	Successful Joint Resistance
(1) Only Victim	114/443	19/443	5/443	214/568	41/568	21/568	81/262	10/262	5/262
Indicates Resistance	25.7%	4.3%	1.1%	37.7%	7.2%	3.7%	30.9%	3.8%	1.9%
(2) Only Beneficiary	31/78	18/78	9/78	26/49	22/49	14/49	33/82	8/82	3/82
Indicates Resistance	39.7%	23.1%	11.5%	53.1%	44.9%	28.6%	40.2%	9.8%	3.7%
(3) Both Responders	190/228	117/228	110/228	23/28	12/28	11/28	180/232	77/232	67/232
Indicate Resistance	83.3%	51.3%	48.2%	82.1%	42.9%	39.3%	77.6%	33.2%	28.9%
(4) Neither Responder	20/141	5/141	0/141	59/230	7/230	4/230	20/138	8/138	3/138
Indicates Resistance	14.2%	3.5%	0.0%	25.7%	3.0%	1.7%	14.5%	5.8%	2.2%

Table 4: Fixed Effects Logit Models of DAC Challenge Decision Based on Cheap Talk Messages

	Ex Post Communication		Public Ex Ante Communication		Private Ex Ante Communication	
Cheap Talk:	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge
Only Victim	0.12	0.07	1.16**	1.64**	0.61†	-0.87
Indicates Resistance	(0.35)	(0.59)	(0.24)	(0.56)	(0.34)	(0.67)
Only Beneficiary	1.45**	1.74**	0.91*	3.14**	1.25**	0.69
Indicates Resistance	(0.39)	(0.61)	(0.40)	(0.67)	(0.38)	(0.83)
Both Responders	4.01**	3.23**	2.72**	4.22**	2.83**	1.55*
Indicate Resistance	(0.42)	(0.59)	(0.60)	(0.83)	(0.37)	(0.62)
1/period	4.19**	2.21*	5.25**	2.42**	3.46**	3.55**
	(0.83)	(0.98)	(1.05)	(0.86)	(0.92)	(1.33)
Log likelihood	-250.8	-127.7	-329.5	-91.4	-242.4	-85.8
Observations	855	464	859	354	648	324

Notes: All models are estimated with subject fixed effects. Some subjects were dropped due to zero variation in challenge decision. Standard errors are shown in parentheses. ** denotes significance at the one-percent level; * denotes significance at the five-percent level; † denotes significance at the ten-percent level (all two-tailed tests).

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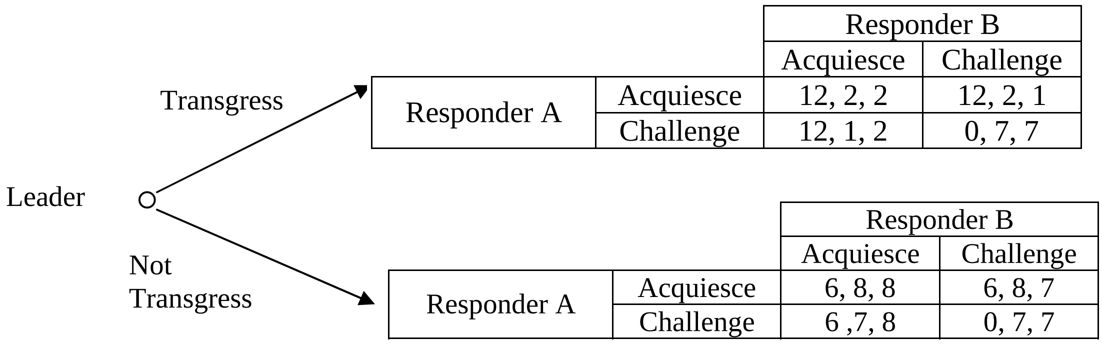

Figure 1: The Basic Collective Resistance Game (payoffs are for (Leader, Responder A, Responder B))

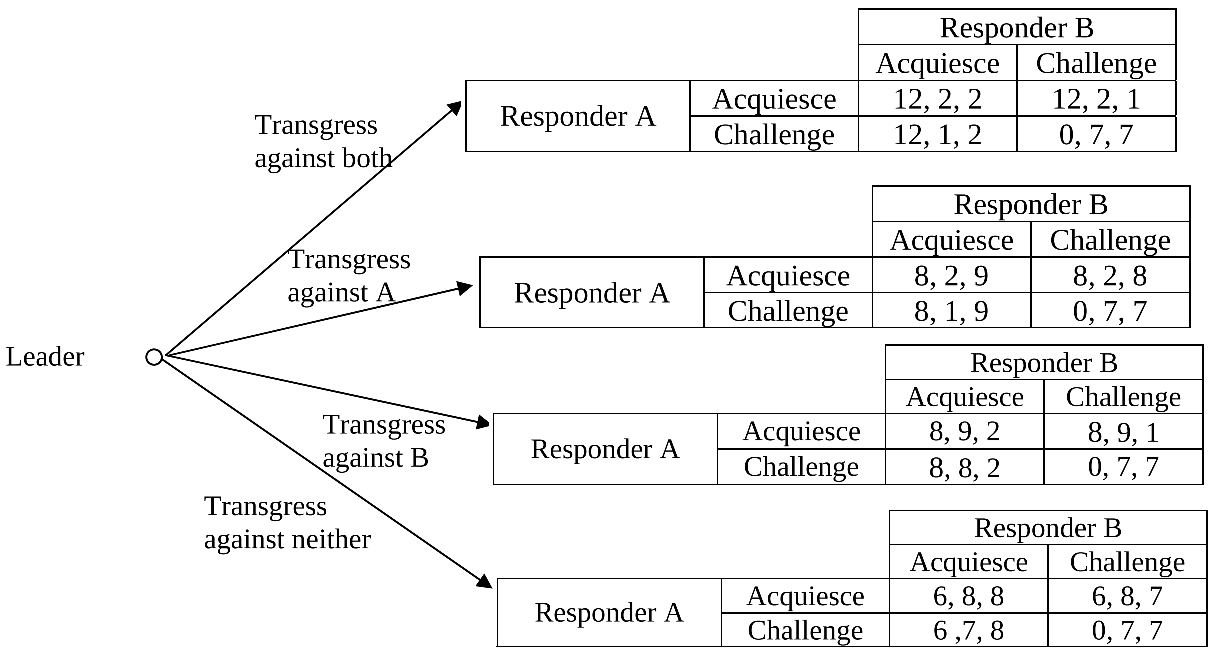

Figure 2: The Divide-and-Conquer Collective Resistance Game (payoffs are for (Leader, Responder A, Responder B))

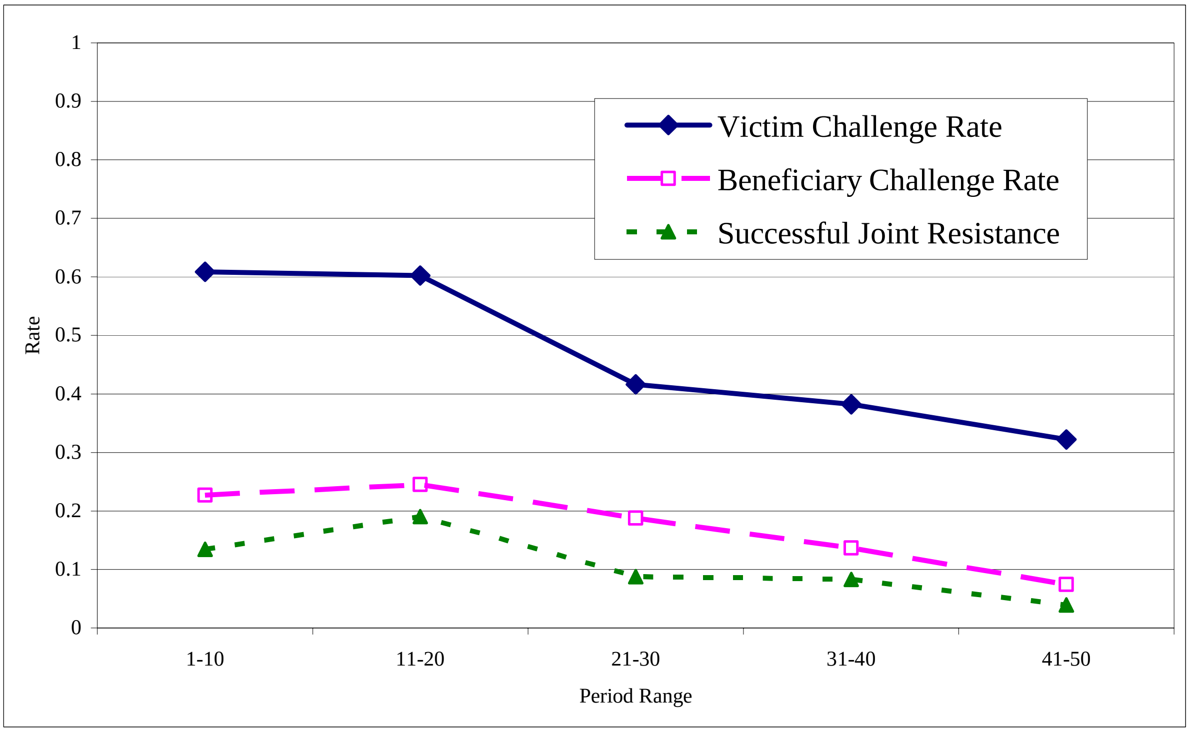

Figure 3: Challenge and Successful Resistance Rates for DAC Transgressions (No Communication)

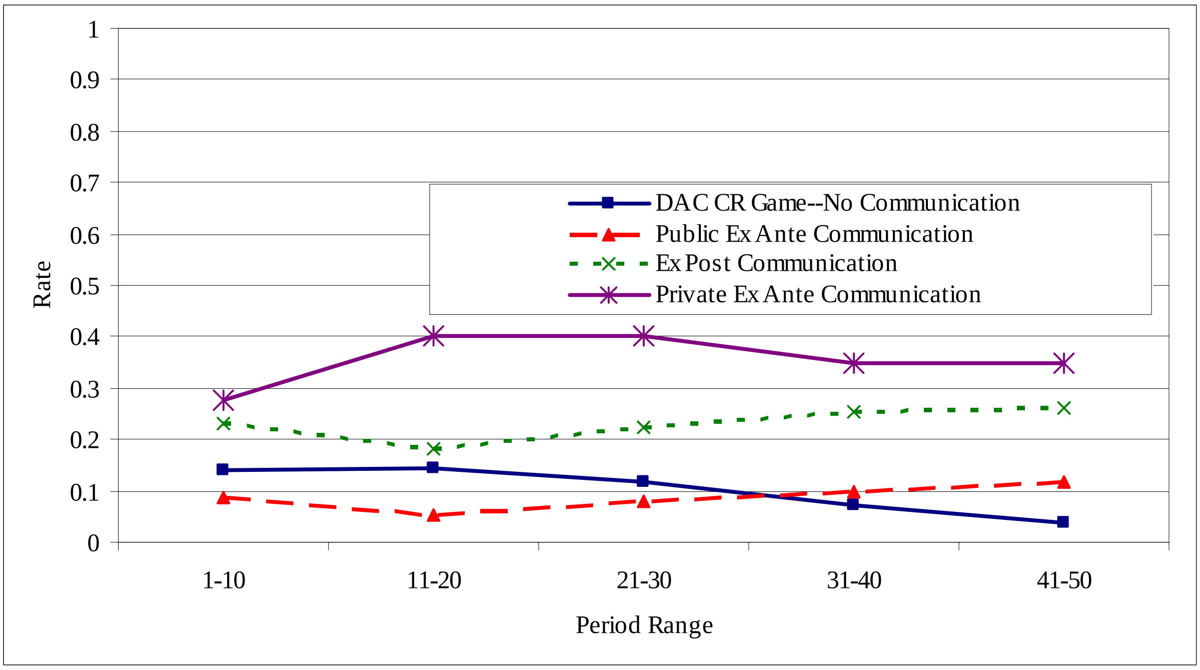

Figure 4: No Transgression rates for all DAC CR game treatments

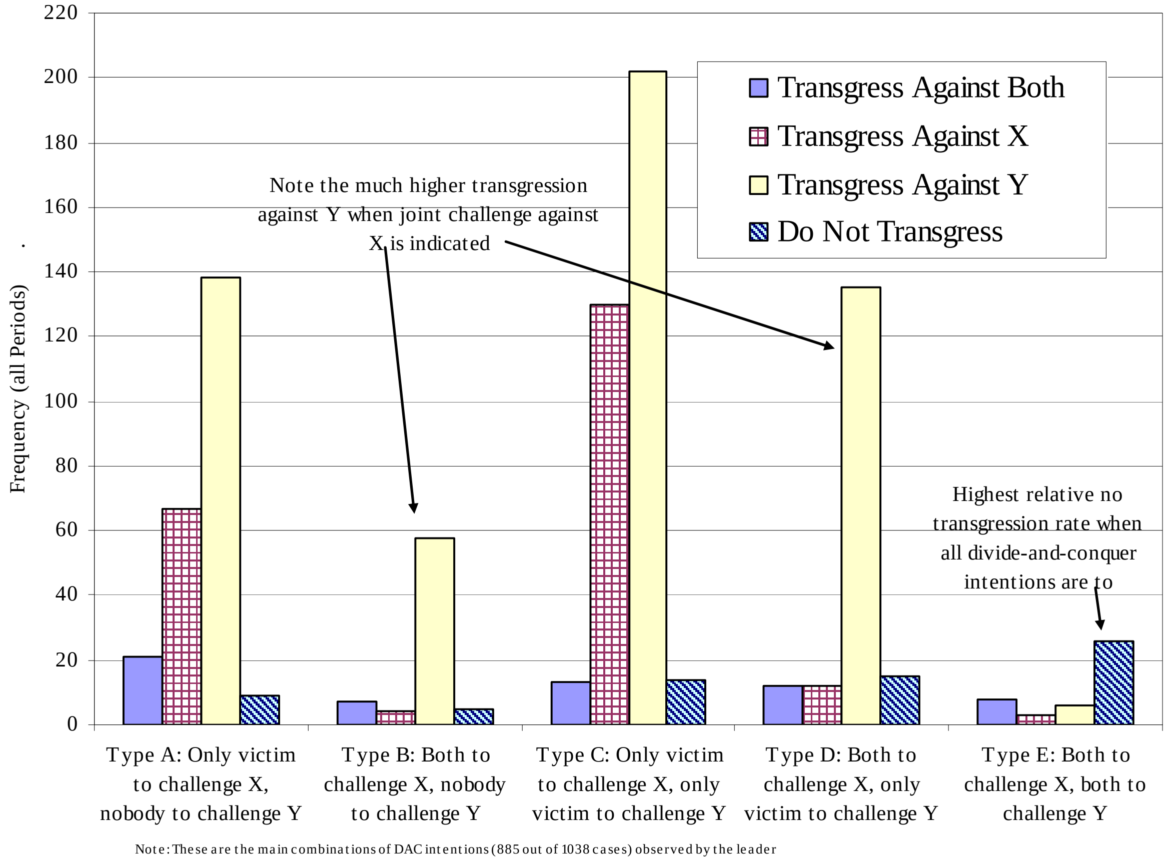

Figure 5: Leader Transgression Decisions Depending on Responder Public Ex Ante Intentions