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COORDINATING RESISTANCE THROUGH COMMUNICATION AND REPEATED INTERACTION*

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Abstract

Successful deterrence of leader expropriation is important for economic development. This paper studies experimentally how repeated interactions and communication can help deter leaders from extracting surplus from their subordinates. We show that repetition alone is far from sufficient in deterring leader expropriation. Communication between subordinates is critical for increasing coordinated resistance even when the information communicated is highly restrictive. Adding communication reduces expropriation significantly even in the presence of repetition.

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Key words: Communication, Cheap Talk, Collective Resistance, Divide-and-Conquer, Laboratory Experiment, Repeated Games, Social Preferences

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This paper reports an economic experiment to evaluate the effectiveness of repeated interactions and communication in deterring leaders' attempts to employ divide-and-conquer strategies to extract surplus from their subjects. Since the seminal work of North and Weingast (1989), a sizable economic literature has emphasized that an important condition for successful economic development is the existence of mechanisms that can deter the predatory behaviour of the state: if political leaders can confiscate the wealth of citizens without any repercussion, no one will have the incentive to engage in costly production and investment (North, 1990; Weingast, 1995, 1997, 2005; Acemoglu *et al.*, 2005; Grief, 2006; Acemoglu and Robinson, 2012). Some contributions to this literature have emphasized that coordinated resistance by citizens is a key mechanism in deterring leader expropriation (Weingast, 1995, 1997; Acemoglu and Robinson, 2006, chapter 11). Researchers, however, have also pointed out that leaders may expropriate wealth from one group, and share it with another group to "bribe" them and secure their support (Weingast, 1995, 1997). Such divide-and-conquer strategies are difficult to defeat. Citing the former Congo ruler Mobutu as an example, Acemoglu *et al.* (2004) argue that divide-and-conquer tactics allow rulers to adopt socially costly policies to extract surplus without meeting effective challenges, and this is an important cause for under-development.

Using a game-theoretic model in which a leader first decides whether to engage in divide-and-conquer and responders then decide simultaneously whether to incur the cost to challenge the transgression, Weingast (1995, 1997) emphasizes the importance of repeated interaction in deterring divide-and-conquer (hereafter DAC). This paper uses this coordinated resistance (hereafter CR) game to study experimentally how repetition *and* communication may facilitate coordinated resistance against DAC. Figure 1 illustrates the one-shot CR game, which is based on Weingast (1995, 1997) and captures the following ideas. First, successful transgression allows the leader to extract surplus from others and increases his *private* payoff, even though it reduces *total* surplus in society because some surplus is destroyed in the process. In the Figure 1 payoffs, successful transgression against an individual reduces her payoff by 6 and increases the leader's payoff by 3, since a transgression destroys half of the confiscated surplus. Second, challenging a transgression is costly regardless of whether it succeeds, and the responders face a coordination problem in deciding whether to challenge. The transgression will fail if and only if *both* responders incur the cost to challenge. Third, the leader can either transgress against both responders, or can practices DAC. When the leader practices DAC he shares 1 of the 3 units of the surplus expropriated from the "victim" with the "beneficiary" to gain her support.

Our study has several novel features, and we first highlight those regarding repeated interaction here. First, Weingast focuses on how repetition may enable *victims* and *beneficiaries* of DAC to use history-dependent strategies to facilitate cooperation to defeat DAC, but he does not consider how repetition can also enable the leader to use history-dependent strategies to punish any beneficiary who refuses to cooperate with him. This threat of targeted punishment by the leader can make repetition a two-edged sword in affecting cooperation in this social dilemma with endogenous roles, Second, the literature on divide-and-conquer cited above does not consider social preferences. Recent studies of this CR game (Cason and Mui, 2007, Rigdon and Smith, 2010), however, find that social preferences can affect behaviour even in the one-shot CR game. To our knowledge, this study is the first that provides empirical support to the novel observation that even in the presence of social preferences, repetition can be limited in its effectiveness in deterring divide-and-conquer.

To illustrate why repeated interaction may have limited effects in deterring DAC intuitively, consider a repeated CR game played by the leader and two responders A and B, in which DAC is defeated only when it is challenged by both A and B. Suppose that in period one, the leader picks A as the victim and extracts surplus from A and shares part of this surplus with B. Furthermore, the leader plans to continue to target A as the victim and share the extracted surplus with B in the future if B, as the beneficiary, does not challenge the leader. The leader, however, will switch to target B as the victim in the future if B refuses to cooperate with him and challenges him as a beneficiary. Suppose B has social preferences, and against her material self-interest she prefers that the DAC be defeated. Despite such preferences and the existence of repeated interaction, when the leader adopts the strategy of punishing a challenging beneficiary, the threat of being trapped as a victim forever can deter B from taking the risk to attempt to coordinate with A to challenge the divide-and-conquer transgression by the leader. .

Our experiment includes three different forms of repetition, encompassing finite and indefinite matching, to investigate the robustness of our results. We find that in all of these repeated game treatments, leaders target beneficiaries who previously challenge DAC. Overall, both indefinite and finite repetition reduce DAC compared to the one-shot game, and by similar rates. Leaders still choose DAC at least half the time, however, which suggests that repetition alone is far from sufficient to deter DAC effectively.

This suggests that the ability of the leader to use history-dependent strategies to punish a beneficiary who refuses to cooperate with him can limit the effectiveness of repetition in deterring DAC. This inspired a follow-up treatment to directly investigate the effect of reducing the leader's ability to target challenging beneficiaries. In this treatment, a leader and two responders play the repeated CR game, but the responders are randomly re-assigned the A/B labels each period, effectively hiding their identity from the leader while still maintaining fixed matching groups. Therefore, if a responder challenges as a beneficiary, the leader cannot determine who this "non-cooperating" beneficiary is in the next period for targeting. We find that in this treatment beneficiaries are significantly more likely to resist and coordinated resistance against DAC occurs more frequently.

Our finding that repetition alone is far from sufficient in deterring DAC suggests the need to study other mechanisms that can complement repetition in deterring DAC, and it is natural to consider communication as one such mechanism. Compared to repetition, communication has received a lot less attention in the emerging literature on DAC. For example, the important work by Weingast (1995, 1997) focuses on repetition, but does not consider communication.

In our experiment, we find that the "intended choice" communicated by the beneficiary is critical for increasing resistance to DAC, and that communication reduces the rate of "mis-coordinated resistance" in which one responder challenges while the other does not. We also find that adding communication reduces DAC substantially even in the presence of repetition, and that intentions communicated by the responders are more effective than the history of past resistance for coordinating responders' current resistance. We also compare repetition treatments without communication to the Random Matching with Communication treatment that adds communication only to the one-shot CR game. We find that repetition alone is no more effective than non-binding communication in one-shot game in reducing DAC.

While the existing literature on the predatory state abstracts from social preferences, our experiment shows that repetition can be limited in its effectiveness in deterring DAC even in the presence of social preferences. This result, together with our findings showing that communication can be informative and effective in deterring DAC even in the presence of repetition, strongly suggest that it is important to consider the effects of repetition *in conjunction with* communication or other mechanisms that may also enable potential challengers to DAC to coordinate their actions. As we discuss further in the conclusions, our study also suggests that understanding how leaders may engage in strategic actions to prevent citizens from taking advantage of communication and repeated interaction to defeat DAC can be a promising new direction for better understanding how society can restrain predatory behaviour by the leader, which is widely-regarded as a root cause for under-development.

While concerns about leader expropriation and under-development motivate our study, DAC is widely observed in many other settings. A defendant facing multiple plaintiffs may make different settlement offers to the plaintiffs to induce plaintiffs to settle their claims for less than they are jointly worth (Che and Spier, 2008). An incumbent monopolist can use DAC to achieve "naked exclusion" (Rasmusen *et al.*, 1991). A firm that is negotiating contracts with several unions may offer poor terms to some and more favourable terms to others to create divergent interests among the unions. Kutalik and Biddle (2006) discuss how concessions imposed through bankruptcy court in recent management-union disputes at several airlines have targeted specific unions, and some unions have joined forces to form the *Airline Workers United*—an across occupations and airlines organization—to counter this divide-and-conquer strategy. We highlight some implications of our findings for DAC in other settings in the concluding section.

Besides contributing to the literature on DAC, this paper also contributes to the emerging experimental literature on the indefinitely repeated games. The importance of infinitely repeated interaction in facilitating cooperation has been widely-studied in the literature (see Mailath and Samuelson, 2006, for a survey), and the laboratory offers a useful environment in which one can implement a probabilistic termination design to directly assess the effects of indefinite repetition (Roth and Murnigham, 1978). As Duffy and Ochs (2009) point out, surprisingly few studies have exploited this possibility to identify the empirical conditions under which indefinitely repeated play actually facilitates cooperation. Overall, our empirical knowledge about indefinitely repeated games lags far behind the theoretical literature. For example, the theoretical prediction that there should be a sharp difference between the cooperation rate in the finitely repeated and infinitely repeated prisoner's dilemma has been widely emphasized in the literature. Direct supporting evidence regarding this prediction, however, only became available recently in Dal Bó (2005), which compares the cooperation rate for these two types of repeated interaction while holding the expected duration of the repeated game constant across the two treatments.

The small number of experimental studies on indefinitely repeated games focus on widely studied games such as the public goods games (Palfrey and Rosenthal, 1994) and the prisoner's dilemma (Camera and Casari, 2009; Dal Bó. 2005; Duffy and Ochs, 2009; Normann and Wallace; 2011, Blonski *et al.*, 2011; Dal Bó and Frechette, 2011, and Fudenberg *et al.*, 2012). Furthermore, few studies have considered repeated play and communication simultaneously (for exceptions see Hackett *et al.* (1994), Wilson and Sell (1997), and Blume and Ortmann (2007), who all study finitely repeated play with communication). Departing from the prisoner's dilemma and the standard public goods games paradigm, the CR game studied in this paper allows for interesting endogenous role asymmetries among the players, and how these roles can be determined as a result of history-dependent strategies by others. Adopting a complete factorial design that includes various forms of repetition and the presence and absence of communication allows us to compare and identify the marginal impacts and interactions of repetition and communication as mechanisms for coordinating resistance against divide-and-conquer. Our findings that repetition is a two-edged sword and has limited effectiveness in deterring divide-and-conquer, and that communication can be informative in the repeated CR game, are both novel empirical results in the literature on indefinitely repeated games.

The rest of this paper is organized as follows. Section 1 introduces the Coordinated Resistance game and discusses how repetition and communication affect behaviour in the CR game. Section 2 discusses the experimental design. Results are presented in Section 3. Section 4 concludes by discussing implications of our findings for the study of DAC and describes directions of future research.

1. Divide-and-Conquer, Social Preferences, Repeated Interaction and Communication

Recall the CR game illustrated in Figure 1.When the leader practices DAC in the one-shot CR game, a beneficiary with standard (own money-maximizing) preferences will always acquiesce, so the victim will also acquiesce. Therefore, DAC can eliminate the threat of joint resistance by the responders. The one-shot CR game thus has three (pure strategy) equilibria, and the total surplus-maximizing outcome No Transgression is not among them.[1] In one equilibrium, the leader transgresses against both responders, with the expectation that this will not be met by coordinated resistance. (Multiple equilibria exist in the top subgame when the leader transgresses against both, so this subgame is a "stag hunt" game.) In the other two equilibria, the leader expects that transgression against both responders will be defeated, and he therefore transgresses against only one of the responders, with the expectation that neither will challenge. Furthermore, since a beneficiary with standard preferences will always prefer to acquiesce and any promise by him that he will challenge DAC is not credible, allowing the responders to engage in non-binding communication should not affect the incidence of transgression in the one-shot CR game.

The recent literature on social preferences (e.g., Camerer, 2003), however, suggests that some beneficiaries may be willing to act against their material interest to challenge DAC even in the one-shot version of this game. For example, some may be altruistic punishers (Fehr and Gächter, 2002, Gintis *et al.*, 2005), who are willing to incur the cost to punish what they regard to be socially undesirable behaviour, even with no scope for repeated interactions. In an earlier study that focuses exclusively on the one-shot CR game, Cason and Mui (2007) found that non-

[1] Allowing for mixed-strategy equilibrium does not change the key implications of the CR game with or without social preferences, so we shall focus on pure-strategy equilibria in the text.

binding (cheap talk) communication modestly reduces the incidence of transgression. This is not predicted in a model with standard preferences, providing initial evidence that social preferences may affect outcomes in this game. Rigdon and Smith (2010) replicate Cason and Mui's (2007) finding that communication reduces transgression, and present results from new treatments providing further evidence that social preferences are important in this new social dilemma.

To see how social preferences can affect coordinated resistance, for simplicity consider the one-shot CR game with social preferences, in which a responder disapproves of the leader's transgression, and her utility is decreasing in the leader's payoff. If this social preference is strong enough, then a beneficiary will be willing to act against her own material interest to challenge the leader's DAC transgression against the other responder when she expects that the victim will also challenge.[2] In the presence of social preferences, when DAC takes place, both (Challenge, Challenge) and (Acquiesce, Acquiesce) are Nash equilibria in the subgame played by the two responders. Therefore, No Transgression can now be supported as an equilibrium in the one-shot CR game, if both responders always challenge when any transgression takes place. While social preferences can transform the DAC subgame into a stag hunt game in utilities, in the absence of any coordinating device the fact that "both acquiesce" and "both challenge" are equilibria implies that coordination failure can still prevent successful joint resistance.[3]

Repeated interaction further complicates the coordination problem faced by the responders, First, note that No Transgression can again be supported as equilibrium in the repeated CR game with social preferences—for example, if both responders always challenge

[2] In a technical appendix available at the journal's online site and at http://users.monash.edu.au/~vlmui/CR_app.pdf, we formally analyse the CR game with social preferences both with and without repetition, and also consider the effects of communication. We also consider the impact of incomplete information, in which an agent can either have social preferences or the standard narrow self-interest preferences, but her "type' is her private information.

[3] This is similar to the coordination problem in the presence of multiple equilibria in earlier experimental studies such as Battalio *et al.* (2001), in which the games considered have multiple equilibria with standard preferences and complete information. As we discuss in the conclusions, publicly observable random events can help solve this coordination problem by correlating resistance strategies.

when any transgression takes place. Repetition, however, also allows the leader to use history-dependent strategies to punish the challenging beneficiary and deter coordinated resistance. To illustrate this observation, consider first the following Divide-and-Conquer equilibrium with Persistent Beneficiary, in which the leader practices DAC against responder A in the first period and will continue to do so in every period, while both responders always acquiesce when facing DAC, but always challenge if the leader transgresses against both of them. In this equilibrium, the leader always chooses B as the beneficiary of DAC, and B does not want to deviate to challenge. Challenging is costly and will not only cause her to suffer a loss in the current period, but is futile and will not lead to coordinated resistance either in the current period or in the future. Importantly, the leader always targets A as the victim in this equilibrium. Therefore, when B challenges in the current period but fails to spark off any coordinated resistance, as the persistent beneficiary B will still get her beneficiary payoff in all future periods. She will get the material payoff as a beneficiary, although she suffers a psychological disutility due to the fact that the leader will now succeed in his transgression.

Now consider the following Divide-and-Conquer equilibrium with Punishment against the Challenging Beneficiary, in which the leader practices DAC against responder A in the first period and will continue to practice DAC against A except when the current beneficiary challenges him. If the beneficiary in the current period (which is B in this case) challenges him, the leader will punish the challenging beneficiary by switching to DAC against B in the next period, and will continue to do so except when challenged by the beneficiary (now A). The responders will always acquiesce when facing DAC but will always challenge if the leader transgresses against both of them. The beneficiary again does not want to deviate to challenge, because the leader will punish any challenging beneficiary in this equilibrium. If a beneficiary challenges, coordinated resistance will still fail in the current period, and the current beneficiary will also then be trapped as a victim of DAC in all future periods. In his pioneering analysis of the repeated CR game, Weingast (1995, 1997) considers a model with standard preferences and focuses on how repetition can allow the victim and the beneficiary to use "trigger strategies" to facilitate coordinated resistance, but does not consider social preferences or how the leader can use history-dependent strategies to punish the challenging beneficiary.[4] The above observations, however, highlight that while repetition may allow the victim and the beneficiary to use history-dependent strategies to facilitate cooperation, repetition also allows the leader to use history-dependent strategies to punish the challenging beneficiary and deter coordinated resistance.

Besides repetition, another mechanism for coordinating resistance is communication between the responders. In particular, suppose that each period, after the leader makes his decision, the two responders can engage in non-binding and private communication to indicate their intentions whether to challenge. While a babbling equilibrium always exists in such cheap talk games, an informative equilibrium also exists in the repeated CR game with social preferences and communication. In the presence of social preferences, the beneficiary will prefer to challenge when she believes that the victim will challenge, and (Challenge, Challenge) is Pareto superior to (Acquiesce, Acquiesce) for the responders. The beneficiary has the incentive to use communication to indicate an intention to challenge, and will also follow-through on her promise to challenge when she believes that her indicated intention changes the behaviour of the victim. Given these considerations, communication is likely to be informative (Farrell and Rabin,

[4] Weingast (1995, 1997) shows that if the CR game is repeated infinitely then sufficiently patient players can adopt the following trigger strategies to support the outcome of (No Transgression, Acquiesce, Acquiesce) as an equilibrium. For the leader: if either A or B acquiesced to any transgression in an earlier period, transgress against both A and B thereafter; otherwise, do not transgress. For responder A (B): if responder B (A) challenges every previous transgression, then challenge any transgression in the current period and acquiesce otherwise; if responder B (A) acquiesces to any previous transgression, then acquiesce thereafter.

1996) and can facilitate coordinated resistance, and the beneficiary's indicated intention is the key in determining the rate of successful joint resistance. Communication is not risky because it is not observable by the leader, so the leader cannot condition his choice on the responders' messages.

Furthermore, communication can help reduce mis-coordinated resistance. In the absence of communication, the victim must decide whether to challenge without knowing the beneficiary's intention. Mis-coordinated resistance happens, for example, in period one when the victim challenges but the beneficiary acquiesces. With communication, however, the victim will not challenge after observing a beneficiary's intention to acquiesce.

2. Experimental Design

To study the effect of repetition and communication on DAC, we employ the CR game developed by Weingast (1995, 1997).[5] We conduct 42 independent sessions across six different repeated game treatments, as summarized in Table 1, involving 378 human subjects. To compare the effect of communication in one-shot game to the effect of repetition, our data analysis also includes two treatments (144 additional subjects) featuring random matching (with and without communication) previously reported in Cason and Mui (2007). The three forms of repetition explore how changes in the length or type of repeated interaction (indefinite or fixed horizon) affect subjects' behaviour. Because the one-shot CR game has multiple equilibria, even with finite repetition and with standard preferences, the No Transgression outcome can be supported as an equilibrium up to the second to the last period (Benoit and Krishna, 1987). Although the

[5] Cason and Mui (2007) and Rigdon and Smith (2010) study the effect of binary restrictive communication in the one-shot CR game, while Cason and Mui (2012) study the effect of free-from communication in the one-shot CR game. Boone *et al.* (2009) and Landeo and Spier (2010) study experimentally how incumbent monopolist can use divide-and-conquer to achieve "naked exclusion" using the model developed by Rasmusen *et al.* (1991). None of these studies, however, consider repetition.

lack of a sharp difference between finite repetition and infinite repetition for games with multiple equilibria is well-recognized; however, as a reflection of our earlier observation that empirical evidence lags behind theories in the study of repeated games, there is little empirical evidence regarding this proposition and our design allows for a direct test.

Subjects were recruited by e-mail and through web page and classroom announcements from the general student population at two large universities, and all were inexperienced in the sense that they participated in only one session of this study. Sessions lasted for at least 48 decision periods. As noted in the introduction, this is one of the first experimental studies to examine the interaction of type of repeated play and communication using a full factorial design.

The experiment instructions, which are available in an online Appendix I along with the experiment data, 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. At the end of every period, subjects learned all actions and monetary payoffs for the three individuals in their group, and they recorded these choices and their own earnings on a hardcopy record sheet. Each session had nine participants, but two sessions were conducted simultaneously so 18 subjects were present for each data collection period. Subject roles remained fixed: leaders always remained leaders, and responders always remained responders throughout the session.

The Random Matching treatments were conducted for 50 periods and serve as the baseline that corresponds most closely to the one-shot game. In these treatments the instructions emphasized that subjects were randomly re-grouped each period. Subjects in the Long Horizon (hereafter LH) Finite Repetition treatment were randomly grouped to form a three-person group in period 1, and these groupings remained fixed for all 50 periods.

In the Indefinite Repetition treatment, groupings lasted for a random number of periods. Subject labels ("Persons" 1, 2 and 3) remained unchanged for all periods of each supergame grouping. At the end of each period in this treatment, the experimenter threw an eight-sided die, and for die rolls of 1, 2, 3, 4, 5, 6 or 7 the groupings remained unchanged for another period. When the die roll was 8 the current grouping was immediately terminated. At that point each participant was randomly re-grouped with two other participants to form a new three-person group. All groupings terminated probabilistically using the die rolls, and no groupings were artificially ended due to time limits.[6] An average of 6 repeated games (max=10, min=3) were conducted per session in this treatment.

In the Equivalent Horizon (hereafter EH) Finite Repetition treatment, subjects were randomly regrouped at the end of every 8^{th} period. The experimenter also made a verbal announcement that regrouping was taking place at these periods. These sessions lasted for 48 total periods (6 repeated games). Since repeated games end with a probability of 1/8 in each period in the Indefinite Repetition treatment, the repeated game has an expected horizon of 8 periods. Dal Bó (2005) argues that to compare the difference between finite and indefinite repetition of a particular game, one should consider a finitely repeated game with a horizon the same as the *expected* horizon of the indefinitely repeated game. In half of the sessions for the EH treatment without communication the subject labels ("Persons" 1, 2 and 3) remained unchanged for all periods of each repeated game grouping, as in the other repeated game treatments. As pointed out earlier, the leader's threat of punishing the challenging beneficiary can deter coordinated resistance. The laboratory approach allows the introduction of counter-factual

[6] We avoided hitting the time constraint through a session termination rule that was explained in the instructions at the beginning of the session: If the total number of periods conducted in the session at the conclusion of a grouping exceeded 49, or if less than 30 minutes remained in the two and a half hour time period reserved for the session, then a new re-grouping was not initiated and the session was terminated.

environments to directly test this observation. In the other half of the sessions of this treatment we added a new information condition in which the responder labels ("Persons" 2 and 3) were randomly re-assigned each period to obscure the individual responder identities from the leader. This removes some of the risk of challenging DAC as a beneficiary and should increase coordinated resistance.

In the communication treatments, after learning the leader's decision, the responders simultaneously sent a binary message to the other responder in their group in each period: a nonbinding "intended" choice (either X or Y), prior to making the actual challenge or acquiesce decision. The leader knew that responders communicate with each other prior to making decisions, but did not observe the messages.

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.[7] Exchange rates were chosen before 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

Figure 2 presents the time series of the rate the leaders transgress, separately for all eight

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

treatments. Leader transgressions are overwhelmingly the divide-and-conquer type, and transgression against both responders is uncommon. Nearly half of the attempts to transgress against both responders occur in periods 1 through 10, but these transgressions are met with successful coordinated resistance 69 per cent of the time. This discourages leaders from pursuing this most aggressive type of transgression, and after these initial 10 periods 95.5 per cent of the transgressions are the DAC type. In our analysis below, we shall focus on DAC. We begin by documenting that leaders target beneficiaries who previously challenge DAC, and that successful joint resistance reduces transgression. Section 3.2 reports how repetition and communication affects resistance behaviour. Section 3.3 compares leader transgression rates across treatments.

3.1. *Leader Responses to Histories in the Repeated Games*

FINDING 1. *Leaders target beneficiaries who previously challenge DAC, and a history of past resistance within a repeated game increases the likelihood of converging to the outcome with No Transgression.*

<u>Support:</u> As discussed above, repetition allows the leader to employ a "punishing the challenging beneficiary" strategy to deter resistance. The evidence indicates that leaders target beneficiaries who resist earlier DAC. Consider first the EH Finite Repetition treatment, since it provides a large number of repeated games of a fixed length. Define a repeated game that converges to transgression in this treatment as one with leader transgression in 6 or more out of its 8 periods. In 9 of these repeated games the leader chose DAC in the first period and experienced resistance by only the beneficiary, and he switched to target that beneficiary with the alternative DAC in 8 of these 9 cases (89 per cent). Similarly, in 13 of these repeated games the leader chose DAC in the first period and experienced joint resistance by the beneficiary and victim, and he switched to target the beneficiary with the alternative DAC in 10 of these 13 cases

(77 per cent). The leader responses in the other repeated game treatments are similar, and the first column of Table 2 provides evidence using a logit regression employing data from all of these treatments. It shows that the leader is significantly more likely to switch to the alternative DAC rather than remain with the same DAC following beneficiary resistance.

To address the second part of Finding 1, again first consider the eight-period repeated games of the EH Finite Repetition treatment. We can define a No Transgression repeated game as one without any transgression in at least half the periods, including the final (eighth) period. The leader tried DAC in at least one earlier period in 30 of these repeated games, and she encountered beneficiary resistance in 26 of these cases (87 per cent). Early beneficiary resistance is therefore strongly associated with eliminating transgression in the repeated game. The definition of a No Transgression repeated game is less straightforward in the Indefinite Horizon treatment because of its differing period lengths, and the LH Finite Repetition treatment provides few repeated games. Those repeated game treatments nevertheless provide qualitatively similar results. For example, the second column of Table 2 reports a logit regression that pools across repeated game treatments and indicates that leaders are significantly more likely to switch to No Transgression following beneficiary resistance.

3.2. *Resistance in the Divide-and-Conquer Subgames*

Having established that leaders target the challenging beneficiaries in the repeated games, we next turn to evaluate empirically whether joint resistance rates differ in the repeated game from the one-shot game baseline. We expect that joint resistance should occur more often in early rounds of a given repeated game: In later rounds of a repeated game, responders have either succeeded in coordinated resistance and the leader will no longer be practicing DAC, or they have failed, in which case the leader will be successfully transgressing and the responders will have given up resisting. This suggests a selection bias, in that DAC that are observed in the later rounds of a repeated game should be significantly less likely to be successfully resisted.

FINDING 2. *Successful resistance to DAC transgression occurs more frequently in the early rounds of the repeated games than the later rounds, both with and without communication. Repetition also increases joint resistance for the early rounds compared to the random matching baseline with communication.*

Support: Figure 3 illustrates the decline in the successful joint resistance rate in each of the first 8 rounds of the repeated games, separately for the Communication and the No Communication treatments. This figure includes the EH Finite and Indefinite Repetition conditions (pooled), and excludes the initial periods 1-16 of each session to eliminate the initial repeated games that are strongly influenced by subject learning. The joint resistance rate declines across periods in all cases, and is substantially greater in the Communication condition (the solid line labelled with triangles), as well as in the EH Finite Repetition condition with responder labels reassigned. In this latter follow-up repeated game treatment responders could not communicate, but the label reassignment obscured the beneficiary's identity from the leader. This latter result provides the first evidence that resistance is more common in the early periods of a repeated game when the leader is unable to target challenging beneficiaries.

For statistical support for Finding 2, define the first 3 rounds as the early repeated game rounds, and after round 3 as later repeated game rounds. The joint resistance rate is higher in the early rounds than the late rounds in all 6 individual sessions for Indefinite Repetition/Communication, and in 5 of the 6 individual sessions for EH Finite Repetition/ Communication (pairwise Mann-Whitney n=6 one-tailed p-value<0.05 for both). In the No Communication treatment the joint resistance rate is higher in the early rounds than the late rounds in 5 of the 6 individual sessions for EH Finite Repetition (pairwise Mann-Whitney n=6 one-tailed p-value<0.05).[8] For the EH Finite Repetition with responder labels randomly reassigned, the joint resistance rate is higher in the early rounds than the late rounds in all 6 individual sessions, also leading to a significant difference (p-value<0.05).

Repetition also increases successful joint resistance in the Communication treatments during the early rounds of the repeated game, but not in the later rounds, relative to the Random Matching/Communication treatment. The overall joint resistance rate in the early rounds of a specific repeated game (after dropping the first 16 periods to exclude the initial repeated games, as above) is 33.0 per cent in Indefinite Repetition/Communication and 26.4 per cent in EH Finite Repetition/Communication. Both of these are significantly higher than the joint resistance rate of 12.6 per cent for the Random Matching/Communication treatment (U=6.5 and U=11; n=8, m=6, one-tailed p-value<0.05 for both). The joint resistance rate during the later rounds of a specific repeated game is 16.3 per cent in Indefinite Repetition and 11.3 per cent in EH Finite Repetition. Neither of these are different from the 12.6 per cent rate in the Random Matching/ Communication treatment (U=18 and U=21; n=8, m=6, one-tailed p-value<0.05 for both).

Our next result establishes a link between earlier and later period resistance.

FINDING 3. *In all repeated games treatments without communication, earlier period resistance to DAC transgression significantly increases resistance to later DAC transgression.*

Support: Table 3 presents fixed effects logit models of DAC resistance for the three repeated game treatments without communication to evaluate whether repetition enables responders to use their action to coordinate future resistance in the absence of communication.

[8] Only two of the six sessions in the Indefinite Repetition No Communication treatment have early round DAC transgressions to resist, so a statistical test is not possible in that treatment.

Only DAC that are immediately preceded by a DAC are included for these model estimates.[9] The table shows that resistance to DAC transgression in the previous period of that same repeated game strongly influences later resistance. Note, however, the previous challenge by a beneficiary is more important in affecting future resistance, and in several columns of Table 3 the victim-only resistance indicators appear weaker than the other types of previous resistance.

We have shown that leaders target challenging beneficiaries in repeated game treatments. Our follow-up treatment with random reassignment of responder identity provides additional direct evidence that the leaders' threat of punishing the challenging beneficiaries deters resistance.

FINDING 4. *Beneficiary resistance and joint, coordinated challenge is greater in the follow-up treatment that randomly re-assigns responder labels, relative to the comparable EH Finite Repetition with responder identities fixed throughout each repeated game.*

Support: Random reassignment of responder identity prevents the leader from targeting challenging beneficiaries. This nearly triples the DAC joint resistance rate during the later periods 21-48 of the sessions, from 8.4 per cent to 24.8 per cent in the EH Finite/No Communication treatment. This difference is statistically significant based on a Mann-Whitney test that employs independent sessions as the unit of observation (one-tailed p-value<0.05). This higher joint resistance rate arises from a large increase in the frequency of beneficiary resistance when the beneficiary's identity is hidden from the leader, from 12.8 per cent to 30.2 per cent. This difference is highly significant (Mann-Whitney one-tailed p-value<0.01).

As discussed in section 1, private communication that is not observed by the leader, however, provides another coordinating device for the victim and the beneficiary. Even in the

[9] We include a dummy variable for the first three rounds of each repeated game since (as just documented) the resistance rate varies within the repeated game, as well as a time trend 1/period to control for overall learning patterns within a session.

presence of repeated interaction, this non-binding communication facilitates joint resistance. Table 4 displays the joint resistance rates for each session for the later periods, and a comparison of the two columns indicates that communication improves coordination in the repeated game, and these differences are highly significant in the EH Finite and Indefinite Repetition treatments (Mann-Whitney *p*-values<0.05). Furthermore, the "intended choice" communicated by the beneficiary is critical. Communication also reduces the incidence of mis-coordinated resistance, and increases joint resistance in the first period of a repeated game.

FINDING 5. *The "intended choice" communicated by the beneficiary is most important for increasing resistance to DAC transgression, and communication reduces the mis-coordinated resistance rate.*

Support: Table 5 displays the different combinations of intended resistance to DAC transgression communicated in the four treatments that featured communication, as well as the resulting frequencies of actual coordinated resistance. Figure 4 indicates that victims of DAC transgressions challenge about 30 to 60 per cent of the time, and beneficiaries challenge about 10 to 30 per cent of the time. Table 5 indicates that communication helps coordinate successful resistance. Rows 1 and 2 show that successful joint resistance never occurs more than 4 per cent of the time when the beneficiary does not signal intended resistance. By contrast, row 4 shows that successful joint resistance occurs 48 to 70 per cent of the time when both responders indicate intended resistance. Even when only the beneficiary indicates an intention to resist, the successful joint resistance rate reaches about 30 per cent in the finite horizon treatments.

Table 6 presents statistical support for the conclusion that both victims and beneficiaries choose to resist a DAC transgression when the beneficiary or (especially) when both responders indicate that they intend to resist. These fixed effects logit models indicate that the likelihood of actual resistance for both victims and beneficiaries is always significantly higher when only the beneficiary or when both responders indicate an intention to resist, compared to the omitted case of no intended resistance. The beneficiary's intention apparently plays a more important role to facilitate coordinated resistance, since the impact of the victims' intention is always smaller and sometimes insignificant.

As discussed in section 1, communication can reduce mis-coordinated resistance. The data provide clear evidence that mis-coordinated resistance to DAC is less common in the communication treatments, falling from a range of 28 – 42 per cent in treatments without communication to 22 – 29 per cent in treatments with communication. A random effects logit model that controls for the different matching protocols and an overall time trend indicates that this reduction in miscoordination is highly significant (p-value<0.001). Considering only the first period of the match (to remove repeated interactions that can also convey information), this reduction in miscoordination due to communication is statistically significant for each matching protocol individually even based on very conservative nonparametric Mann-Whitney tests (one-tailed p-values are 0.018 for EH Finite Repetition, 0.027 for Indefinite Repetition, 0.033 for LH Finite Repetition, and 0.037 for the Random Matching baseline).

Finding 5 shows that communication can be informative even in the presence of repetition. The following result confirms that even in the presence of repetition, by being less risky and informative, communication further increases joint resistance.

FINDING 6. *Even in the presence of repetition,* a*dding communication increases responders' resistance substantially. Furthermore, communication is more effective than the history of past resistance to coordinate responders' current resistance.*

<u>Support:</u> The top three rows of Table 7 report that previous period resistance has a

weaker influence on current resistance in the Communication treatments. The logit models in this table include both the previous resistance as well as the current period communications, essentially combining the explanatory variables used in Tables 3 and 6. Current period resistance is systematically more likely only when both responders resisted in the previous period. By contrast, the variables representing different intention messages shown in the middle of the table indicate that both responders always strongly increase actual resistance when the beneficiary alone, or both responders, indicate an intention to resist. Likelihood ratio tests shown toward the bottom of this table indicate that the communications are always jointly highly significant determinants of both victim and beneficiary resistance, but previous period resistance sometimes has an insignificant influence on current resistance. Our findings suggest that earlier action of resistance help coordinate resistance in the current period. However, the result here also suggests that while earlier action of resistance helps coordinate future behaviour, the presence of multiple equilibria in repeated game makes them imperfect indicators for future intentions, and non-binding communication provides a clearer signal about intentions in the current period and is extremely helpful in facilitating coordination.

3.3. *Overall Transgression Rate*

We conclude with a summary of the implications of the resistance and DAC rates on overall performance, as summarized by the transgression rate.

FINDING 7. *Repetition alone reduces the rate that leaders transgress, but no significant differences exist in overall DAC rates between the different repeated game treatments.*

Support: Table 8 presents the DAC rates for each individual session for the later periods. Considerable variation exists across sessions within all treatment conditions. In the repeated game treatments without communication, averaged across sessions, transgression occurs 92.5 per cent of the time in the Random Matching/No Communication baseline shown on the upper left. Adding repetition decreases transgression, with a highly significant decrease to 67.4 per cent for LH Finite Repetition (Mann-Whitney U=7.5; for sample sizes n=8, m=6, one-tailed p-value<0.05) and a marginally significant decrease to 79.8 per cent for EH Finite Repetition (U=13; one-tailed p-value<0.10), but no significant change for Indefinite Repetition (U=25; *ns*). We employ one-tailed tests because the research hypothesis is that communication and repetition will increase resistance and reduce transgression.

As discussed in section 2, although the theoretical insight by Benoit and Krishna (1987) regarding the lack of sharp difference between finite repetition and infinite repetition for games with multiple equilibria is well-recognized, there is not much direct empirical evidence regarding this proposition. Although not a main focus of our study, our experiment provides direct evidence for this theoretical insight. In particular, although transgression rates are higher in the Indefinite Repetition treatment (87.9 per cent) than both of the Finite Repetition treatments, these differences are not statistically significant (Mann-Whitney two-tailed p-values=0.15).

We have reported a rich set of behavioural evidence supporting the insight that the leader's threat of punishing the challenging beneficiaries limits the effectiveness of repetition alone in facilitating coordinated resistance against DAC. We also find empirically that communication is informative, and can increase coordinated resistance even in the presence of repetition. We conclude by reporting that these properties of repetition and communication as mechanisms for coordinating resistance are reflected in their effects on transgression rates.

FINDING 8. *Repetition alone is no more effective than communication alone in reducing transgression. Holding the matching protocol constant, adding communication always reduces the transgression rate.*

Support: Adding communication, even in the Random Matching environment, results in a highly significant decrease in transgression (U=10; n=m=8, one-tailed p-value<0.05). Importantly, the transgression rate in the Random Matching/Communication treatment (75.3 per cent overall) is not significantly different from the best repeated play no communication treatment (LH Finite Repetition, at 67.4 per cent), indicating that communication alone is at least as effective as repetition in reducing transgression (U=20; *ns*).

The interaction of communication and repetition decreases transgression even further, and in these late periods the transgression rate falls below 45 per cent in the LH Finite Repetition/Communication treatment. This is significantly less than the Random Matching/ Communication level (U=10; one-tailed p-value<0.05). The other two repetition and communication treatments result in marginally significant decreases in transgression relative to the Random Matching/Communication level (U=12 and U=12.5; both one-tailed p-value<0.10), but all communication/repetition treatments have significantly less transgression than the Random Matching/No Communication baseline.

Adding communication, holding the matching protocol constant, also usually reduces the transgression rate significantly. In particular, the decrease in transgression from adding communication is highly significant for Random Matching (U=10; n=m=8, one-tailed p-value<0.05), Indefinite Repetition (U=3; n=m=6, one-tailed p-value<0.01) and LH Finite Repetition (Mann-Whitney approximation z=1.78; n=m=18, one-tailed p-value<0.05).[10] The decrease is marginally significant for EH Finite Repetition (U=8; n=m=6, one-tailed p-value<0.10).

[10] Each grouping of three subjects is statistically independent in the LH Finite Repetition treatment because subjects are never regrouped. This leads to 18 independent observations per treatment for this matching protocol.

4. Conclusions

Since the seminal work of North and Weingast (1989), an important economic literature has argued that the successful deterrence of leader expropriation is necessary for economic development. Deterring leader transgression, however, is difficult, especially when the leader can practice divide-and-conquer. In his influential work on divide-and-conquer, Weingast (1995, 1997) focuses on how repetition may enable victims and beneficiaries of DAC to use history-dependent strategies to facilitate cooperation to defeat DAC, but he does not consider how repetition can also enable the leader to use history-dependent strategies to punish beneficiaries who refuse to cooperate with him. Besides this neglect on how the threat of punishing the challenging beneficiary may deter coordinated resistance even in the presence of repetition, the literature on leader expropriation also does not consider social preferences.

Using a laboratory CR game, this paper presents experimental evidence that repetition is a two-edged sword in affecting cooperation in this setting. This study is the first to provide empirical support to the novel observation that even in the presence of social preferences, repetition alone can be of limited effectiveness in deterring divide-and-conquer. This result, together with our other findings showing that communication can be informative and significantly reduce DAC even in the presence of repetition, strongly suggests that research seeking to identify mechanisms that can deter divide-and-conquer should avoid focusing on repetition alone. Instead, we should consider repetition in conjunction with communication, or repetition in conjunction with other mechanisms that may enable potential challengers of DAC to coordinate their actions.

This study also contributes to the emerging experimental literature on indefinitely repeated games. As discussed in the introduction, our empirical knowledge about indefinitely repeated games lags significantly behind the theoretical literature, and the small number of experimental studies on indefinitely repeated games focus on the prisoner's dilemma and public good games where there is no asymmetry between the roles of players. Most existing work also does not consider the interaction between communication and repetition. Our findings regarding this DAC social dilemma that has interesting endogenous role asymmetry constitute novel empirical results in the literature on indefinitely repeated games. We hope that these results will stimulate interest in studying additional rich and under-explored classes of repeated games with endogenous roles.

Our results also reveal that non-binding communication can be informative and effective in facilitating coordinated challenge even in the presence of repeated interaction. Compared to coordination through costly actions, communication provides victims and beneficiaries with a less costly means to coordinate their actions, and when it is not observed by the leader, is also safer than costly observable actions that can be used by the leader to target the challenging beneficiary. Our results naturally imply that political and organizational leaders have the incentive to make communication between their subordinates observable, and such information can be used to implement the punishing the challenging beneficiary strategy to deter coordinated resistance against divide-and-conquer.

For example, the Chinese government has recently mandated that users of Twitter-like micro blog websites must authenticate their identity with official documents bearing their real names before they can send any messages, leading to serious concern that such regulation will significantly deter communication through micro blogs (Phys. Org, 2012). As discussed in the introduction, organizational leaders, similar to political leaders, also frequently employ divide-and-conquer strategies. For example, the management of a firm may use divide-and-conquer to prevent coordinated resistance by unions. Interestingly, the issue of whether employees can use company emails to promote union activities has been the subject of a recent high profile lawsuit (*Guard Publishing Company v. NLRB,* see, for example, the report by the US Chamber of Commerce, 2010). The policy and legal implications for employers who observe employees' personal information about trade union membership or their discussions about union activities by monitoring personal communication through the company network are the subject of debates by scholars and practitioners in the UK (Oliver, 2002) and the US (DelPo and Guerin, 2011). In future work, we plan to study what happens in the repeated CR game if the leader can invest resources to observe stochastically the communication between responders, and also investigate to what extent that victims and beneficiaries can solve the "higher order" coordinated resistance problem of coordinating to resist such attempts by the leader.

Finally, future research can investigate the role of publicly observed random events as coordinating devices in facilitating coordinated resistance against DAC. The importance of random events in triggering citizen revolts has been widely recognized. For example, Zuo and Benford (1995) discuss how the death of the ousted reformer leader Hu Yaobang triggered the massive protests that ended with the Tiananmen Square Massacre in China in 1989. Egorov *et al.* (2009) observe that a dictator's decision regarding media censorship is affected by the concern that media report of policy failures may facilitate citizen revolt. Shadmehr and Bernhardt (2011) study the role of public signals in coordinating citizen revolt in the presence of payoff uncertainty. In the CR game, social preferences can transform the subgame played by the victim and the beneficiary when the leader practices DAC into a stag hunt game, in which both (Challenge, Challenge) and (Acquiesce, Acquiesce) are Nash equilibria. Therefore, if a publicly observed random event can take place after the leader engages in divide-and-conquer, it is natural to consider a correlated equilibrium (Aumann, 1974) in which the victim and the beneficiary can use this random event as a coordinating device. For example, the victim and the beneficiary can coordinate on the (Challenge, Challenge) equilibrium when the random event occurs, and otherwise coordinate on the (Acquiesce, Acquiesce) equilibrium.

If this random event occurs with a sufficiently high probability, then the availability of such a coordinating device can deter the leader from practicing divide-and-conquer. While the importance of random events in triggering popular revolts is widely recognized, to our knowledge no study relates this observation to correlated equilibrium and empirically investigates how the likelihood of these events affect leader transgression and coordinated resistance. One possible reason for the absence of such studies is that the probabilities of the occurrence of such events can be correlated with other factors that can potentially affect leader and citizen behaviour in the field, leading to classic identification problems. The control available in the laboratory provides a useful setting to understand better the causal effects of such random events for coordinated resistance against divide-and-conquer, and we leave this question for future research.

Table 1

Experimental Design (522 Total Subjects)

	No Communication	Communication
Long Horizon Finite Repetition (50 Periods)	6 Sessions (54 Subjects) 2 at Monash Univ., 4 at Purdue Univ.	6 Sessions (54 Subjects) 2 at Monash Univ., 4 at Purdue Univ.
Equivalent Horizon Finite Repetition (8 Periods)	12 Sessions[a] (108 Subjects) 6 at Monash Univ., 6 at Purdue Univ.	6 Sessions (54 Subjects) 2 at Monash Univ., 4 at Purdue Univ.
Indefinite Repetition (7/8 probability of continuation)	6 Sessions (54 Subjects) 2 at Monash Univ., 4 at Purdue Univ.	6 Sessions (54 Subjects) 2 at Monash Univ., 4 at Purdue Univ.
Random Matching[b] (50 Total Periods)	8 Sessions (72 Subjects) 6 at Monash Univ., 2 at Purdue Univ.	8 Sessions (72 Subjects) 6 at Monash Univ., 2 at Purdue Univ.

[a] Six of the 12 sessions in this No Communication, Equivalent Horizon Finite Repetition treatment were conducted with responder labels randomly re-assigned each period to obscure responder identity from the leader, as discussed in the text.

[b] Data from the two Random Matching treatments were previously reported in Cason and Mui (2007).

Table 2

Fixed Effects Logit Models of Leader Transgression Decisions: Repeated Game Treatments

Resistance in Previous DAC Transgression of this Match:	Dependent Variable: Leader switches to DAC against other responder	Dependent Variable: Leader switches to No Transgression
Victim Resisted	0.099 (0.160)	0.139 (0.198)
Beneficiary Resisted	0.845** (0.221)	0.803** (0.231)
Log likelihood	-513.1	-333.0
Observations	1195	1027

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

Table 3

Fixed Effects Logit Models of DAC Challenge Decision Based on Previous DAC Challenges within Current Repeated game: No Communication Treatments

Dependent Variable = 1 if Responder Challenges a DAC Transgression

	Indefinite Repetition		Equiv. Horizon Finite		Long Horizon Finite		Resp. Labels Reassigned	
Resistance in Previous DAC Transgression of this Match:	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge
Only Victim Resisted	1.31** (0.25)	0.58 (0.45)	1.02** (0.26)	1.16* (0.56)	0.81** (0.31)	1.54** (0.56)	0.58* (0.029)	-0.05 (0.40)
Only Beneficiary Resisted	1.08* (0.53)	-0.12 (0.82)	1.88** (0.63)	1.63* (0.78)	1.96** (0.65)	1.82* (0.81)	1.35** (0.45)	0.48 (0.52)
Both Responders Resisted	1.87** (0.55)	-1.17 (1.15)	2.63** (0.57)	3.43** (0.71)	2.05** (0.66)	1.90** (0.70)	4.47** (1.11)	2.32** (0.55)
1/period	5.05* (2.19)	5.32† (2.86)	3.37† (1.90)	2.27 (2.01)	7.05* (3.21)	2.97 (3.78)	1.64 (1.89)	-1.94 (1.85)
Early 3 rounds dummy var.	0.12 (0.36)	-0.36 (0.56)	0.25 (0.26)	-0.14 (0.42)	-2.09† (1.23)	-2.87† (1.73)	0.25 (0.30)	0.39 (0.37)
Log likelihood	-212.0	-83.6	-177.7	-62.5	-140.0	-67.3	-134.4	-86.1
Observations	533	272	431	266	404	215	336	247

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).

Table 4

Rates for Independent Sessions that Responders Successfully Jointly Resist a Divide-and-Conquer Transgression (Sessions ordered highest to lowest)

	No Communication	Communication
	23.7%	43.1%
Random	15.0%	24.3%
Matching	8.9%	21.2%
(one-shot)	4.4%	12.7%
	3.4%	8.5%
	1.2%	4.8%
	0.0%	2.6%
	0.0%	1.2%
Treatment Average	**7.1%**	**14.8%**
	34.8%	88.9%
Long Horizon	25.8%	15.0%
Finite Repetition	11.7%	14.0%
(50 periods)	8.1%	10.8%
	3.6%	5.7%
	0.0%	0.0%
Treatment Average	**14.0%**	**22.4%**
	18.5%	26.5%
Equivalent Horizon	11.5%	21.6%
Finite Repetition	9.5%	17.3%
(8 periods)	6.2%	12.5%
	3.2%	9.9%
	1.3%	8.1%
Treatment Average	**8.4%**	**16.0%**
Indefinite	28.9%	57.1%
Repetition	12.6%	36.0%
(7/8 probability	6.3%	25.0%
of continuation,	5.3%	17.5%
8 periods in	1.9%	17.1%
expectation)	1.7%	8.9%
Treatment Average	**9.5%**	**26.9%**

Note: The early periods 1-20 are excluded from these calculations.

Table 5

Successful Resistance Rates for Different Combinations of Messages, Divide-and Conquer Transgressions

	Message Combination:	Random Matching	Indefinite Repetition	Equivalent Horizon Finite	Long Horizon Finite
(1)	Neither Responder	0/141	0/73	0/105	0/142
	Indicates Resistance	0.0%	0.0%	0.0%	0.0%
(2)	Only Victim	5/443	7/263	9/246	4/155
	Indicates Resistance	1.1%	2.7%	3.7%	2.6%
(3)	Only Beneficiary	9/78	5/33	11/38	8/24
	Indicates Resistance	11.5%	15.2%	28.9%	33.3%
(4)	Both Responders	110/228	91/140	80/115	56/88
	Indicate Resistance	48.2%	65.0%	69.6%	63.6%

Table 6

Fixed Effects Logit Models of DAC Challenge Decision Based on Communicated Messages

Dependent Variable = 1 if Responder Challenges a DAC Transgression

	Random Matching		Indefinite Repetition		Equiv. Horizon Finite		Long Horizon Finite	
Message Combinations:	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge
Only Victim	0.12	0.07	1.84**	0.23	2.33**	1.18	1.88**	0.73
Indicates Resistance	(0.35)	(0.59)	(0.56)	(0.83)	(0.51)	(1.07)	(0.46)	(1.17)
Only Beneficiary	1.45**	1.74**	3.01**	2.44**	2.56**	4.71**	2.25**	4.49**
Indicates Resistance	(0.39)	(0.61)	(0.69)	(0.94)	(0.63)	(1.18)	(0.63)	(1.29)
Both Responders	4.01**	3.23**	5.74**	4.46**	6.35**	4.83**	6.80**	4.78**
Indicate Resistance	(0.42)	(0.59)	(0.68)	(0.85)	(0.75)	(1.11)	(1.13)	(1.15)
1/period	4.19**	2.21*	0.43	-0.82	0.49	0.55	4.68*	3.36
	(0.83)	(0.98)	(0.89)	(1.02)	(0.91)	(0.91)	(2.20)	(2.67)
Early 3 rounds			0.51†	0.79*	0.18	0.59	-1.00	0.22
dummy var.			(0.30)	(0.38)	(0.29)	(0.39)	(1.37)	(1.80)
Log likelihood	-250.8	-127.7	-142.6	-84.7	-127.7	-68.6	-97.9	-46.4
Observations	855	464	500	458	479	331	376	235

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).

Table 7: ***Fixed Effects Logit Models of DAC Challenge Decision Based on Previous DAC Challenges within Current Repeated game and Current Period Messages Communicated***
Dependent Variable = 1 if Responder Challenges a DAC Transgression

	Indefinite Repetition				Equiv. Horizon Finite				Long Horizon Finite			
Resistance to Previous DAC Transgression:	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge	Victim Challenge	Beneficiary Challenge
Only Victim	0.32	0.29	-0.02	0.19	0.85*	0.06	0.97*	-0.75	-0.48	-1.06	-0.44	-1.44
Resisted	(0.30)	(0.47)	(0.39)	(0.65)	(0.35)	(0.48)	(0.48)	(0.61)	(0.43)	(0.67)	(0.50)	(0.87)
Only Beneficiary	2.89*	1.60†	2.36*	0.72	2.18†	0.46	1.97	0.00	1.14	-0.22	0.90	-1.44
Resisted	(1.17)	(0.91)	(1.20)	(1.30)	(1.26)	(0.96)	(1.39)	(1.06)	(1.40)	(1.21)	(1.53)	(3.15)
Both Responders	2.33**	1.89**	1.60**	0.86	3.39**	0.43	2.64**	-0.89	2.92**	2.03**	2.05*	2.19*
Resisted	(0.45)	(0.46)	(0.56)	(0.74)	(0.81)	(0.62)	(0.93)	(0.86)	(0.76)	(0.69)	(0.87)	(1.09)
Messages:												
Only Victim			1.52*	0.04			2.36**	1.38			0.72	-1.03
Indicates Resistance			(0.60)	(1.23)			(0.65)	(1.15)			(0.54)	(1.25)
Only Beneficiary			2.29**	3.08*			2.90**	4.83**			1.56*	7.55*
Indicates Resistance			(0.82)	(1.51)			(0.75)	(1.37)			(0.73)	(3.13)
Both Responders			5.15**	6.02**			6.14**	4.32**			4.82**	7.01*
Indicate Resistance			(0.75)	(1.60)			(1.02)	(1.23)			(0.94)	(2.87)
1/period	0.11	0.86	1.35	2.52	1.48	1.49	-0.31	3.04	7.25†	7.24	9.28*	22.1*
	(1.73)	(1.83)	(2.74)	(3.27)	(1.96)	(2.18)	(2.96)	(2.23)	(4.12)	(4.75)	(4.41)	(9.46)
Early 3 rounds	0.64†	0.69†	0.30	0.78	0.65*	0.50	0.35	0.69	-1.92	-0.13	-2.59	-2.17
dummy var.	(0.33)	(0.40)	(0.42)	(0.55)	(0.33)	(0.40)	(0.42)	(0.54)	(1.76)	(1.66)	(1.94)	(2.19)
LR test: Previous DAC resist terms jointly insignificant			12.8*	1.4			12.0*	2.0			8.6†	9.2†
LR test: Current cheap talk terms jointly insignificant			108.6**	81.6**			70.8**	43.0**			49.4**	52.4**
Log likelihood	-146.9	-76.9	-92.6	-36.1	-95.9	-60.8	-60.5	-39.3	-89.8	-47.1	-65.1	-20.9
Observations	368	308	368	308	305	182	305	182	277	158	277	158

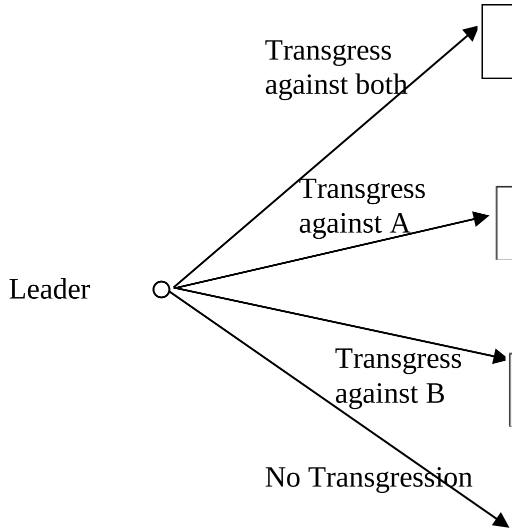
Notes: All models are estimated with subject fixed effects. Some subjects were dropped due to zero variation in challenge decision. Standard errors are shown in parentheses. ** denotes significance at the one-percent level; * denotes significance at the five-percent level; † denotes significance at the ten-percent level (all two-tailed tests). The likelihood ratio (LR) test statistics are distributed χ^2(3 d.f.).

Table 8

Rates for Independent Sessions that Leaders Transgressed (Sessions ordered lowest to highest)

	No Communication	Communication
	66.7%	37.8%
Random	90.0%	56.7%
Matching	91.1%	65.6%
(one-shot)	94.4%	77.8%
	97.8%	86.7%
	100.0%	87.8%
	100.0%	93.3%
	100.0%	96.7%
Treatment Average	**92.5%**	**75.3%**
	41.1%	10.0%
Long Horizon	43.3%	22.2%
Finite Repetition	66.7%	38.9%
(50 periods)	68.9%	47.8%
	85.6%	52.2%
	98.9%	94.4%
Treatment Average	**67.4%**	**44.3%**
	34.5%	44.0%
Equivalent Horizon	77.4%	51.2%
Finite Repetition	78.6%	58.3%
(8 periods)	92.9%	60.7%
	97.6%	61.9%
	97.6%	84.5%
Treatment Average	**79.8%**	**60.1%**
Indefinite	40.4%	15.1%
Repetition	93.3%	28.0%
(7/8 probability	95.7%	38.9%
of continuation,	98.2%	77.8%
8 periods in	100.0%	78.4%
expectation)	100.0%	81.4%
Treatment Average	**87.9%**	**53.2%**

Note: The early periods 1-20 are excluded from these calculations.



Transgress against both

		Responder B: Acquiesce	Responder B: Challenge
Responder A	Acquiesce	12, 2, 2	12, 2, 1
	Challenge	12, 1, 2	0, 7, 7

Transgress against A

		Responder B: Acquiesce	Responder B: Challenge
Responder A	Acquiesce	8, 2, 9	8, 2, 8
	Challenge	8, 1, 9	0, 7, 7

Transgress against B

		Responder B: Acquiesce	Responder B: Challenge
Responder A	Acquiesce	8, 9, 2	8, 9, 1
	Challenge	8, 8, 2	0, 7, 7

No Transgression

		Responder B: Acquiesce	Responder B: Challenge
Responder A	Acquiesce	6, 8, 8	6, 8, 7
	Challenge	6 ,7, 8	0, 7, 7

Fig. 1. ***The Divide-and-Conquer Coordinated Resistance Game (payoffs are for (Leader, Responder A, Responder B))***

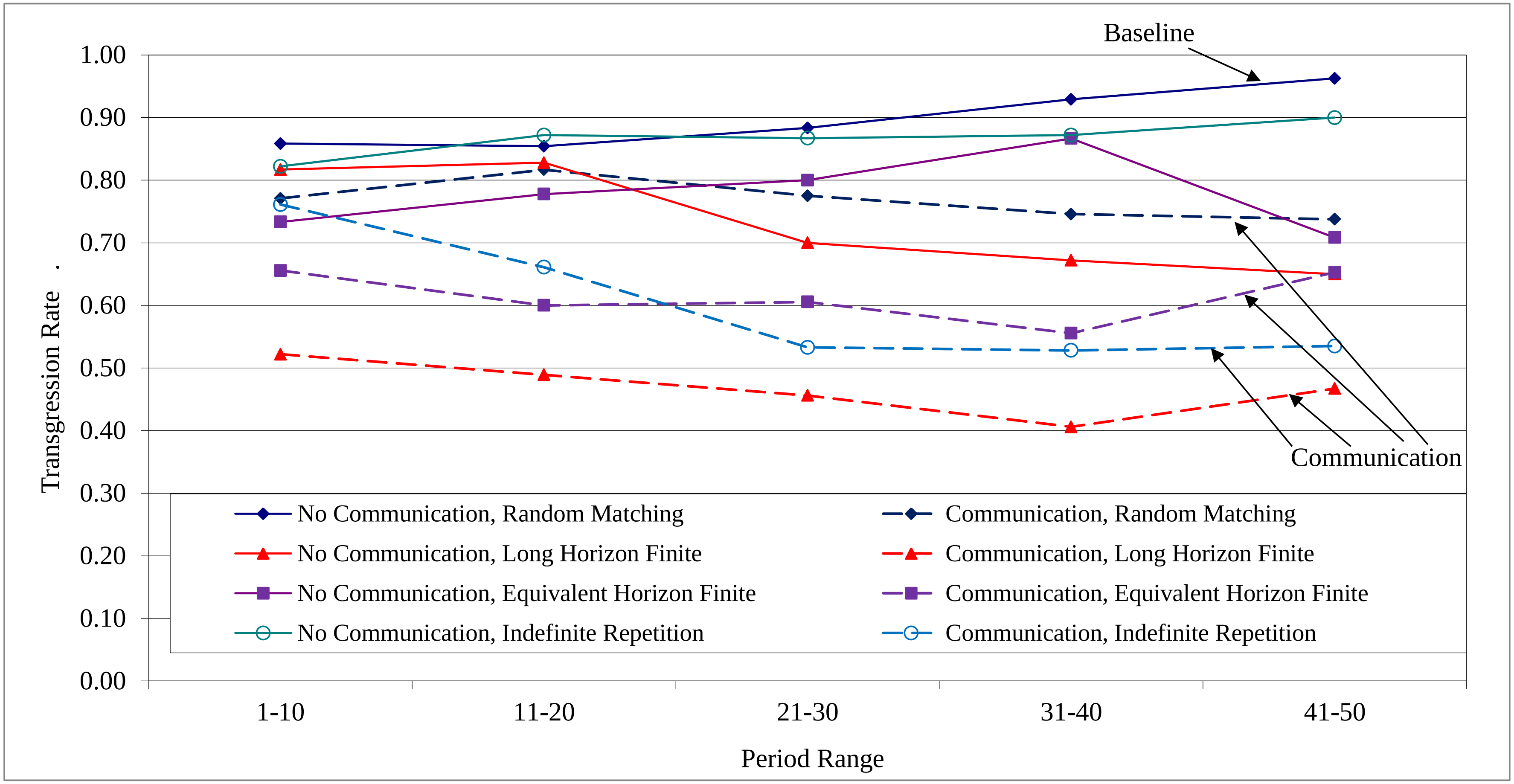


Fig. 2. ***Transgression Rates for All Treatments***

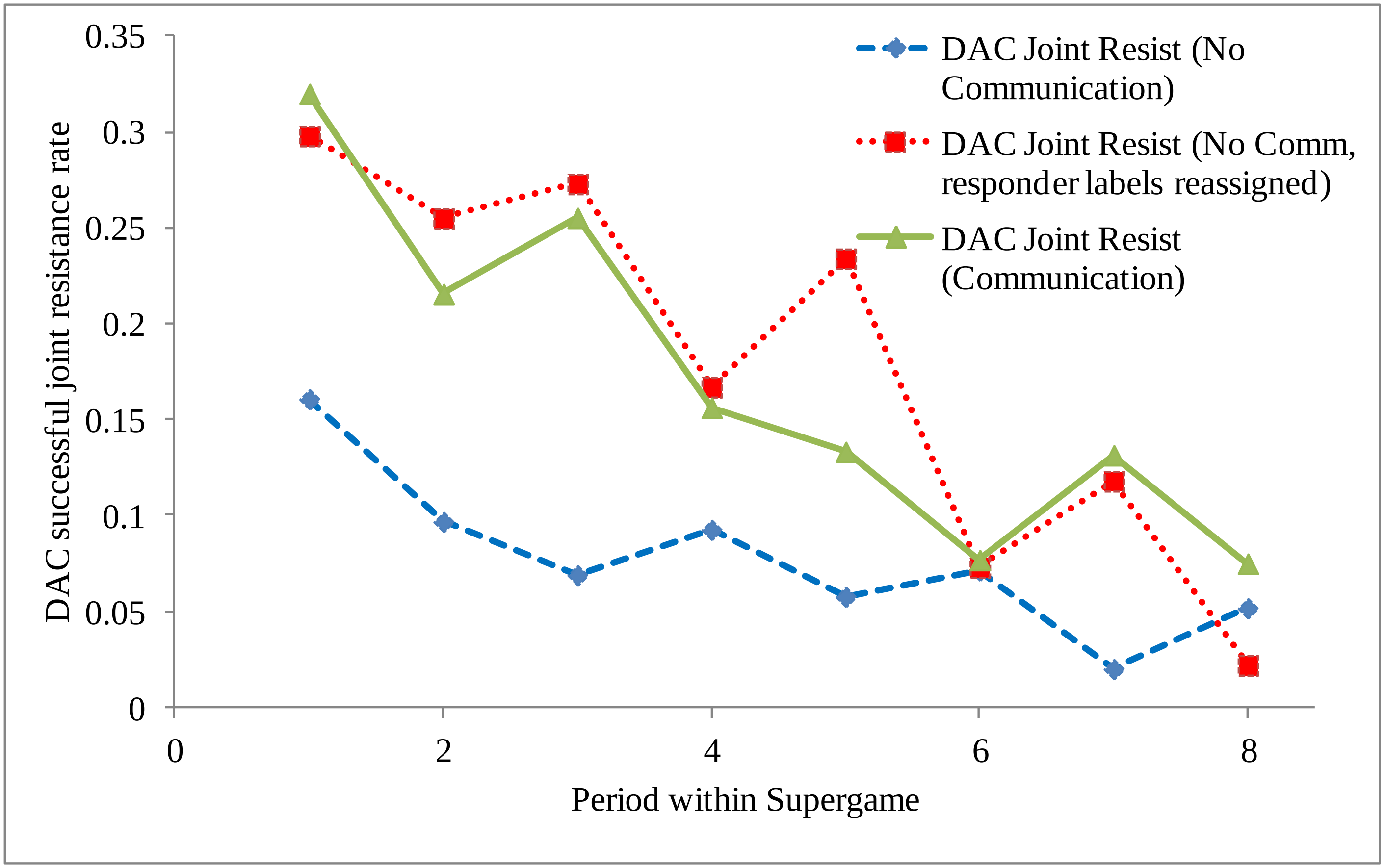


Fig. 3. ***Successful Joint Resistance Rates within Repeated games for EH Finite Repetition and Indefinite Repetition Treatments (after session period 16)***

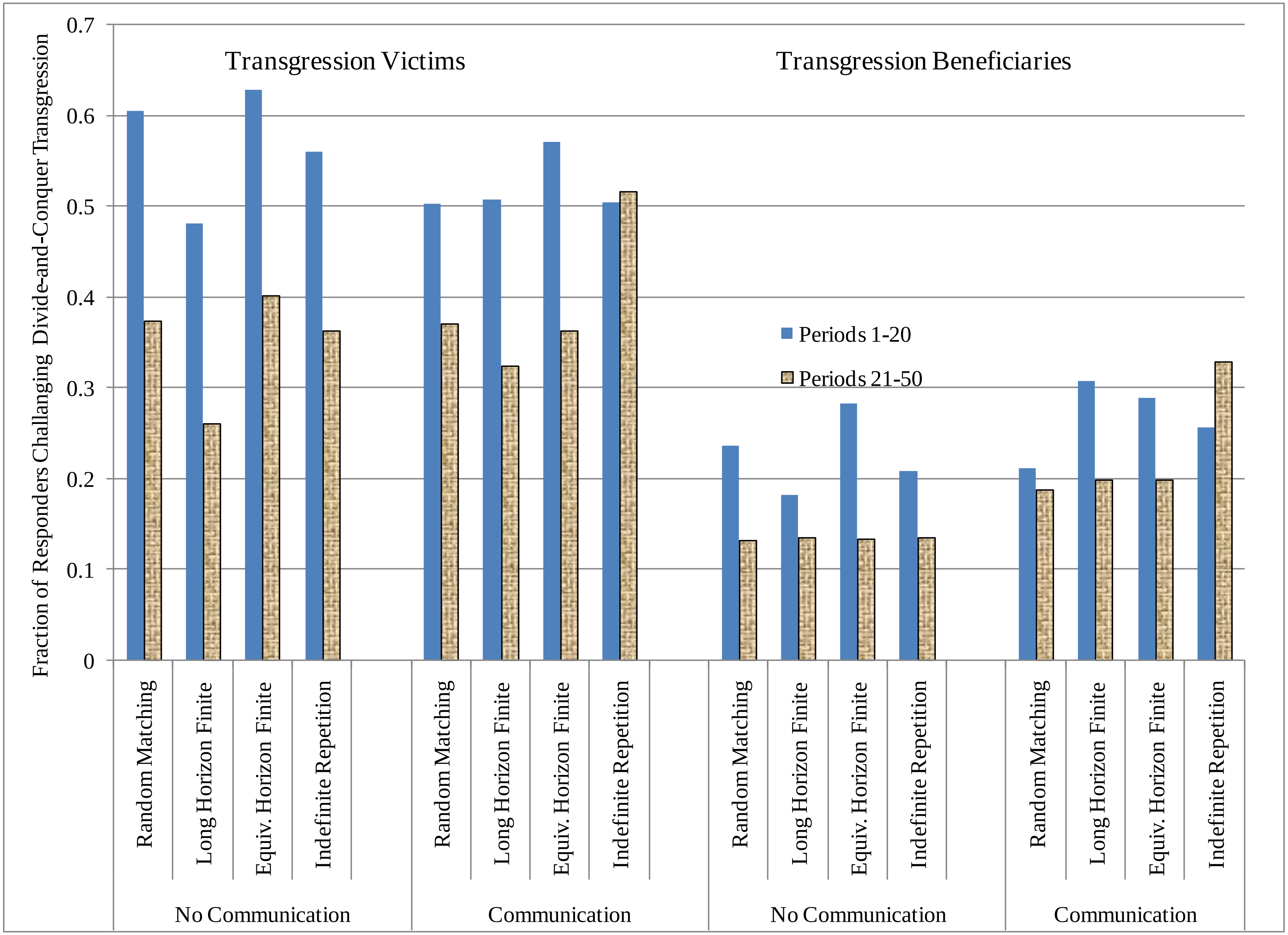


Fig. 4. ***Resistance Rates for Divide-and-Conquer Transgressions***

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