Contracts vs. Trust In Water Adaptation:

incentives to share *for growth* from sharing *of growth*

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Abstract

We explore links between efficiency and equity in allocation of a fixed resource, specifically the power of sharing adaptation surplus for motivating participation. Our novel experimental design fits many resources-bargaining settings, including the participatory water allocation in the state of Ceará in NE Brazil that inspired it. To examine trust, we modify an asymmetric-productivities Ultimatum game (UG) by adding a final, surplus-sharing step. This step decouples the division of the pie from its growth and we study how willingness to cede resources (creating growth) varies with institutions that can affect beliefs about how the returns will be shared. Thus: [1] proposers suggest initial resource splits; [2] responders accept or reject, where accepting yields surplus and rejecting yields a low default payment for all; [3] if an initial split is accepted, proposers choose whether to share their incomes. Our generically framed experiments had 570 participants in Ceará from the ends of a large new canal running to the capital city from the largest agricultural valley. We consider three institutional designs distinguished by levels of communication. In a 'No Communication' benchmark and in 'Message' (where the proposer sends a non-binding message about the surplus to be shared if the proposal is accepted), we find trust, i.e. productive optimism about sharing that partially replaces rights. Yet when the sharing message is a binding 'Contract', efficiency and equity rise.

Keywords

bargaining, trust, field experiment, water, allocation, Brazil,

JEL Codes

C78, C93, Q2, Q25

1. Introduction

This paper explores impacts of resource-allocation institutions with artefactual field experiments (Harrison and List 2004) in Ceará State in Brazil's Northeast. We examine efficiency and equity from joint allocations of a fixed resource. We find that trust does provide some form of solution to limited contracts (Arrow 1972) but yet when contracts align expectations then both efficiency and equity rise. This indicates gains from, e.g., the often contentious and costly establishment of natural resource rights. Our results inform institutional design for resource allocation and, given our initial water allocation focus and large developing country sample, contribute to the natural resources and development literatures (Cardenas and Carpenter 2005, Levitt and List 2007).

Our novel experimental design applies to many bargaining (or multi-party resource allocation) settings but was inspired by the Jaguaribe-Metropolitan hydrosystem. The Jaguaribe River is the source of water for over forty municipalities including the most important economic centers of the Jaguaribe Valley, the largest and most agriculturally productive valley in Ceará. Reservoirs in the valley are central to rural life but also supply the capital, Fortaleza, where urban industry and services now make up 85% of state GDP and monetary productivity of water is higher.

The newest and largest Castanhao reservoir will soon supply Fortaleza via the newest and largest Integration canal. No official process to allocate water using the canal has been given but Ceará's history of participatory water allocation suggests the option of a bargaining institution. The state (which in part plays a 'capital city' role[1]) and the valley currently interact in participatory water allocation committees that decide, by consensus or by vote, the rate of release of water from the reservoirs (including Castanhao) for the purposes of use within the valley, mostly for irrigation.

There are not, generally, producer rights to water, i.e. no promise by the state to deliver a given level of water. In practice, as the amounts available from the reservoir rise and fall with rainfall, irrigators in the valley are rationed, roughly in equal proportion. While formal rights do not exist, though, payments to rural rice farmers to not farm in the dry season of 2000 ("Aguas Do Vale"), introduced the idea of receiving money instead of the water one might typically have received. More generally considering expected compensation for resources (informally) surrendered, the propaganda for the Integration canal conveyed that the state as a whole would do better and so all would gain. For instance, rural investments could well rise with state GDP and tax revenue.

Many situations are described by bargaining over a fixed resource with an idea of compensation in the presence of asymmetric productivities that imply an aggregate impact of resource division. To focus on the effects of institutional rules, as well as on one's expectation about compensation, we add a final, surplus-sharing step to the Ultimatum Game (UG) with asymmetric productivity. UG is a good base when players must agree, i.e. nobody has a clear right to dictate resource use or, at the least, rejecting dictates is possible through courts, protests, or otherwise imposing costs.

Without our final step, efficiency and equity are inseparable in the asymmetric productivity UG. As resources move to a high-productivity proposer, the total pie and the proposer's share grow.

[1] Links are strong between large producers and state planners. The state benefits from employment and taxes. Thus, the state that decides on rural investments (schools, roads and more) and surely values rural welfare also is known by the rural agriculturalists to face pressures to support growth and investment within the main metropolitan areas.

Our new design usefully and realistically decouples the division of the total pie from its growth. Unequal earnings due to productive allocation of resources can be addressed in a final sharing.

Our design has three steps: [1] proposers are two (or four) times more productive and they set the agenda by requesting an amount of the resource (that is represented by a bag of 10 tokens); [2] responders accept the split or reject it, the latter giving both a small default payment of R$5; [3] if responders accept, then proposers must decide whether to send back some of their earnings. Maximizing efficiency in [1] and [2] requires that the proposers be allocated all of the resource. Desired divisions of the largest possible pie then could be achieved in [3], the final sharing step.

Our focus is variation across rules, given this basic design, as our motivation to do experiments is limits on the empirical alternatives for examining the consequences of different institutions.[2] In 'No Communication', proposers' sharing intentions are not signaled. Thus responders decide based solely upon the proposed initial resource split in [1]. In 'Message', along with the initial proposed split in [1] a non-binding written message states what transfer of surplus will occur in [3] if the responder accepts in [2]. Finally in our 'Contract' institution, this additional message sent in [1], along with the proposed initial resource split, is binding and so equals the transfer.

Without a binding transfer message, responders let resources go to more productive proposers in the knowledge that total revenue will rise but not knowing who will get it. Thus proposers who ask for most of the resources invite responders to trust that compensation will be forthcoming. This is like the classical trust or investment games (see Berg et al. 1995 or Guth et al. 1997).[3] In our structure we see also the requests for trust by the proposers, in initially asking for resources.

Our first key result is finding many requests for trust by proposers that are accepted by trusting responders. This essentially confirms prior literatures albeit in a structure comparable to the UG. This trust certainly raises the aggregate pie and it pays off for responders, though rather weakly, so positive optimism about sharing (beyond many models' predictions) partially replaces rights.

Yet our main comparative result is that contracts perform better in terms of efficiency and equity. Under binding written messages, proposers wary of imperfect trust are liberated to request most or all of the resources in the initial split, which raises efficiency. Then the 3rd-step sharing splits the pie not evenly but sufficiently to improve responders' absolute earnings and even their share.

The rest of the paper is as follows. Section 2 provides background on related experimental work in two literatures, ultimatum bargaining and trust. Section 3 describes our experimental design. Next Section 4 presents our empirical results and Section 5 concludes with additional thoughts.

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[2] Lab and field experiments to study environmental and natural resources dilemmas are not new. A review of such research is Ostrom 2010. Water-use experiments have explored the relation between upstream and downstream users in watersheds and in irrigation systems (Kelsey 2009, Cardenas et al. 2009, Janssen et al. 2008, D'Exelle et al. 2009, Cardenas et al. 2008, Cardenas and Janssen et al. 2008). Water experiments are also used to study market institutions (Murphy et al. 2000, Murphy and Howitt 1998, Dinar et al. 2000, Cristi 2007, Alevy et al. 2009).

[3] Walker and Ostrom 2002, p. 382, defines trust "as the willingness to take some risk in relation to other individuals on the expectation that the other will reciprocate". This definition fits also our use of the term 'trust' in these results. Another of relevance is Harvey (2002), p. 292: "To trust means you relay on others not to take advantage of you".

2. Related Experimental Literatures

2.1 Ultimatum Bargaining Games

Our modification of the Ultimatum bargaining game (UG) permits an examination of trust while also allowing direct comparison with the "classic" UG game and some particular UG variations. Thus we can see the effects upon both proposer and responder UG bargaining behavior of having the option for responders to 'invest' in proposers, given requisite trust in the sharing of returns.

In particular, we can compare to "classic" UG games played with the same field population as in the current paper. For prior work focused on asymmetry in access to information about resource quantity to be divided (Pfaff and Velez et al. 2009 and 2010), we ran classic UG bargaining with symmetric productivities and a default payment of zero given rejection.[4] Proposals are for 60% on average and 94% are accepted (for reviews, see Camerer 2003 and Oosterbeek et al. 2004).

Our emphasis on the growth impacts of the division of the pie requires asymmetric productivity, i.e. that a unit of resources earns more in the hands of one of the actors, in our case the proposer. Many asymmetric productivity UG games have also been run in the past. Proposers ask for fewer resources if they have higher returns but more (offering less) if responders have higher returns. One might imagine that different rates of return on resources could create conflict about what is fair, explaining higher rejection rates (Schmitt 2004, Kagel et al. 1996, Gneezy and Guth 2003).

For asymmetric productivities, usefully we can again compare to UG games run in the past with the same field population. Retaining the default payment of zero from the classic UG, we found an average request by the proposers for 52%, when proposers are two times as productive, and 46% when four times more productive. In both, modal proposed split is 50% of resource units, implying two to four times more earnings for proposers, and acceptance rates are around 85%.

Finally, we re-emphasize and here spell out that in a typical UG with asymmetric productivities, it is not possible to decouple the size and division of the pie. The only way to increase the total earnings from the resources is to allocate more resources to the proposer, e.g. for the proposer to keep 80% of the resources instead of simply 60% or less than 50% (given the asymmetric result). In contrast, our addition of the final, surplus-sharing step after typical UG steps does decouple efficiency from equity. The initial resource allocation drives pie size and sharing divides the pie.

2.2 Trust / Investment Games

Another closely related literature for our experiments is the classic "trust" or "investment" game (Berg et al. 1995, Guth et al. 1997). There an actor gives up a sure gain like our R$5 for a chance to gain more, yet also a risk of gaining less. The decision about whether to trust is the first action, i.e. the first mover must trust the second, more productive actor. This first choice is very similar to the choice that our second movers make. Our responders could refuse the initial proposal and thereby obtain the certain default payment or, instead, trust the proposers to share surplus later. Accepting permits the action to move ahead, with larger pie but also uncertain future sharing.

[4] That is not an exact benchmark for here, though, as in our modified UG the default payment with rejection is R$5.

Yet that classic trust game does not capture an important element of our and many other settings. Our setting, and experiment, involve a first actor essentially betting that the second one will trust. If our UG proposers, who initiate the interactions, do not believe the responder will trust enough to accept an unequal split for the sake of growth, then they can avoid rejection by requesting less. This would inefficiently decrease the pie. Thus, unlike in the classic trust game, the magnitude of the trust requested -- which sets the trust question that must be answered by responders, and thus also the efficiency of the outcome given acceptance -- is decided on within the proposal and thus not by the actor who must choose whether to trust. In a classic trust game, they are done jointly.

Our results are not directly comparable to results in the "classical trust game" (Berg et al. 1995), yet it is worth discussing prior trust games and results here. In the original design, first movers send between 50%-65% of their initial endowment (seen as an evidence of trust). Second movers reciprocate by sending between 30%-40% of their earnings depending on the conditions (Berg et al 1995, Burks et al 2003; Holm and Danielson, 2005; Walker and Ostrom 2002). With a typical ratio of asymmetric productivities being three, returning a third of earnings means a first mover gets back only what he sent and thus does not share in the surplus. Thus we see non-zero sharing. Further, it does increase the pie. Yet most likely it is less than the trusting actors had envisioned.

2.2.1 Motivations

Trust literature has explored motives and reports a high individual heterogeneity in motivations (Henrich et al. 2001; Walker and Ostrom 2002; Cox 2004; Asharf, Bohnet and Piankov 2003; and Kiridaran et al. 2009). Asharf, Bohnet and Piankov (2003) found that altruism (warm-glow kindness) is relevant for those who trust little and only a fraction of subjects´ trustworthiness is based upon reciprocity. Other have explored gender difference with mixed results regarding its effect on trust (see for example the work of Croson and Buchan 1999 in Asia and United States, Chaudhuri and Gangadharan 2002, Eckel and Philip 1996 and 1998 and Croson et al. 2008).

One important underlying (or motivations) link is between 'trust' and risky decisions or gambles. Karlan (2005), in work within Peru, explores whether trust in the classical investment game is a measure of the propensity to gamble and he suggests that those who invest more are risk takers. Kiridaran, Mestelman, Nainar, and Shehata (2009) find a strong significant positive relationship between risk attitudes and trust only for participants whose 'social value orientations measure' (that is a measure developed by Griesinger and Livingston 1973) indicate neither strongly pro-social nor strongly pro-self leanings. On the other hand, Bohnet and Zeckhauser (2004) find a distinction between types of expectations, i.e. that participants "are much more willing to take risk when the outcome is due to chance than when it depends on whether another player proves trustworthy" (pp, 479). Eckel and Wilson (2004) explored risk orientation (using 3 different instruments) and trust and found that no risk measure correlates with trust. They say "subjects do not think of trust decisions and financial gambles as similar" (Eckel and Wilson 2004 pp. 464).

2.2.2 Communications

Trust literature also has explored the effect of communication.[5] Lunquist, Ellingsen and Johannesson (2009) find aversion to lying in bargaining with asymmetric information and

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[5] Communication to enhance cooperative behavior has been widely explored in experimental literature, especially in the context of public and common pool games. See Shankar and Pavit (2002) and Cardenas et al. (2003) for reviews.

different communication treatments. They found this aversion to increase with the size of the lie and also find that freely formulated messages yield the fewest lies and the greatest efficiency. We find otherwise, seeing a significant fraction of sharing messages not implemented as stated.

Others also have reported lies in bargaining games. In particular, Ellingsen (2009), found that propensity to lie depends and it is conditional on the quality of the relationship measured by the performance on a paired Prisoner' dilemma game. Participants lie more in the bargaining game when their opponents defected in the Prisioner' dilemma game. Here, in contrast, we are observing lies by the proposers when the responders have made a cooperative choice to trust.

Charness and Dufwenberg (2006) explore the impacts of written messages upon trust and the role for guilt aversion. They use a free-form message they call a 'promise' and they find that this type of message is powerful because it shapes beliefs that influence motivation. They find that this enhances trustworthy behavior. In our results below, we find much less message impact.[6]

Ben-Ner and Putterman 2009 also are more positive than our results concerning communication. They explore multiple forms of pre-play communication which they find increase trust, and then the trusting increases trustworthiness. Contracts were largely unnecessary. Thus, trust institutions alone are suggested to achieve close to the optimal outcomes -- a viable alternative to contracts.

More like our results, Casari and Cason 2007 compare an unenforceable 'bonus' (similar to our Message treatment) with enforceable contracts in a new 'partnership' game that is similar to a principal-agent game. Contracts outperform bonuses and in their bonus treatment a high share of participants lie (that is consistent with the results of our Message institution). The paper suggests an effort "to identify where explicit contracts perform worse and better than implicit contracts".

3. Experimental Design

Experiments were conducted in Fortaleza and in the Jaguaribe Valley, in Limoeiro do Norte, with 570 participants, 302 in Fortaleza and 268 in Limoeiro. Many were students (from farming families in the Valley) though with more diversity than typical US experimental student pools as university staff, officers from public institutions and, within Limoeiro, also farmers participated. Recruitment was via local contacts. All treatments were done in each site. Table 1 summarizes.

Table 1 -- Subject Characteristics

	# obs.	Mean	Std. Dev.	Min.	Max.
Age	568	22,5	4,8	18	54
Gender	570	0,52	0,5	0	1
Education (years)	570	15,2	1,9	8	18

[6] Note that the message in our Message treatment could be a 'promise', as proposers write sharing 'intentions'.

Experiments were modified ultimatum games (UG) with asymmetric productivity and a surplus-sharing step (see the description of the three steps within our Introduction above). Experiments were neutrally framed, i.e. refer to generic bargaining over generic resources (bag of tokens).[7] Each set of paired participants had to allocate a bag of 10 chips. Each chip was worth $R2 for proposers but $1R for responders in 2:1 asymmetric productivity and $R4 versus $R1 in the 4:1. Each of our three institutional designs (see Introduction) was done for each productivity ratio:

Table 2 -- Observations Per Treatment

	No Communication	Message	Contract
2 : 1	44	42	51
4 : 1	44	49	55

In each session (typically with 20-30 subjects), each subject participated in two one-shot games. The games reported here were those played first. In each game, players were randomly paired to avoid learning. Proposers learned responders' decisions at the end of the second game. Identities were anonymous. Roles were randomly assigned and kept for both games. After instructions, we did a quiz to check understanding then responders went to another room. At session's end, one of the games was randomly chosen and payments were made in accordance with those decisions.

Studying people from the regions in Ceará that are affected by resolutions about water allocation, while having our core experiments framed generically (without either water or regional context), makes these 'artefactual field experiments' (according to Harrison and List´s (2004) typology). Since distinct populations could well behave differently (see, for instance, Henrich et al. 2005), despite generic framing we were eager for results from a population relevant for water policy.[8]

A survey afterward included socio-demographic questions, an open-ended question about one's behavior in the game and the General Social Survey (GSS) with trust-related questions similar to Glaeser et al. 2000 and Gachter et al 2004. Finally, for measure of participant attitudes to risk, we did a risky-choice task similar to that in Eckel and Wilson 2004 but adapted to our case.[9] Pfaff and Velez 2010 examine the trust results' relation to the survey and risky choice task.

[7] Consider the following four experimental possibilities (and see Harrison and List 2004 for more such thinking): European or US university students with generic framing; field populations with generic framing; field populations with local framing; and interventions in field populations' local reality. It is tempting to argue that more to the end of the list is better and without question the last possibility provides observations like any other observational data for inferring parameters relevant for real local policy. However, moving from the 2nd to the 3rd approach involves real tradeoffs and either could be preferred. In particular, if the attempts to frame are communicating *only some of the relevant details* that should inform real choices for such a population, and if they induce *idiosyncratic reactions* to the framing specifics that significantly affect choices, then the unframed field ('artefactual') experiments (i.e. 2nd approach) may be preferred. For a concrete example, if the framing involves the description of a policy that could be chosen by the local government and because of past political history in the area participants react in the experiments based upon their displeasure with the current president of the country in question, results are not generally relevant.

[8] In prior UG (Pfaff, Velez et al. 2010), water and region framing did not change any of the results significantly.

[9] The choice was A, giving 10R$ for sure, versus B, a lottery with 10% chance of R$0, 20% chance of R$5, 40% chance of R$10, 20% chance of R$15 and 10% chance of R$20 (this has the same expected value as does option A).

4. Results

4.1 Trust Has Gains Yet Also Gaps

4.1.1 Expecting & Expressing Trust

We see expectations and expressions of trust in our one-shot game, consistent with prior work. Trust is expressed if responders accept initial resource splits that earn them less than the default they get if they reject the proposal. Trust is expected when a proposer asks for such initial splits, which here means over half of the resources. That trust was both expected and expressed can be seen within the Ask and Acceptance choices in "No Communication" and "Message" (Table 3).

Table 3 -- Average Results By Treatment

	Average Ask (chips)	Average Message (R$)	Accept %	Average Ask If accepted	Average Message If accepted	Average Transfers If accepted
NoComm. 2:1	6,6	(none)	70%	5,87	(none)	2,45
Message 2:1	7,1	4,0	88%	6,97	3,92	2,84
Contract 2:1	8,3	5,2	68%	8,06	5,97	(=message)
NoComm. 4:1	6,6	(none)	86%	6,13	(none)	4,79
Message 4:1	6,9	8,3	73%	6,36	8,36	5,92
Contract 4:1	7,8	8,9	80%	7,77	10,0	(=message)

In the No Communication treatment, proposers clearly expect trust on average, asking for more than half the resources (6.6 > 5.0, p=0.00 for both 2:1 and 4:1), such that final-step sharing is required for a responder to earn more than the default. Our appendix provides the data for each level of proposer request. For this treatment, we see that over half the proposers requested trust.

Responders in No Communication fulfill proposers' expectations of trust by expressing trust, as suggested in Table 3 by on average ¾ of responders accepting in this treatment. Keeping in mind the results of typical asymmetric-productivities UG games in which proposers ask for half or less of the resources, the acceptance rates here are relatively high given these unequal productivities. In the appendix for this treatment we can look specifically at the requests for trust (> 5 tokens). The bottom rows for the two cases show that ½ and ¾ accept -- significant expressions of trust.

Results for our Message treatment are consistent in revealing expectation and expression of trust. Table 3 shows Average Ask choices implying frequent requests for trust (7.1 & 6.9 > 5, p=0.00) and Acceptance choices implying trust (on average 80%, again quite high given unequal splits). Behind these averages, the appendix for this treatment shows that well over half of the proposers put forward resource splits that are requests for trust, of which on average over ¾ are accepted.

Across institutions, the Message appears to induce an expectation of greater trust. Within an institution, the appendix shows that responders do not respond uniformly to asymmetry ratios. For instance, acceptance of requests for trust was higher in the No Communication treatment for the 4:1 case but, for Message, acceptance of requests for trust was higher for the 2:1 asymmetry.

Across both institutions there is a commonality, though, in a limit to the trust that is expressed. The appendices for these treatments show that, for all four cases, the requests that were accepted averaged under 8, while those that were rejected averaged over 8. While clearly trust has been expressed, and it is expected, and it is productive, there are limits upon the behaviors it permits.

4.1.2 Trust's Aggregate & Private Returns

Certainly the expectation of (i.e., requests for) trust and its expression are efficient in aggregate. Asymmetric resource productivities imply that more resources for proposers in initial splits, such as seen in the No Communication and Message treatments relative to, e.g., an asymmetric UG, generate greater total earnings. Thus, all the earnings examined within Tables 4a and 4b below are greater than what would have been generated by an asymmetric UG done in this way. In terms of efficiency, then, optimism about sharing is productive. Further, sharing does occur.

Yet a different question is whether responders, i.e. the actors who must express or extend trust, benefit as a group (naturally proposers could benefit and also they control the final-step sharing). Table 3 averages show responders gain from trust (versus choosing default payoffs by rejecting) although those gains may be better described as 'made whole' than as 'a large share of surplus'.

In the No Communication treatments, monetary transfers after acceptances do beat the default. For responders a token is worth R$1, so the number of tokens equals earnings before transfers, and specifically adding transfers to the responder share of initial resource splits yields over R$5 (in 2:1, average accepted token splits of 5.9 leave R$4.1 for responders, yielding 6.6 (> 5) when average transfers of R$2.5 are added; in 4:1, a 3.9 split plus 4.8 transfers yields R$8.7 in total).

Much as for the expectation and expression of trust above, the results for our Message treatment are consistent with the No Communications treatment (for 2:1, requests of 7 leave the responders with 3 but average transfers after acceptance were 2.8; for the 4:1 case, responder splits average 3.6 so transfers of 5.9 yield R$9.5 total). Earnings are above R$5, i.e. 'trusters are made whole' on average (but not in all cases (see appendix)), at the least, and sometimes even do a bit better.

Yet we will see in Table 4a below that proposers earn over R$19 when proposals are accepted. Since rejection yields only R$5 for each actor, over 75% of the surplus stays with proposers. Such Dictator-Game (DG) style, final-step sharing behavior seems consistent with DG results.

Another less positive perspective on the Message institution is that trust is not fully justified even if it has positive (albeit low) private payoffs. The reason is that the proposers are regularly lying. Table 3 shows transfers lower than non-binding messages (see detail in Pfaff and Velez 2010).[10]

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[10] Looking only at the "requests for trust" (i.e. requests > 5), lying occurs in 50% of the 2:1 cases and in 30% of the 4:1 cases. Surely, this level of dishonesty does, *per se*, indicate some limitations upon implicit contracts. Being deceived might represent a form of disutility that could be in fact greater than the gains from increase earnings.

4.2 <u>'Contracts' Perform Better</u>

4.2.1 Efficiency

Binding resource-compensation 'contracts', i.e. full enforcement of final-step sharing messages, clearly improve aggregate efficiency relative to trust alone (even adding non-binding messages). As initial and accepted requests for resources increase, so do earnings. Table 3 shows higher Ask and higher accepted Ask in 'Contract' (8.1 for 2:1 and 7.8 for 4:1) than in "No Communication" (5.87 and 6.13 respectively) or in "Message" (6.97 and 6.36). This implies a gain in efficiency.

The maximum possible for earnings is either 20 or 40 in the two respective cases. In considering the efficiency of institutions, we consider the earnings summed across proposers and responders. For accepted observations, Table 4a ranks 'Contract' 1st in this efficiency measure (p=0.00, using one-tailed t-tests, for both cases of 'No Communication' and for the 4:1 case of 'Message').

Looking within the 'Contract' institution, in Table 4a the efficiency in 2:1 ($18/$20) is higher than that in 4:1 ($33/$40). Table 4b, though, includes rejection observations and the fact that the proposers are less aggressive within 4:1 raises acceptance (see Table 3 above). This effect of not asking for as much increases efficiency for less aggressive requests in ways not seen in Table 4a.

Table 4a -- Earnings Given Acceptance

TREATMENT	Proposer Average Earnings	Responder Average Earnings	Sum of Average Earnings	Average of (Prop. Earn /Resp Earn)	Mininum (=Responder) Earnings
Contract 2:1	10,14	7,91	18,05	1,36	5
Message 2:1	11,11	5,86	16,97	2,40	0
NoComm. 2:1	9,29	6,58	15,87	1,52	4
Contract 4:1	21,09	12,23	33,32	1,98	5
Message 4:1	19,53	9,55	29,08	2,41	4
NoComm.4:1	19,74	8,66	28,39	3,25	0

4.2.2 Equity

As noted in 4.1.2, proposers share little more than needed to avoid a loss for trusting responders. Responder earnings of R$5.8 in the Message 2:1 game, e.g., are above default but not by much. Thus, given that acceptance has generated significant surplus, we see that mostly it is not shared. Given this, enforceability (i.e. 'Contract') does better for equity as measured in three key ways.[11]

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[11] We note equity oriented comments by players concerning 'Contract': *"Participant A chose a very fair option, in which both will earn R$10" (Responder in Contract 2:1). "I asked for 10 tokens because I will earn 40, transferred R$20 …so I and participant B will end up with R$20 which is good for both" (Proposer in Contract 4:1)*

A relative measure of equity is the ratio of proposers to responders' earnings. Closer to Rawls would be a focus on aiding the lowest earner, i.e upon the always lower earnings of responders. A third measure is the frequency of earnings being allocated as if by a 50-50 distribution rule. Tables 4a and 4b address the first two in their two final columns (and appendices add detail).

Table 4b -- Earnings Overall

TREATMENT	Proposer Average Earnings	Responder Average Earnings	Sum of Average Earnings	Average of (Prop.Earn /Resp.Earn)	Mininum (=Responder) Earnings
Contract 2:1	8,53	7,0	15,53	1,24	5
Message 2:1	10,38	5,76	16,14	2,23	0
NoComm. 2:1	8,02	6,11	14,13	1,37	4
Contract 4:1	17,87	10,78	28,65	1,79	5
Message 4:1	15,67	8,35	24,02	2,03	4
NoComm.4:1	17,73	8,16	25,89	2,98	0

'Contract' was best on all criteria. Its average proposer-over-responder earnings ratio is lower, i.e. more equitable, and considerably lower relative to both of the other institutional treatments, both in Table 4a for accepted observations and in Table 4b for all observations (for instance, in the latter, just above, 1.24 for 2:1 and 1.37 for 4:1 versus 2.23 and 2.03 as well as 1.37 and 2.98).

Concerning the least well off players, both 'No Communication' and the 'Message' institutions permitted outcomes in which a responder earned zero. That did not occur in 'Contract', indeed the minimum there is not surprisingly at the default. Zero for responders surely is not possible in 'Contract', as responders would not accept a 0% share in the resource split plus a zero transfer. As discussed further below, poor responder outcomes are less common when more is explicit.

'Contract' also best provided the best expected equity outcome for responders, equal earnings. Among accepted observations, 'Contract' had the most (2:1 37%, 4:1 27%) where earnings were distributed evenly. Interestingly, equal earnings are not due to timidity on the part of proposers. Within 'Contract, in most of the 2:1 games and over half of the 4:1 games with equal earnings, proposers asked for 10 chips. Those observations truly maximized on both efficiency and equity.

4.3 Transparency & Welfare

As noted above concerning efficiency (which even Table 3 conveys), 'Contract' ranks first and that is always significant for the 4:1 cases of treatments. Table 4b confirms this for the summed earnings for all observations (with rejections).[12] For 2:1, the 'Contract' summed earnings are not significantly above 'Message'.[13] Yet in this efficiency rankings may not be indicative of welfare.

[12] Using a one tail t test, summed earnings in "Contract" (4:1) are greater than "Message" (p=0.01) and also " No Communication" (p=0.08). "Message" are not significantly greater than "No Communication" in 4:1 (p=0.17).

Specifically, when trusting in future sharing responders accept offers they would rather not have, so here the simple earnings numbers for 'Message' are masking some loss from being exploited. Since the averages obscure all the critical facts, we move directly to the details in the appendices.

Recall, if the sharing message is non-binding it permits lying in the sense of a transfer lower than indicated in the written message. What the details concerning specific offers show is that some of the requests that are accepted in 'Message' end up producing outcomes a responder would reject had the final terms been transparent. We know this because we see similar 'Contract' rejections.

In the appendices, consider first the requests for 8 (sizeable requests). In 'Message' 2:1, accepted transfers average R$3. This is less than is promised in the written sharing message, meaning that a responder who trusted the written sharing message was not actually informed of the final terms. These actual transfers do 'make responders whole', in the sense of being a bit above the default. Yet would they have been accepted if transparent? Responder choices in 'Contract' 2:1 suggest the answer is no. For requests for 8, the average transfer that is *rejected* is 2.8, very close to 3.

Consider then requests for 9 (i.e., almost all of the resources). In Message 2:1, accepted transfers average R$2.5. Again this is less than promised. Further, responders facing requests for 9 within 'Contract' 2:1 treatment rejected transfers that averaged R$2.6. Thus, while explicit enforceable contracts may be rejected more in a one-shot game such as ours, this should benefit responders who otherwise can be lied to and end up with outcomes they would have rejected if explicit.

5. Discussion (bullets for conference draft)

- New design fits realities and compares to both UG and Trust.
- Trust exists and such sharing optimism is socially productive.
- Yet responders gain little on average and are easily exploited.
- Addressing this, with contracts both efficiency and equity rise.
- Provides insights into the gains from costly creation of rights.
- Future Research: one-shot trust might be less than when repeat.
- Future Research: contracts in reality may not be quite as perfect.

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[13] Using a one tail t test, "Contract" (2:1) are significantly greater than "No Communication" (p=0.03) but not than "Message" (p=0.19). In thish case, "Message" are significantly greater than "No Communication" in 2:1 (p=0.00).

Appendix -- No Communication

Treatment	# Chips Ask For	Number of Obs.	Rate of Acceptance	Average R$ Transfer if accept
No Com. 2:1	2	0	-----	-----
	3	1	100%	0,00
	4	7	100%	0.57
	5	10	100%	0.60
	6	5	60%	1.00
	7	6	66%	3.25
	8	5	4%	7.00
	9	4	25%	8.00
	10	6	50%	9.33
	***Trust** (i.e. Ask > 5)* (average Ask = 8.0)	***Trust** (i.e. Ask > 5)* 26 (59%)	***Trust** (i.e. Ask > 5)* 50% (Ask =7.8 if Accept) (Ask = 8.2 if Reject)	***Trust** (i.e. Ask > 5)* 5.07
No Com. 4:1	2	1	100%	0.00
	3	4	100%	1.75
	4	2	100%	2.50
	5	12	100%	2.16
	6	4	100%	2.50
	7	5	100%	6.00
	8	5	80%	4.50
	9	0	-----	-----
	10	11	54%	14.33
	***Trust** (i.e. Ask > 5)* (average Ask = 8.4)	***Trust** (i.e. Ask > 5)* 25 (57%)	***Trust** (i.e. Ask > 5)* 76% (Ask =7.9 if Accept) (Ask = 9.6 if Reject)	***Trust** (i.e. Ask > 5)* 7.57

Appendix -- Message

Treatment	# Chips Ask For	Number of Obs.	Rate of Acceptance	Average R$ Transfer if accept	Average R$ Message if accept	% with Message > Transfer	Average R$ Message no accept
Message 2:1	2	0	-----	-----	-----	-----	-----
	3	0	-----	-----	-----	-----	-----
	4	3	100%	0.66	0.66	0%	-----
	5	4	100%	2.25	2.75	25%	-----
	6	8	87%	1.57	3.42	71%	4
	7	13	92%	3.00	3.75	42%	4
	8	5	80%	3.00	4	75%	6
	9	3	66%	2.50	3.5	50%	3
	10	6	83%	6.00	8	20%	6
	***Trust** (i.e. Ask > 5)* (average Ask=7.6)	***Trust** (i.e. Ask > 5)* 35 (83%)	***Trust** (i.e. Ask > 5)* 86% (Ask =7.5 if Accept) (Ask = 8.0 if Reject)	***Trust** (i.e. Ask > 5)* 3.1	***Trust** (i.e. Ask > 5)* 4.4	***Trust** (i.e. Ask > 5)* 50%	***Trust** (i.e. Ask > 5)* 4.6
Message 4:1	2	0	-----	-----	-----	-----	-----
	3	1	100%	2,00	2	0%	-----
	4	4	100%	1,50	3,75	50%	-----
	5	12	91%	2,18	5,63	64%	2
	6	5	100%	5,60	8,8	40%	-----
	7	9	66%	6,66	7,33	17%	5.3
	8	4	75%	7,33	12	33%	6
	9	6	16%	10,0	15	100%	7
	10	8	62%	16,2	16,6	20%	15
	***Trust** (i.e. Ask > 5)* (average Ask = 8.1)	***Trust** (i.e. Ask > 5)* 32 (65%)	***Trust** (i.e.Ask > 5)* 63% (Ask =7.7 if Accept) (Ask =8.6 if Reject)	***Trust** (i.e. Ask > 5)* 9.5	***Trust** (i.e. Ask > 5)* 11.1	***Trust** (i.e. Ask > 5)* 30%	***Trust** (i.e. Ask > 5)* 8.5

Appendix -- Contract

Treatment	# Chips Ask For	Number of Obs.	Rate of Acceptance	Average R$ Transfer if accept	Average R$ Transfer no accept
Contract 2:1	2	0	----	----	----
	3	0	----	----	----
	4	0	----	----	----
	5	7	100%	1,71	----
	6	4	100%	2	----
	7	4	100%	3,5	----
	8	9	22%	6	2,8
	9	4	25%	8	2,6
	10	23	73%	9,11	5,5
	Ask > 5 (average Ask=8,9)	**Ask > 5** 44 (86%)	**Ask > 5** 64%	**Ask > 5** 7,0	**Ask > 5** 3,6
Contract 4:1	2	1	100%	9,11	----
	3	0	----	----	----
	4	1	100%	5	----
	5	3	100%	5	----
	6	11	90%	6,6	6
	7	7	71%	7	3,5
	8	12	41%	7,6	4
	9	4	100%	10,25	----
	10	16	93%	16	8
	Ask > 5 (average Ask = 8.1)	**Ask > 5** 50 (91%)	**Ask > 5** 78%	**Ask > 5** 10,8	**Ask > 5** 4,4

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