

MPRA

Munich Personal RePEc Archive

Sequential vs. Simultaneous Trust

Gross, Till and Servátka, Maroš and Vadovič, Radovan

Carleton University, MGSM Experimental Economics Laboratory,
Macquarie Graduate School of Management, Carleton University

3 October 2019

Online at <https://mpra.ub.uni-muenchen.de/96343/>
MPRA Paper No. 96343, posted 09 Oct 2019 02:19 UTC

Sequential vs. Simultaneous Trust

by

Till Gross, Maroš Servátka, and Radovan Vadovič*

October 3, 2019

We examine theoretically and experimentally the implications of trust arising under sequential and simultaneous designs, where one player makes an investment choice, and another player decides whether to share the investment gains. We show analytically that in some cases the sequential design may be outperformed by the simultaneous design. In an experiment we find that the investment levels and sharing rates are higher in the sequential design, but there are no corresponding differences in beliefs. We conjecture that this happens because in the sequential design substantially more trust is necessary to induce cooperation. Our data strongly support this conjecture.

Keywords: trust, investment, efficiency, institutional design

JEL classification code: C9, D02, D9

1 Introduction

Trust and trustworthiness are crucial elements of economic and social interactions, (mostly) leading to improved efficiency and well-being (Putnam, 1993; Fukuyama, 1995; Knack and Keefer, 1997; La Porta et al., 1997; Dasgupta, 2000; and Zak and Knack, 2001). It is often the case that gains from mutual

* Till Gross and Radovan Vadovič: Department of Economics, Carleton University and Ottawa-Carleton Graduate School of Economics, Ottawa, Canada; till.gross@carleton.ca and radovan.vadovic@carleton.ca. Maroš Servátka (corresponding author): MGSM Experimental Economics Laboratory, Macquarie Graduate School of Management, Sydney, Australia and University of Economics in Bratislava, Bratislava, Slovakia; maros.servatka@mgsm.edu.au. We are especially grateful to Steve Tucker who significantly contributed to the design of the experiment and earlier versions of this paper. We also thank Bram Cadsby, Tim Cason, Jim Cox, Cary Deck, Martin Dufwenberg, and Fei Song for helpful comments and discussions. Finally, we thank the editor Gerd Muehlheusser and two anonymous referees for useful suggestions that helped improve the paper. Financial support was provided by University of Canterbury, College of Business and Economics. Maroš Servátka thanks University of Alaska – Anchorage for their kind hospitality while working on this paper.

interaction between two individuals can only be realized if one of them (the trustor) is able to trust the other (the trustee) to behave cooperatively (Arrow, 1976). In this situation the trustor faces a dilemma. Once he chooses the level of exposure (e.g., an investment), it is entirely up to the trustee to decide how the gain is divided between the two of them. This makes investing a risky proposition. Throughout history, institutions have evolved to shield us from unnecessary exposure by discouraging or preventing opportunistic actions and free-riding (e.g., Ostrom, Walker, and Gardner, 1992). Policies based on reputation and punishment, which allow verification of individual identities and enable legal recourse (for example, the centralized ID verification system, credit histories, and escrow accounts), are particularly powerful at reducing the need for exposure. In this paper, we aim to isolate the effect of trust on the success of the relationship.

Trust crucially depends on the degree of exposure and it is well-established that people tend to reciprocate trust, i.e. that a person is more likely to behave cooperatively if he can observe that he has been trusted.¹ Given this observation, it may seem that interactions which require trust should be based on a sequential design (allowing the trustee to observe the level of exposure before deciding whether to cooperate or not; for example advance orders or payments, such as, ordering a pizza to be picked up, or purchasing an apartment in a building to be built), rather than a simultaneous design (where the trustor and trustee make their decisions at the same time; for example collaborations on complex projects by teams of consultants who work in parallel), because the former appears to be more efficient. The reason is that in the sequential design, the trustor can presumably always “mimic” being in the simultaneous design by setting his investment level to what would have been expected in the simultaneous design. More importantly, in the sequential design, the trustor can credibly convey a high level of trust (by choosing a high level of exposure) and induce a cooperative response. We show in a simple theoretical model that such a conclusion would be premature: while the sequential design dominates the simultaneous design in our baseline model with homogeneous agents, sufficient heterogeneity of agents leads to the opposite conclusion.

To illustrate the intuition, consider the following situation: the trustor makes an investment, the investment is tripled, and the trustee decides whether to cooperate and share the total surplus equally or keep everything to himself. Suppose the trustee’s behavioral response is governed by a sharing response function which specifies the probability of sharing to be increasing and convex in the level of investment. The key to the argument is the idea that different trustors may optimally choose different investment levels. This could, for instance, be driven by heterogeneity in risk attitudes (e.g., see Fairley et al.,

¹For clean evidence of trust and conditional cooperation (reciprocity) that have been separated from other-regarding preferences, see Cox (2004), Cox and Deck (2005), Cox, Friedman and Sadiraj (2008), and Cox, Kerschbamer, and Neurerer (2016). Nice surveys on trust in economic decision-making are presented in Camerer (2003, Chapter 2), Fehr(2009), and Charness and Kuhn (2011).

2016).² We will use risk aversion to construct our argument. However the argument itself does not necessarily require risk aversion to be the behavioral driver. What is needed is heterogeneity in investment levels. Suppose that the trustor may be either risk averse or risk neutral, and that it is optimal for the risk neutral trustor to make the maximum possible investment in both types of design (sequential and simultaneous). In the sequential design, the risk averse trustor optimally chooses his investment level independent of the risk neutral trustor's decision. Being risk averse, he does not want to invest much, but this leads to a low probability of sharing, so the risk averse trustor does not invest anything at all.

The situation is different in the simultaneous design. There, the probability of sharing does not depend on the actual individual investment but on the expected investment. As opposed to the sequential design, the trustee in the simultaneous design does not know whether the trustor is risk neutral (and hence takes the maximum possible exposure) or risk averse. Since the probability of sharing is increasing in the (expected) investment level, the returns to investment of the risk averse trustor are higher than in the simultaneous design, and he invests a small, but strictly positive amount. There is an analogy to externalities: investment in the simultaneous design has a positive externality, as it increases (in expectation) the probability of sharing for other trustors. When all players are identical, then investment is lower than in the sequential design, which has no externality, because individual trustors do not take into account how higher investment on their part would lead to a higher probability of sharing for other trustors. When players are heterogeneous, the externalities have asymmetric effects, and internalizing them could thus result in *less* efficiency. In our example, the risk neutral trustor would not change his decision if the externality were internalized, whereas the risk averse trustor benefits greatly from the externality.

To evaluate the relative efficiency of the sequential design empirically, we conduct a laboratory experiment. In happenstance data, it is difficult to find examples of comparable transactions under both the simultaneous and sequential design; moreover, in the modern world there is a plethora of confounding factors from other supporting institutions, such as the presence of enforceable contracts, public monitoring, or reputational concerns. The societal infrastructure typically involves a complex web of rules and policies, making it hard to disentangle the effects of individual incentives. For example, thanks to the Internet and easy access to online review boards, most business transactions now involve not only the information on the level of exposure but also a reputa-

²The connection between trust and risk preferences has been subject to some controversy. It seems that a trust situation is inherently a situation of choosing between risky prospects, i.e., risk preferences should play a role. However, several studies, e.g., Eckel and Wilson (2004) or Houser, Schunk, and Winter (2010), surprisingly find very little correlation between behavior in the trust game and risk preferences elicited from lottery choices. In a recent clever experiment Fairley et al. (2016) clarify that risk preferences indeed play a role but only in the proper context of a trust setting that involves another human participant possibly letting the trustor down.

tional concern even when dealing with apparent strangers. In the same vein, the widespread use of credit cards has effectively taken anonymity out of most transactions. When stakes are substantial, institutions have evolved to employ legal contracts and verification methods that explicitly remove exposure. A beautiful example of expedited institutional evolution is the case of the online auction house eBay and its introduction of the feedback system and the escrow option. Unfortunately, we cannot rewind the clock and collect data from societies that were much simpler than the one we live in today.³ However, we can approach this question with data from a laboratory experiment, in which we can precisely control the decision-making environment and vary the institution, *ceteris paribus* (Smith, 1994). It allows us to observe exactly when and to what degree the sequential design fares better or worse than the simultaneous design.

A modified version of the Berg, Dickhaut, and McCabe (1995) investment game is the main vehicle of our experimental design in which the trustor (player A in the experiment) initially chooses an amount t to be sent to the trustee (player B). This amount is tripled and the trustee must decide whether to return half of this tripled amount back or whether to keep it all to himself. When the game is played sequentially, the amount sent is observable and the trustee can thus condition his decision on t . Conditioning the response on t is not possible if the game is played simultaneously because t is not observed.

The original Berg *et al.* experiment identifies trusting behavior by observing that trustors often send money to their counterpart trustees who in turn often reciprocate by returning positive amounts (see Dufwenberg and Kirchsteiger, 2004; Falk and Fischbacher, 2006; Cox, Friedman, and Gjerstad, 2007; and Cox, Friedman, and Sadiraj, 2008 for models of reciprocity). While there are also other possible motivations why players would send and/or return positive amounts, such as other-regarding preferences (cf. Cox, 2004), preferences for increasing social welfare (Charness and Rabin, 2002), or guilt aversion (Dufwenberg, 2002; Dufwenberg and Gneezy, 2000; Charness and Dufwenberg, 2006; Battigalli and Dufwenberg, 2007), the behavior in the investment game can be seen as a proxy for trusting and trustworthy behavior (Charness, Cobo-Reyes, and Jiménez, 2008).

The recent theoretical and experimental literature has produced some relevant insights into various other mechanisms that have been shown to influence the decisions of trustors and trustees, for example by introducing enforceability, competition, or psychological incentives. (See Ellingson and Johannesson (2008), Engle-Warnick and Slonim (2004), Charness and Dufwenberg (2006, 2010), Chaudhuri and Gangadharan (2007), Bracht and Feltovich (2008, 2009), Ben-Ner and Putterman (2009), Ben-Ner, Putterman, and Ren (2011), Servátka,

³In principle one could observe behavior in more primitive societies in remote places even today (e.g. Gneezy *et al.*, 2009; Henrich, 2001). But there is no telling whether one can find comparable examples of simultaneous and sequential institutions and obtain enough observations for meaningful analysis. Nevertheless such effort, even if generating only examples, would be most welcome in helping us understand the evolution of institutional designs. Another interesting approach is to study the process of the emergence of new institutions in the lab (e.g. Kimbrough *et al.*, 2008).

Vadovič, and Tucker (2011a, 2011b), Huck, Luenser, and Tyran (2012), Deck, Servátka, and Tucker (2013), Sheremeta and Zhang (2014), Houser and Xiao (2015), Dufwenberg, Servátka, and Vadovič (2017), and many others). Such mechanisms, however, are not always available to the transacting parties. From the perspective of this strand of the literature, our study deals with a more subtle yet important institutional design feature, namely the timing of decisions (and thus the availability of information about the trustor’s decision to the trustee). The distinction implied by simultaneous or sequential timing is central to our understanding of trust. From the policy perspective, in certain interactions, this feature might be relatively easy to manipulate and lead to a significant impact on the transaction outcome.

Our focus on the simultaneous or sequential nature of decisions relates our study to earlier work by Clark and Sefton (2001), who explore conditional cooperation in the context of a sequentially played prisoner’s dilemma game. Their data strongly support the sequential design as being more efficient. However, because the prisoner’s dilemma game is so simple and action spaces are binary for both players, issues related to the level of exposure are nonexistent in their experiment. Similarly, Ahn *et al.* (2007) study cooperation in a one-shot prisoner’s dilemma game. Their focus is on asymmetric payoffs for the two players and how this affects cooperation, both in a simultaneous and a sequential game. Ahn *et al.* find that asymmetry reduces cooperation in a simultaneous design and interacts with the order of play in a sequential design. In contrast, we focus on comparing the efficiency aspects by different orders of play. The order of play can also be prescribed by the game form. Schotter, Weiss, and Zapater (1996) and McCabe, Smith, and LePore (2000) find that subjects play games in extensive forms differently from games in strategic forms, suggesting that the “mode” in which decisions are made might be an important determinant of observed behavior. Lastly, our treatment variation is also reminiscent of the Cournot and Stackelberg duopoly comparison (e.g. Huck, Mueller, and Normann, 2011).

2 Theory

A player of type A faces a choice of how much to invest, $t \in [0, e]$, in a joint venture with another player B . The investment triples and B decides whether the two players share the proceeds equally or whether B keeps everything. We assume that B ’s behavior is governed by a sharing response function, $p : [0, e] \rightarrow [0, 1]$. It maps the investment level into the probability that B chooses to split equally. We assume that $p(0) = 0$ and that p is twice continuously differentiable and monotonically increasing, i.e. $p'(t) > 0$.⁴

⁴This relationship is consistent with a number of prominent reciprocal preference models, such as Charness and Rabin (2002), Cox, Friedman and Gjerstad (2007), Cox, Friedman and Sadiraj (2010), Ellingsen and Johannesson (2008), Dufwenberg and Kirchsteiger (2004), Fehr and Schmidt (1999), or Levine (1998). Our argument is general and does not require commitment to a specific model; however, in the appendix we do derive this type of response function for a particular model as an example.

Our primary concern is to evaluate the efficiency of the simultaneous design relative to the sequential design. The only difference between the two is that in the sequential design, B observes t before making his decision while in the simultaneous design he does not. Efficiency is determined entirely by A 's choice of the investment level t . We use the dot and double-dot notation to reflect players' first- and second-order beliefs, respectively.⁵ A chooses t to maximize expected utility:

$$EU_k(t; \dot{p}_k, \ddot{t}) = \dot{p}_k(\ddot{t}_k)u(e + t/2) + [1 - \dot{p}_k(\ddot{t}_k)]u(e - t), \quad k \in \{q, m\},$$

where u is a positive, concave, and twice-continuously differentiable utility function increasing over payoffs and k is either the simultaneous (m) or the sequential design (q). In the sequential design t is observed by B and hence we set $\dot{t}_q = t$. We denote by t_k^* the optimal choice of player A for a given problem and \mathbf{x} is the average value over all players of type A for variable x .

For tractability, we make the following assumptions:

- The first-order belief of B 's response function has the same properties as the actual response function and is independent of the design, i.e. $\dot{p}_q(t) = \dot{p}_m(\dot{t})$ for $t = \dot{t}$. In the following, we will thus drop the subscript on the first-order beliefs about the response function; similarly, we simplify notation by setting $\dot{t} = \dot{t}_m$. Also, expected utility is written as $EU_m(t; \dot{t})$ and $EU_q(t; t)$ in the simultaneous and sequential case, respectively.
- Beliefs in the simultaneous case are consistent, i.e. $\dot{t} = \mathbf{t}_m^*$.
- When there are multiple possible equilibria, we assume the most efficient one will be chosen.⁶

First we will show that for the case of homogeneous players, the sequential design is always at least as efficient as the simultaneous design. With heterogeneous players, on the other hand, one or the other may be more efficient. The intuition is simple: In the sequential case, each type- A player's actions are independent of another; all benefits of a higher probability of sharing due to higher investment are thus internalized. In the simultaneous case, though, there is an externality. When players of type A consider how much to invest, they do not take into account how their investment affects the equilibrium average investment level and thus the expected probability of sharing.⁷ When players

⁵ \dot{p} is thus A 's point belief of B 's response function and \dot{t} is A 's point belief of what B believes A has invested.

⁶It is clear that there are multiple potential equilibria in the simultaneous case, since $\dot{t} = 0, t_m^* = 0$ is always an equilibrium. But even in the sequential case, it is possible to have multiple equilibria, since we do not impose any restrictions on the exact shape of the utility and response function; it is therefore possible that there are two distinct levels of investment which satisfy $t = \operatorname{argmax} EU_q(t; t)$.

⁷We could also think of the simultaneous design as one where players of type B are able to observe the average investment of players of type A , but not each individual's investment. We then have a classical positive-externality problem, where the investment is always lower

are heterogeneous in their risk attitudes, the high investment levels of some of them can have a positive spill-over effect on others through having a positive effect on the expected sharing rate. For instance, if there are risk neutral players who always invest, this boosts the average investment and hence the sharing response. Then, even highly risk averse investors, who would normally not invest under the sequential design, might be swayed to invest.⁸

PROPOSITION 1 *When all players A are identical, then $t_m^* \leq t_q^*$.*

The proof follows directly from the intuition laid out above. Consider an interior solution, for which the first-order condition has to be satisfied:

$$(1) \quad \partial EU_m(t_m^*; \dot{t}) / \partial t = \dot{p}(\dot{t})u'(e + t_m^*/2)/2 - [1 - \dot{p}(\dot{t})]u'(e - t_m^*) = 0$$

The first-order condition for the sequential design evaluated at the *simultaneous optimum*, using the condition above, is

$$(2) \quad \begin{aligned} \partial EU_q(t_m^*; t_m^*) / \partial t &= \dot{p}(t_m^*)u'(e + t_m^*/2)/2 - [1 - \dot{p}(t_m^*)]u'(e - t_m^*) \\ &\quad + \dot{p}'(t_m^*)[u(e + t_m^*/2) - u(e - t_m^*)] \\ &= \underbrace{\dot{p}'(t_m^*)[u(e + t_m^*/2) - u(e - t_m^*)]}_{\text{Incentive Effect}} + \\ &\quad \underbrace{[\dot{p}(t_m^*) - \dot{p}(\dot{t})][u'(e + t_m^*/2)/2 + u'(e - t_m^*)]}_{\text{Distribution Effect}} \end{aligned}$$

When all players A are identical, then $\dot{t} = t_m^*$ and the second term in the expression above, which we label the Distribution Effect, is zero. Since $\dot{p}'(t_m^*) > 0$ and $u(e + t_m^*/2) - u(e - t_m^*) > 0$ for any $t_m^* \in (0, e)$, the first term, which we call the Incentive Effect, is strictly positive. Therefore, the marginal expected utility of an increase in t is strictly positive in the sequential design at the optimum of the simultaneous design. It follows that for any interior solution, $t_m^* < t_q^*$.⁹

The comparison of the first-order conditions reveals precisely the trade-off mentioned above: since the probability of sharing is increasing in investment ($\dot{p}'(\cdot) > 0$), the expected marginal utility in the sequential design is always at least as high as the expected marginal utility in equilibrium in the simultaneous

than optimal (which does naturally not arise when each player A 's investment is directly observable).

⁸Again, we can think of the simultaneous design as a case where only the average, but not individual investment are visible to players of type B . Then, people who optimally invest the full amount exert a positive externality on others who are more risk averse and invest less than the maximum. Note that this argument does not rely on an upper bound for investment. It is sufficient that the sharing function is relatively flat in the region where the less risk averse person invests.

⁹It is also clear that if $t_m^* \in (0, e)$, then $EU_q(t_m^*; t_m^*) \geq EU_q(t; t) \forall t \in [0, t_m^*]$, implying that there is no possible optimal t smaller than t_m^* in the sequential case which yields a higher expected utility than t_m^* . It follows from $EU_q(t_m^*; t_m^*) = EU_m(t_m^*; t_m^*) \geq EU_m(t; t_m^*) \forall t$, since $t_m^* = \operatorname{argmax}_t (EU_M(t; t_m^*))$; moreover $EU_m(t; t_m^*) > EU_m(t; t) \forall t \in (0, t_m^*)$, since $\dot{p}'(\cdot) > 0$ and $\partial EU_m(t; \dot{t}) / \partial \dot{t} > 0 \forall t > 0$ and $EU_m(t; t) = EU_q(t; t)$.

design. The latter does not take into account how the probability of sharing rises with exposure.

To complete the proof, consider an equilibrium candidate $t_m^* > t_q^*$ at a corner solution, i.e. $t_m^* = e$ (the corner solution of $t_m^* = 0 > t_q^*$ obviously cannot qualify). Then it follows that

$$(3) \quad \begin{aligned} EU_m(e; e) &= \dot{p}(e)u(3e/2) + [1 - \dot{p}(e)]u(0) \\ &> EU_q(t_q^*; t_q^*) \\ &\geq EU_q(e; e) \\ &= \dot{p}(e)u(3e/2) + [1 - \dot{p}(e)]u(0), \end{aligned}$$

which is a contradiction.¹⁰ We can thus state that if $t_m^* = e$, then $t_q^* = e$, and therefore generally $t_m^* \leq t_q^*$.

When players are heterogeneous in their risk preferences, it is this same externality, that previously made the sequential design more efficient, which can now lead to a more efficient outcome in the simultaneous design:

PROPOSITION 2 *When players A are heterogeneous, then there exist equilibria such that $\mathbf{t}_m^* > \mathbf{t}_q^*$.*

When players are heterogeneous, then it is no longer true that $\dot{t} = t_m^*$ for every individual; for some individuals, $\dot{t} < t_m^*$ and for some $\dot{t} > t_m^*$. The distribution effect is thus not generally zero, but is positive for some and negative for others. An individual's choice of t depends positively on \dot{t} :

$$(4) \quad \frac{\partial t_m^*}{\partial \dot{t}} = \frac{\dot{p}(\dot{t}) [u'(e + t_m^*/2)/2 + u'(e - t_m^*)]}{-[\dot{p}(\dot{t})u''(e + t_m^*/2)/4 + [1 - \dot{p}(\dot{t})]u''(e - t_m^*)]}$$

We derive this expression by taking the total derivative of the first-order condition, equation (1). The larger $\dot{p}(\dot{t})$, the higher the effect of \dot{t} on t_m^* . If the function $p(\cdot)$ is sufficiently flat for those where $\dot{t} < t_m^*$ and sufficiently steep for those where $\dot{t} > t_m^*$, then the distribution effect is positive for those who react strongly to a change in \dot{t} and negative for those who barely change their investment in response to a change in \dot{t} ; this gives rise to the possibility of $\mathbf{t}_m^* > \mathbf{t}_q^*$. Another possibility, as mentioned above, is that some agents are at a corner solution, $t = e$, in which case the incentive and the distribution effect for them is zero, while others with a lower choice of t face positive incentive, but negative distribution effects. In sum, this again allows for the possibility that $\mathbf{t}_m^* > \mathbf{t}_q^*$.

We now provide a concrete example to highlight these effects. Consider an economy with two players of type A. The first is risk neutral with $u_1(x_1) = x_1$

¹⁰The inequality $EU_m(e; e) > EU_q(t_q^*; t_q^*)$ follows from the fact that $EU_m(e; e) \geq EU_m(t; e) \forall t$ by virtue of $t_m^* = e$. Expected utility is strictly increasing in $\dot{t} \forall t > 0$, so $EU_m(t; e) > EU_m(t; \dot{t}) \forall \dot{t} \in [0, e)$. Combining these two statements yields $EU_m(e; e) > EU_m(t; \dot{t}) \forall t \in (0, e)$; since $t_q^* = e$ when $EU_q(e; e) = EU_q(0; 0)$ and $EU_m(t; t) = EU_q(t; t)$, it follows that $EU_m(e; e) > EU_q(t_q^*; t_q^*)$ if $t_q^* < e$.

and the second is risk averse with utility $u_2(x_2) = x_2^{1/2}$. The sharing function is $\dot{p}(t) = 0.66 + 0.01t$ (and the same for \dot{t}). One can readily verify that the first player chooses to invest the entire endowment ($e = 10$) in both the sequential and simultaneous design, while the second does not invest at all in the sequential case and invests $t \approx 3.4$ in the simultaneous case.¹¹

The intuition behind this example is that even if the second player does not invest anything, the probability of sharing is greater than $2/3$ when the first player invests everything, which is the break-even point for a risk neutral player, who thus does invest the full amount. The marginal utility of increasing t at $t = 0$ is therefore strictly positive for the risk averse player in the simultaneous case, while it is strictly negative in the sequential case (since $\dot{p}(0) = 0.66 < 2/3$).¹² The risk neutral player exerts a “positive externality” (in the form of a higher probability of sharing) on the risk averse player, which raises his investment. At the same time, “internalizing the externality” (i.e. taking into account the effect a larger investment has on the probability of sharing) would not increase the risk neutral player’s investment. Importantly, the higher efficiency of the simultaneous compared to the sequential design does not hinge on a corner solution. One can readily construct examples where both types of players (neither of whom being risk neutral) are at an interior solution under each design.

In sum, when moving from the simultaneous to the sequential design, the player who invests more will see his probability of sharing rise, while the player who invests less experiences a lower probability of sharing. Due to this, the first player will thus invest more and the second player less (which we call the “distribution effect”), when going from the simultaneous to the sequential design. Moreover, both invest more because they now take into account that a higher investment implies a higher probability of sharing (we call this the “incentive effect”). With homogeneous players, the net distribution effect is zero, while the incentive effect is positive. With heterogeneous players, the distribution effect may be positive or negative, and could thus potentially outweigh the incentive effect. The key condition is that in the sequential design, one player invests a relatively large amount, and that this amount is not affected much by a lower probability of sharing, while the other player invests a relatively small amount, and that this amount is affected relatively strongly by a higher probability of sharing. Then the net distribution effect is negative and may overcome the incentive effect.

3 Experimental design and procedures

Our experiment consists of two treatments in which two anonymously paired subjects play a modified one-shot investment game described in the previous

¹¹We solved this using a simple Matlab code (available upon request); it is easy to find examples for $\mathbf{t}_m^* > \mathbf{t}_q^*$ (and of course also for the converse).

¹²The marginal expected utility also does not turn positive for higher values of t , which is a theoretical possibility in our framework. It arises from the fact that we make no assumptions about $\dot{p}(t)$ beyond $\dot{p}'(t) > 0$.

section. The treatments vary in the timing of play, and thus in the availability of information that player B has at the time of making his decision. In one treatment, called SEQ, players A and B play the game sequentially. Player B chooses the split of the tripled amount only after he observes how much player A has sent. In the other treatment, denoted SIM, both players make their decisions simultaneously and thus player B chooses a split without knowing how much player A has sent.

Let us discuss a couple of features of our design in more detail. First, notice that player A's action space is rich while player B's action space is binary. If player A faced just a binary decision to either send money or not, then his action would not vary the level of exposure. Player B's action space is also important because it determines the belief of A. If B also faced a rich action space, as in the original investment game (Berg *et al.*, 1995), he would have to decide what whole dollar amount to return. Instead, B's decision is stated as a fraction in order to make the behavior of subjects comparable between the two treatments.

Comparing the behavior of subjects playing the game sequentially and simultaneously is somewhat similar to the comparison of the direct response method and the strategy method. It could potentially result in the "hot" and "cold" elicitation procedure effects, respectively (Brandts and Charness, 2000). Empirically, the direct response method and strategy method often yield similar results (Brandts and Charness, 2011), although there are some environments where the qualitative results can be reversed just by changing the response elicitation method (e.g., Güth, Huck, and Mueller, 2001; Brosig, Weimann, and Yang, 2003; Cooper and Van Huyck, 2003; and Casari and Cason, 2009) or by changing the method in combination with changing other factors, such as the context in which the game is played (e.g., Falk, Fehr, and Fischbacher, 2003 and Cox and Deck, 2005). Note, however, that our treatments are different from the hot versus cold comparison as in the simultaneous treatment we do not allow for conditional responses which the strategy method would elicit.

The experiment consisted of eight sessions, four for each treatment, conducted at the University of Canterbury in New Zealand. A total of 156 subjects were recruited from economics and mathematics undergraduate courses. Some of the students had previously participated in economics experiments, but none had experience with the investment game. Each subject only participated in a single session of the study, making the design across-subjects. On average, a session lasted 50 minutes including the initial instructional period, questionnaire (which was not announced to the subjects at the start of the experiment and for which the subjects were paid 5 NZD instead of the show up fee) and private payment at the end. Subjects earned on average 18.85 NZD. All sessions were hand-run under the single-blind social distance protocol.

Each session included between 18 and 22 subjects. The subjects were free to choose any seat upon entering the room. Once everyone was seated, a coin was publicly flipped to determine which side of the room was to be which type. The instructions were then projected onto a screen and read aloud while the subjects followed along with their own copy. The allocation of a player A and player B to

a particular pair was done by randomly matching one subject from each type.

In the first stage of the game, players A were endowed with \$10 and had to decide how much of this endowment they want to keep for themselves and how much to transfer to their anonymous player B counterpart. This was done by circling one of the whole numbers ranging from 0 to 10 on their decision sheet. Any amount transferred by player A was to be tripled by the experimenter. In the second stage, players B had to decide how much of the tripled amount they wanted to keep for themselves and how much to transfer back to their player A counterpart. This decision was restricted to a binary choice of either HALF or ZERO. Just as for players A, this decision was done by circling one of the two choices on player B's decision sheet.

The sequence of events differed slightly between sessions implementing the sequential and simultaneous treatments. In SEQ, players A first made their transfer decision. All decision sheets were collected and the amounts transferred from players A were copied to their counterpart player B decision sheets, which were then returned to the B players. Presented with the decision of their player A counterparts, B players made their decision on whether to return HALF or ZERO. The experimenter collected all decision sheets, transferred the decision information of B players to their player A counterparts' decision sheets, and returned the decision sheets to all players to reveal their earnings. In SIM, both player types made their decisions simultaneously. The experimenter collected all decision sheets, copied the information from each player's decision sheet to their counterparts', and returned the decision sheets to all players to reveal their earnings.

In both treatments we saliently elicited player A's beliefs about their counterparts' behavior prior to playing the game. To prevent the asymmetry in tasks and payoffs, B players had a chance to predict the average elicited belief of A players and were paid for their accuracy in the same manner. The belief elicitation protocol closely follows Dufwenberg and Gneezy (2000).¹³ Players of type A were asked to predict the percentage of all B players who would transfer HALF in the second stage by completing the following statement, "I believe that ...% of players B in the room will return HALF of the tripled amount." The subjects' earnings depended upon the accuracy of their prediction. For this task, all subjects were endowed with \$5. For every one percentage point deviation from the actual outcome, ten cents were deducted from the \$5. Therefore, a deviation of 50% or more resulted in zero earnings. It is important to note that in SEQ, player A's belief depends also on an estimate of how much is sent by other A players as these amounts will affect the responses of B players by the very nature of the sequential interaction. An alternative belief elicitation procedure

¹³The beliefs of subjects in an investment game were also elicited by Ortmann *et al.* (2000) and Ashraf *et al.* (2006). Advantages and disadvantages of using a linear scoring rule are discussed in Woods and Servátka (2016). For a nice survey of the literature on measuring beliefs using different scoring rules, see Schlag, Tremewan, and van der Weele (2015), who also discuss issues of beliefs affecting behavior and the practicality of implementing complex scoring rules.

would be to ask about player A's subjective probability that the paired player B will return HALF. However, this is not verifiable given our design and thus we would not be able to make such a procedure monetarily salient.

4 Results

Table 1 provides a summary of subjects' behavior. Overall, we observe that the investment levels as well as A players' beliefs are both slightly higher in SEQ than in SIM. When it comes to B players the difference is more substantial as B players share almost twice as much in SEQ than in SIM.

Table 1
Summary of subject behavior

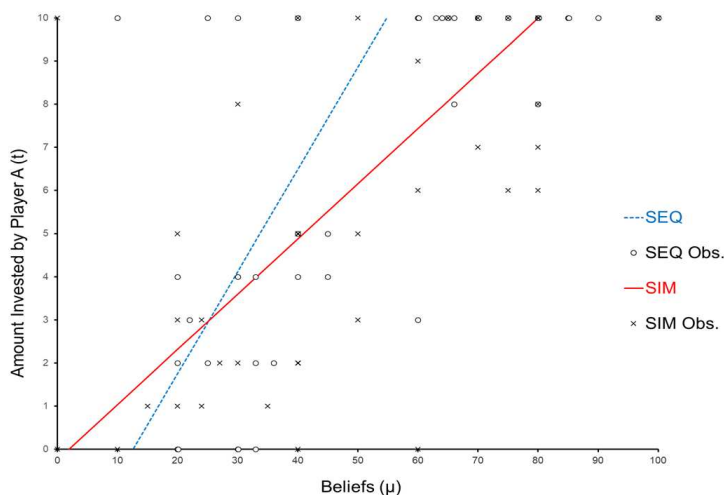
	Sequential (n=41)	Simultaneous (n=37)
Player As		
Average amount sent (t)	6.59 (3.92)	5.22 (3.65)
Median amount sent	10	5
Average belief	50.63 (23.88)	46.49 (25.41)
Player Bs		
Frequency of ret. HALF	20/41 (=49%)	10/37 (=27%)
Average belief	50.73 (21.34)	37.32 (17.09)

Note: Standard errors included in the parentheses.

Based on our model, a necessary (but not sufficient) condition for SIM to be more efficient than SEQ is that subjects expect a variation in investment levels. Recall that in the model section, we used risk aversion as a source of heterogeneity, however, this is only one such behavioral mechanism and our argument does not specifically depend on it. Figure 1 shows a scatter plot of A players' investment levels in SIM and SEQ against their stated beliefs regarding the choice of HALF by B players. Let us focus on SIM (the x's in the Figure) where the investment levels could be thought of as responses to the elicited beliefs. There are only thirteen A players who invested $t = 0$ (4 subjects) or $t = 10$ (9 subjects), i.e., the extreme values that are consistent with risk neutrality. The remaining 24 A's (64.9%) invested an intermediate amount. Figure 1 clearly shows that for most of the beliefs the corresponding investment levels are widely

scattered (i.e., multiple As investing different amounts given the same belief).¹⁴

Figure 1
Relationship between beliefs and investment levels in SIM



While the conjecture that the sequential institutional design is more efficient seems compelling (due to the fact that the trustor can reveal a high level of trust and induce a high level of cooperation), our theoretical argument suggests that the comparison of the two institutions may not be trivial. Given that we observe a high variation in investment levels, this opens up the possibility that the simultaneous design could outperform the sequential one.

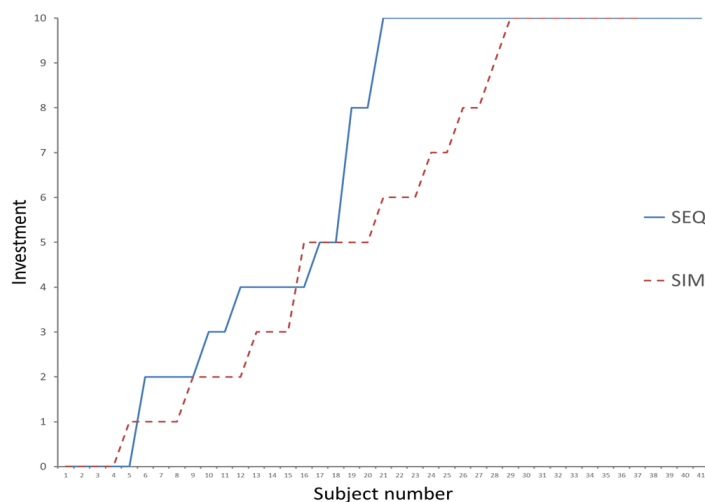
Main result: The efficiency of the sequential institution is higher than the efficiency of the simultaneous institution. The magnitude of the effect, however,

¹⁴This is indicative of and consistent with heterogeneity in risk-aversion levels. There are a plethora of studies showing that subjects' risk attitudes are heterogeneous (e.g. Cox, Robertson, and Smith, 1988; Holt and Laury, 2002, Anderson, Harrison, Lau, and Rutstrom, 2008, to mention a few). While different elicitation methods often yield different risk attitudes (Deck, Lee, Reyes, and Rosen, 2013), the overall heterogeneity is a robust finding. Therefore, it is not surprising that our subjects also exhibit heterogeneity in their risk attitudes. This can be seen by comparing player As' investment levels in SIM against their stated beliefs regarding player Bs returning HALF, i.e. As' expectations of sharing. Note that a risk neutral player A would invest $t = 0$ if his belief is smaller than $2/3$ and 10 if his belief is greater than $2/3$. For a belief other than $2/3$, only a risk-averse player A would invest an amount that is strictly between 0 and 10 .

is only weakly significant.

Support: The average t sent by player A in SEQ and SIM is 6.59 and 5.22, respectively (a 26% increase in investment from SIM to SEQ). The two-sided Mann-Whitney test (adjusting for ties) indicates that the investment levels are significantly different at the 10% level ($p=0.092$). The average investment levels, suggesting mildly higher efficiency of the sequential institution, however, do not tell the entire story. The two institutions induce visibly different distributions of t . In SEQ the investments are more dispersed and pushed to the upper boundary, whereas in SIM they are more concentrated in the middle of the support (see Figure 2). The number of A players who sent the maximum amount $t = 10$ is higher in SEQ than in SIM (51.2% vs. 24.3%), but the number of those who sent nothing does not differ between treatments (12.2% vs. 10.8%). The Epps-Singleton test rejects the hypothesis that the distribution are generated by the same stochastic process ($p=0.049$).

Figure 2
Investment levels in SEQ and SIM



Our data thus indicate that although there are significant differences in investment levels between the two institutions, the efficiency, as measured by t , is only weakly higher in SEQ than in SIM. However, are A players actually better off in SEQ than in SIM? Even though B players share significantly more often in SEQ than in SIM (49% vs. 27%; $p < 0.001$, two-sided Fisher's exact test), whether this makes A players better off is not clear from the summary data. As it turns out, in SEQ B players share primarily in the case when A players

send the full amount. We therefore compare the realized payoffs of A players in SEQ and SIM which were respectively 10.44 and 6.89. The Mann-Whitney test reports that the difference is highly statistically significant ($p=0.002$).

What about B players? Do they share more frequently when they receive a higher t from A players in SEQ? Note that this analysis is meaningful only in SEQ where the choice of t is directly observed by B players before making their decisions.¹⁵

Observation 1: B players only reward the highest level of exposure.

Support: Figure 3 displays the distribution of decisions in SEQ. Bars labeled “A’s invested” present the number of instances in which A players sent a particular t . The adjacent bars labeled “B’ returned HALF” show the number of instances in which B players returned HALF for a given t they received. It is clear from the figure that there is not an increasing relationship between t sent by A’s and the frequency of HALF returned by B’s. Notice that among 41 pairs, 21 (51%) of the A players sent $t = 10$ and 19 (91%) of B players who received $t = 10$ returned HALF. On the other hand, only 1 out of the 20 B players (5%) who received $t < 10$, returned HALF. Our data thus provide evidence that an increase in t does not induce a higher frequency of returning HALF by B players.

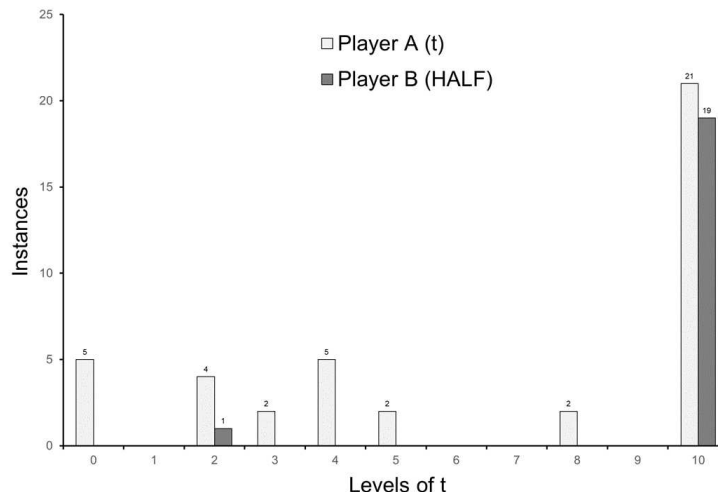
The above observation suggests that sending less than the maximum amount $t < 10$ is interpreted by B players as being distrustful rather than trusting (e.g., as in Falk and Kosfeld, 2006; Schnedler and Vadovič, 2011; see also Morita and Servátka, 2016 and 2018) and leads to a severe reduction in cooperation. Bolton, Brandts, and Ockenfels (1998), Charness and Rabin (2002), and Song (2008) also reject strictly monotone relationship between player A’s exposure and player B’s response. Some non-strict-monotonicity is also observed in the original Berg *et al.* (1995) study as well as in Ortmann, Fitzgerald, and Boeing (2000) and Rigdon (2009); however, it is not as extreme as in our experiment.

At last we compare A players’ beliefs between the two institutions (presented in Figure 4). We have elicited beliefs over actions (returning ZERO or HALF) rather than strategies of player B. In SIM, B players’ strategies coincide with their actions, but in SEQ this is not the case. There, a strategy is a function mapping investment levels into probabilities of sharing. It would be complicated and quite impractical trying to elicit subjects’ full belief function, so instead we opted for a simpler measure over the action space. This still gives us the same idea about what A players in SEQ think about the possible sharing rate by B players. It is this interpretation that we have in mind when comparing A players’ elicited beliefs and formulating the following observation.

Observation 2: While beliefs of A players about B players’ sharing rate do

¹⁵For illustration, when player A sent $t = 10$ in SIM, only 1 out of 9 (11%) B players returned HALF compared to 9 out of 28 (32%) when player A sent $t < 10$. However, this result is just an outcome of the implemented random matching.

Figure 3
Instances of decisions in SEQ



not differ between the two institutions, the average investment t conditional on player's A belief is greater in SEQ than in SIM.

Support: The comparison of beliefs in the two treatments is presented in Figure 4. The average belief of A players in SEQ and SIM is 50.63 and 46.49, respectively. While the belief in SEQ is somewhat higher, the Mann-Whitney test indicates that the difference is statistically insignificant ($p = 0.527$; two-sided). However, what differs significantly between the institutions is the relationship between t 's and elicited beliefs μ . We compare the slopes of regressions of t on beliefs in SEQ and SIM treatments. The Tobit analysis of pooled players' A decisions based on the treatment they participated in has the form:

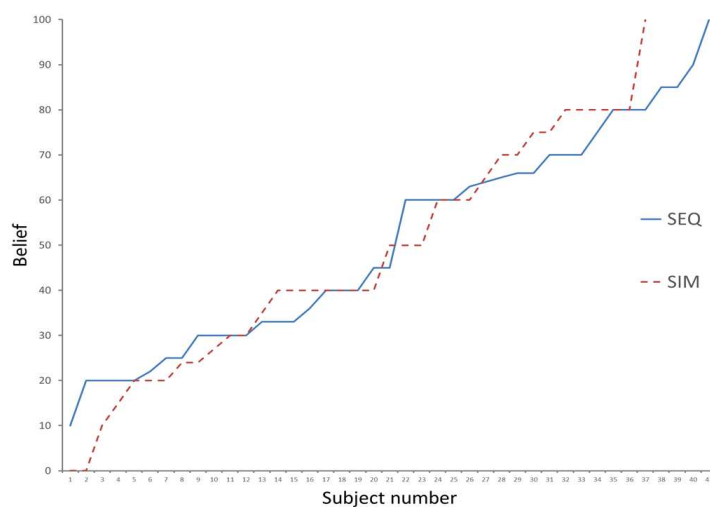
$$t_i = \alpha + \beta_1 \mu_i + \beta_2 T_{SEQ} \mu_i + \gamma T_{SEQ} + \epsilon_i$$

where T_{SEQ} represents a dummy variable that equals 1 for SEQ treatment and 0 for SIM treatment. The bounds for the Tobit estimation were imposed by the experimental design, i.e., 0 and 10. The estimated coefficients are provided in Table 2 and the regression lines are shown in Figure 1. We find that the estimated slope of the regression in SEQ is significantly higher than in SIM. This indicates that investment is more sensitive to beliefs in SEQ than in SIM. It also aligns with our intuition that the all-or-nothing strategy by A players is more frequently used and more successful in SEQ than in SIM.

Table 2
Tobit regression estimates for SEQ vs. SIM

	Coef.	Std. Err.	t-value	$p > t$
A's beliefs (β_1)	0.128	0.036	3.55	0.001
A's beliefs \times Dum. (β_2)	0.109	0.058	1.89	0.063
Dummy (γ)	-2.748	2.813	-0.98	0.332
Cons. (α)	-0.248	1.829	-0.14	0.893
Sigma	4.883	0.623		

Figure 4
A players' beliefs in SEQ and SIM



5 Discussion

Changes of institution (e.g., from an open pit market to a double auction as in Smith, 1962 or from double auction to posted offer as in Smith, 1981) lead to predictable changes in market outcomes. In the current study we set out to explore whether more subtle changes in an economic system, namely the timing of actions (and thus the availability of information about the other player's decision), can cause similar impacts on displayed behavior. Intuition, based on the observed anecdotal and scientific evidence that people tend to reciprocate trust, would suggest that individual interactions that require trust are going to be more efficient if the actions are taken sequentially rather than simultaneously.

The argument is based on the fact that the former institutional design allows the trustor to display trust before the trustee takes an action. While this argument seems intuitive, we theoretically show that under certain circumstances the simultaneous institution might be more efficient. We also compare the two institutional designs experimentally and find that the sequential institution is more efficient; however, this increase in efficiency is only weakly statistically significant and perhaps not as dramatic as one would have intuitively expected. The sequential institution elicits a steeper relationship between the beliefs of A players and their investment levels than the simultaneous one. Interestingly, we also find that it is necessary for the trustor to place complete trust in the trustee in order for this trust to be reciprocated. It seems that trustees reward only what they consider to be absolute trust and appear to interpret any investment smaller than the maximum possible as a sign of distrust.¹⁶

Our results are relevant from a theoretical standpoint and also from the point of view of designing institutions. In practice, institutions have evolved to incorporate various features to make market interactions safer. Most real-life business deals have a sequential structure, which however is heavily reinforced through systems allowing credible reputation building and third-party enforcement (e.g. contracts). In our daily lives we commonly experience sequential exchange. For example, a university first charges tuition and only then delivers classes; a contractor typically first fixes your deck, before collecting the payment; a utility provider delivers a month of service before sending out a bill.

One of the prototypical examples of simultaneous exchange is paying money for a ransom - a situation well-known from blockbuster movies. In cases where formal institutions can offer only limited security, business dealings tend to gravitate toward simultaneous form of exchange. For instance, transactions facilitated by online marketplaces, such as Craigslist, typically display some features of simultaneous exchange. Buying a used car from a private seller involves meeting up at a mutually agreeable spot (e.g. DMV), where the payment collection and signing over the title occurs simultaneously. Another interesting example are transactions in cryptocurrencies. With Bitcoin for instance, there is a some delay between the payment authorization and (a reasonable degree of) confirmation, i.e. the transaction needs to be added to the ledger and covered with several additional blocks. This time interval may be exploited by tricksters and scammers for purposes of double-paying. It is therefore advisable that parties wait for a sufficient confirmation before exchanging the product.

It is virtually impossible to find real life examples that would directly correspond to our experimental environment; nor was this an objective of our study to try to replicate such instances. Instead, we aimed to isolate the role of trust in a simple situation of exchange between two parties. Our main contribution

¹⁶The result that trustees almost exclusively share following the maximum investment may create the impression that our theoretical assumption of strict monotone relationship between the investment level and the probability of equal split ($p'(t) > 0$) is rejected by the data. However, it should be noted that our theoretical formulation is flexible enough to approximate the pattern in the data arbitrarily closely.

to the literature stems from varying the information available to the trustee about the trustor's decision. In terms of our findings, similarly to Clark and Sefton (2001), who studied behavior in a sequential prisoner's dilemma, we also observe that when interaction is sequential, more transactions are initiated and completed. Thus, the sequential design has the potential to increase the overall welfare while making it also profitable for the trusting party. Hence, our experiment advocates carefully designing institutions that allow for a display of trusting behavior.

Laboratory experiments are a powerful tool for comparing and evaluating the performance of institutions, studying their allocative and distributive properties, and exploring their behavioral limitations (Smith, 1982 and 1994; see also Servátka, 2018). Suppressing many realistic features allows for a tight control of the decision-making environment. At the same time, the laboratory results are to be interpreted with caution as they may not necessarily generalize into different strategic and contextual environments in which the interaction between transacting parties might be embedded. For example, while in the experiment subjects were assigned to roles at random, in certain environments of everyday life there could be a selection of opportunistic types into the role of the second mover. In that case the market could eventually fail irrespective of whether decisions are sequential or simultaneous. We therefore consider further laboratory experiments varying the underlying environment as well as field experimentation to be fruitful avenues for future research on the empirical relevance of the sequential versus simultaneous design.

Appendix A: Deriving a Sharing Response Function

B Players face a simple choice (denoted by S), they may either defect (i.e. $S = D$) or cooperate (i.e. $S = C$). We assume that players of type B feel some form of guilt or remorse when betraying the trust of players of type A, that is when they play D . The utility of player i is

$$(A1) \quad u(S_i; \mathbf{t}) = \begin{cases} 3\mathbf{t} - g_i v(\mathbf{t}) & \text{if } S_i = D \\ 3\mathbf{t}/2 & \text{if } S_i = C, \end{cases}$$

where $g_i > 0$ is the "guilt" parameter and $v(\mathbf{t})$ is a strictly increasing, strictly convex function with $v(0) = 0$. The greater the expected trust displayed by players of type A, the greater the guilt of not reciprocating. We assume that B players have the same utility in the simultaneous as in the sequential case, but that it depends in the former on the average (or expected) trust \mathbf{t} , whereas in the latter the actual decision is observable and $\mathbf{t} = t$. B players are all the same, but differ in their guilt parameter g_i , which is distributed on the interval $[0, \infty)$ according to the cumulative distribution function $F(g)$, with $F'(g) > 0$. Players of type B will choose to defect if their expected utility is greater from

doing so, i.e. if

$$(A2) \quad 1.5t \geq g_i v(\mathbf{t}).$$

When trust is zero, any player will defect. The higher the trust / the investment \mathbf{t} , the lower is the cutoff \tilde{g} for which $\tilde{g} = 1.5\mathbf{t}/v(\mathbf{t})$, because $v(\mathbf{t})$ is strictly convex. Since $F'(g) > 0$, a higher \mathbf{t} by A players will thus result in a strictly higher probability of sharing by players of type B. Note that the probability of sharing is not restricted in any way beyond $p' > 0$, since we have not made any further assumptions on the distribution of g and the shape of v . This is obviously but one example of how one can derive the sharing response function that we had postulated in our model, and there are many potential alternative modeling assumptions which yield the same type of response function.

Appendix B: Instructions

The player type and ID number are stated at the top of each page of instructions and on each decision form, as follows:

You are a Player _____

ID#: _____

B.1 GENERAL INSTRUCTIONS

This is an experiment studying decision-making. The instructions are simple and if you follow them carefully and make good decisions, you might earn a considerable amount of money which will be paid to you in cash at the end of the experiment. It is therefore very important that you read these instructions with care.

No Talking Allowed

It is prohibited to communicate with other participants during the experiment. Should you have any questions please ask us. If you violate this rule, we shall have to exclude you from the experiment and from all payments.

Anonymity

Each person will be randomly matched with another person in the experiment. No one will learn the identity of the person she/he is matched with. You will be matched with the same person for the entire experiment.

Types

Each two person group will consist of two types of participants (Player A and Player B) that are assigned randomly. Your assigned type will be listed at the top of each task instruction sheet.

The Game

You are randomly paired with another individual. One member of your pair will be a player A and the other one will be player B. Find your type in the upper right corner of this sheet. You will never be able to find out the identity of the player you are paired with.

Each player's earnings will be determined according to the process below.

- (a) Player A begins the process with \$10, and player B begins with \$0.
- (b) Player A then has the opportunity to transfer all, any portion, or none of his/her \$10 to player B. Player A circles his or her decision on line (1) of the attached Decision Sheet. The amount that is not transferred is player A's to keep. The amount that player A transfers triples when it reaches player B. For example, if A transfers \$10 to B, B receives \$30. If A transfers \$5 to B, B receives \$15. If A transfers \$0 to B, B receives \$0.
- (c) Player B then has the opportunity to transfer half or none of the money he/she has received to player A. Player B indicates his/her decision in line (3) of the Decision Sheet by circling either **HALF** or **ZERO**. The amount that is not transferred is player B's to keep, and the amount transferred is added to player A's earnings.

B.2 Task 1 Instructions for Player A [SIM]

In task 2, the initially described two stage game is played **simultaneously**. That is, player A makes their transfer decision at the same time that player B makes their transfer decision back to player A. Therefore, player B is going to make their decision **without knowing** how much player A has transferred to them.

For task 1, you must answer the following question:

Without knowing how much player A has transferred to them, what is the percentage of players B in the room that will return HALF of the amount that they receive, i.e. HALF of the tripled amount that is transferred to them from player A counterpart?

Your payout will depend on your accuracy. The payout is calculated as follows:

You will start with \$5. For every percentage point (1 % point) of mistake, 10 cents will be deducted from this \$5. The mistake is the absolute value of (your answer – the actual percentage). For example, if you answer accurately, you will get \$5. If you miss by 20% points (i.e., your answer is either twenty percentage points too high or twenty percentage points too low), you will be paid \$3 ($500 - 20 \times 10 = 300$). If your mistake will be larger than or equal to 50% points, then your earnings from this task will be zero.

I believe that % of players B in the room will return HALF of the tripled amount.

B.3 Task 1 Instructions for Player B

In task 2, the initially described two stage game is played **simultaneously**. That is, player A makes their transfer decision at the same time that player B makes their transfer decision back to player A. Therefore, player B is going to make their decision **without knowing** how much player A has transferred to them.

Type A players in task 1 are asked to answer the following question:

Without knowing how much player A has transferred to them, what is the percentage of players B in the room that will return HALF of the amount that they receive, i.e. HALF of the tripled amount that is transferred to them from player A counterpart?

For task 1, please answer the following question:

What is the average answer of players A in the room to question posed to them above?

Your payout will depend on your accuracy. The payout is calculated as follows:

You will start with \$5. For every percentage point (1 % point) of mistake, 10 cents will be deducted from this \$5. The mistake is the absolute value of (your answer – the actual percentage). For example, if you answer accurately, you will get \$5. If you miss by 20% points (i.e., your answer is either twenty percentage points too high or twenty percentage points too low), you will be paid \$3 ($500 - 20 \times 10 = 300$). If your mistake will be larger than or equal to 50% points, then your earnings from this task will be zero.

I believe that the average answer of players A was %.

B.4 Task 2 DECISION SHEET

Player A begins with \$10. Player B begins with \$0.

Each dollar that Player A gives to Player B is multiplied by 3 by the experimenter.

The decisions of both players will be made simultaneously. Therefore, player B **will not know** how much player A has transferred to player B before player B makes their decision of whether to return HALF or ZERO.

(1) **Player A's decision:**

Circle the amount that you want to transfer to player B

0 1 2 3 4 5 6 7 8 9 10

(2) **Player B's decision:**

Circle the amount you want to transfer to player A:

HALF or ZERO

(3) Experimenter calculates total earnings:

Final payoff to player A: _____

Final payoff to player B: _____

B.5 Task 1 Instructions for Player A [SEQ]

In task 2, the initially described two stage game is played **sequentially**. That is, player A makes their transfer decision and then player B makes their transfer decision after being able to see how much player A transferred to them. Therefore, player B is going to make their decision **knowing** how much player A has transferred to them.

For task 1, you must answer the following question:

After seeing how much is transferred to them from player A, what

is the percentage of players B in the room that will return HALF of the amount that they receive, i.e. HALF of the tripled amount that is transferred to them from player A counterpart?

Your payout will depend on your accuracy. The payout is calculated as follows:

You will start with \$5. For every percentage point (1 % point) of mistake, 10 cents will be deducted from this \$5. The mistake is the absolute value of (your answer – the actual percentage). For example, if you answer accurately, you will get \$5. If you miss by 20% points (i.e., your answer is either twenty percentage points too high or twenty percentage points too low), you will be paid \$3 ($500 - 20 \times 10 = 300$). If your mistake will be larger than or equal to 50% points, then your earnings from this task will be zero.

I believe that % of players B in the room will return HALF of the tripled amount.

B.6 Task 1 Instructions for Player B

In task 2, the initially described two stage game is played **sequentially**. That is, player A makes their transfer decision and then player B makes their transfer decision after being able to see how much player A transferred to them. Therefore, player B is going to make their decision **knowing** how much player A has transferred to them.

Type A players in task 1 are asked to answer the following question:

After seeing how much is transferred to them from player A, what is the percentage of players B in the room that will return HALF of the amount that they receive, i.e. HALF of the tripled amount that is transferred to them from player A counterpart?

For task 1, please answer the following question:

What is the average answer of players A in the room to question posed to them above?

Your payout will depend on your accuracy. The payout is calculated as follows:

You will start with \$5. For every percentage point (1 % point) of mistake, 10 cents will be deducted from this \$5. The mistake is the absolute value of (your answer – the actual percentage). For example, if you answer accurately, you will get \$5. If you miss by 20% points (i.e., your answer is either twenty percentage points too high or twenty percentage points too low), you will be paid \$3 ($500 - 20 \times 10 = 300$). If your mistake will be larger than or equal to 50% points, then your earnings from this task will be zero.

I believe that the average answer of players A was %.

B.7 Task 2 DECISION SHEET

Player A begins with \$10. Player B begins with \$0.

Each dollar that Player A gives to Player B is multiplied by 3 by the experimenter.

The decisions of both players will be made sequentially. Therefore, player B will **know** how much player A has transferred to player B before player B makes their decision of whether to return HALF or ZERO.

(1) Player A's decision:

Circle the amount that you want to transfer to player B

0 1 2 3 4 5 6 7 8 9 10

(2) Player B's decision:

Circle the amount you want to transfer to player A:

HALF or ZERO

(3) Experimenter calculates total earnings:

Final payoff to player A: _____

Final payoff to player B: _____

References

- [1] Ahn TK, Lee M, Ruttan L, Walker J (2007), "Asymmetric payoffs in simultaneous and sequential prisoner's dilemma games," *Public Choice*, 132, pp. 353–366.
- [2] Andersen S, Harrison GW, Lau MI, Rutström EE (2008), "Eliciting risk and time preferences," *Econometrica*, 76(3), pp. 583–618.
- [3] Arrow KJ (1976), *The Limits of Organization*, New York: Norton.
- [4] Ashraf, N, Bohnet I, and Piankov N (2006), "Decomposing Trust and Trustworthiness," *Experimental Economics*, Special Issue on Behavioral Economics, 9(3), pp. 193–208.
- [5] Battigalli P and Dufwenberg M (2007), "Guilt in Games," *American Economic Review, Papers and Proceedings*, 97, pp. 170–176.
- [6] Ben-Ner A, Putterman L (2009), "Trust, communication and contracts: An experiment," *Journal of Economic Behavior & Organization*, 70(1-2), pp. 106–121.
- [7] Ben-Ner A, Putterman L, Ren T (2011), "Lavish returns on cheap talk: Two-way communication in trust games," *Journal of Socio-Economics*, 40(1), pp. 1–3.
- [8] Berg J, Dickhaut J, and McCabe K (1995), "Trust, Reciprocity, and Social History," *Games & Economic Behavior*, 10(1), pp. 122–142.
- [9] Bolton G, Brandts J, and Ockenfels A (1998), "Measuring Motivations for the Reciprocal Responses Observed in a Simple Dilemma Game," *Experimental Economics*, 1, pp. 207–219.
- [10] Bracht J, Feltovich N (2008), "Efficiency in the trust game: an experimental study of precommitment," *International Journal of Game Theory*, 37(1), pp. 39–72.
- [11] Bracht J, Feltovich N (2009), "Whatever you say, your reputation precedes you: Observation and cheap talk in the trust game," *Journal of Public Economics*, 93(9-10), pp. 1036–1044.
- [12] Brandts J and Charness G (2000), "Hot and Cold Decisions and Reciprocity in Experiments with Sequential Games," *Experimental Economics*, 2(3), pp. 227–238.
- [13] Brandts J and Charness G (2011), "The strategy versus the direct-response method: a first survey of experimental comparisons," *Experimental Economics*, 14(3), pp. 375–398.
- [14] Brosig J, Weimann J and Yang C-L (2003), "The Hot Versus Cold Effect in a Simple Bargaining Experiment," *Experimental Economics*, 6(1), pp. 75–90.

- [15] Camerer C (2003), *Behavioral Game Theory: Experiments in Strategic Interaction*, Princeton University Press.
- [16] Casari, M. and T. N. Cason (2009), “The Strategy Method Lowers Measured Trustworthy Behavior,” *Economics Letters*, 103, pp. 157–159.
- [17] Chaudhuri A, Gangadharan L (2007), “An experimental analysis of trust and trustworthiness,” *Southern Economic Journal*, pp. 959–985.
- [18] Charness G, Cobo-Reyes R, and Jimenez N (2008), “An Investment Game with Third Party Intervention,” *Journal of Economic Behavior & Organization*, 68, pp. 18–28.
- [19] Charness G, Kuhn P (2011), “Lab labor: What can labor economists learn from the lab?” In *Handbook of Labor Economics*, 4, pp. 229–330.
- [20] Charness G and Rabin M (2002), “Understanding Social Preferences with Simple Tests,” *Quarterly Journal of Economics*, 74(6), pp. 1579–1601.
- [21] Charness G and Dufwenberg M (2006), “Promises and Partnership,” *Econometrica*, 117, pp. 817–869.
- [22] Charness G, Dufwenberg M (2010), “Bare promises: An experiment,” *Economics Letters*, 107(2), pp. 281–283.
- [23] Clark K and Sefton M (2001), “The Sequential Prisoner’s Dilemma: Evidence on Reciprocation,” *Economic Journal*, 111, pp. 51–68.
- [24] Cooper DJ and Van Huyck JB (2003), “Evidence on the Equivalence of the Strategic and Extensive Form Representation of Games,” *Journal of Economic Theory*, 110, pp. 290–308.
- [25] Cox JC (2004), “How to Identify Trust and Reciprocity,” *Games & Economic Behavior*, 46, pp. 260–281.
- [26] Cox, JC and Deck CA (2005), “On the Nature of Reciprocal Motives,” *Economic Inquiry*, 43(3), pp. 623–635.
- [27] Cox JC, Friedman D, and Gjerstad S (2007), “A Tractable Model of Reciprocity and Fairness,” *Games & Economic Behavior*, 59, pp. 17–45.
- [28] Cox JC, Friedman D, and Sadiraj V (2008), “Revealed altruism,” *Econometrica*, 76(1), pp. 31–69.
- [29] Cox JC, Kerschbamer R, and Neururer D (2016), “What is trustworthiness and what drives it?” *Games & Economic Behavior*, 98, pp. 197–218.
- [30] Cox JC, Roberson B, Smith VL (1982), “Theory and behavior of single object auctions,” *Research in Experimental Economics*, 2(1), pp. 1–43.
- [31] Dasgupta P (2000), “Economic progress and the idea of social capital,” in Dasgupta, P. and Serageldin, I. (eds), *Social Capital: A Multifaceted Perspective*, Washington, D.C.: World Bank.
- [33] Deck C, Lee J, Reyes JA, Rosen CC (2013), “A failed attempt to explain within subject variation in risk taking behavior using domain specific risk attitudes,” *Journal of Economic Behavior & Organization*, 87, pp. 1–24.
- [33] Deck C, Servátka M, Tucker S (2013), “An examination of the effect of messages on cooperation under double-blind and single-blind payoff procedures,” *Experimental Economics*, 16(4), pp. 597–607.
- [34] Dufwenberg M and Gneezy U (2000), “Measuring Beliefs in an Experimental Lost Wallet ” *Games & Economic Behavior*, 30, pp. 163–182.
- [35] Dufwenberg M (2002), “Marital investments, time consistency and emotions,” *Journal of Economic Behavior & Organization*, 48(1), pp. 57–69.

- [36] Dufwenberg M and Kirchsteiger G (2004), “A Theory of Sequential Reciprocity,” *Games & Economic Behavior*, 47, pp. 268–98.
- [37] Dufwenberg M, Servátka M, Vadovič R (2017), “Honesty and informal agreements,” *Games & Economic Behavior*, 102, pp. 269–285.
- [38] Eckel CC, Wilson RK (2004), “Is trust a risky decision?,” *Journal of Economic Behavior & Organization*, 55(4), pp. 447–465.
- [39] Ellingsen T and Johannesson M (2008), “Pride and Prejudice: The Human Side of Incentive Theory,” *American Economic Review*, 98(3), pp. 990–1008.
- [40] Engle-Warnick J and Slonim RL (2004), “The evolution of strategies in a repeated trust game,” *Journal of Economic Behavior & Organization*, 55(4), pp. 553–573.
- [41] Fairley K, Sanfey A, Vyrastekova J, Weitzel U (2016), “Trust and risk revisited,” *Journal of Economic Psychology*, 57, pp. 74–85.
- [42] Falk A, Fehr E, and Fischbacher U (2003), “On the Nature of Fair Behavior,” *Economic Inquiry*, 41(1), pp. 20–26.
- [44] Falk A and Fischbacher U (2006), “A Theory of Reciprocity,” *Games & Economic Behavior*, 54, pp. 293–315.
- [44] Falk A and Kosfeld M (2006), “The Hidden Costs of Control,” *American Economic Review*, 96(5), pp. 1611–1630.
- [45] Fehr E (2009), “On the economics and biology of trust,” *Journal of the European Economic Association*, 7(23), pp. 235–266.
- [46] Fehr E and Schmidt KM (1999), “A theory of fairness, competition, and cooperation,” *Quarterly Journal of Economics*, 114(3), pp. 817–868.
- [47] Fukuyama F (1995), *Trust: The Social Virtues and the Creation of Prosperity*, New York: Free Press.
- [48] Güth, W, Huck S, and Mueller W (2001), “The Relevance of Equal Splits in Ultimatum Games,” *Games & Economic Behavior*, 37, pp. 161–169.
- [49] Gneezy U, Leonard KL, List JA (2009), “Gender differences in competition: Evidence from a matrilineal and a patriarchal society,” *Econometrica*, 77(5), pp. 1637–1664.
- [50] Henrich J, Boyd R, Bowles S, Camerer C, Fehr E, Gintis H, McElreath R (2001), “In search of homo economicus: behavioral experiments in 15 small-scale societies,” *American Economic Review*, 91(2), pp. 73–78.
- [51] Holt CA, Laury SK (2002), “Risk aversion and incentive effects,” *American Economic Review*, 92(5), pp. 1644–1655.
- [52] Houser D, Schunk D, Winter J (2010), “Distinguishing trust from risk: An anatomy of the investment,” *Journal of Economic Behavior & Organization*, 74(1-2), pp. 72–81.
- [53] Houser D, Xiao E (2015), “House money effects on trust and reciprocity,” *Public Choice*, 163(1-2), pp. 187–199.
- [54] Huck S, Mueller W and Normann H-T (2011), “Stackelberg Beats Cournot — On Collusion and Efficiency in Experimental Markets,” *Economic Journal*, 111, 474, pp. 749–765.
- [55] Huck S, Lünser GK, Tyran JR (2012), “Competition fosters trust,” *Games & Economic Behavior*, 76(1), pp. 195–209.
- [56] Kimbrough E, Smith V and Wilson B (2008), “Historical Property Rights, Sociality, and the Emergence of Impersonal Exchange in Long Distance Trade,” *American Economic Review*, 98(3), pp. 1009–1039.

- [57] Knack S and Keefer P (1997), “Does Social Capital Have an Economic Payoff? A Cross-Country Investigation,” *Quarterly Journal of Economics*, 112, pp. 1251–1288.
- [58] La Porta R, Lopez-de-Salanes F, Shleifer A, and Vishny R (1997), “Trust in Large Organizations,” *American Economic Review Papers & Proceedings*, 87, pp. 333–338.
- [59] Levine DK (1998), “Modeling altruism and spitefulness in experiments,” *Review of Economic Dynamics*, 1(3), pp. 593–622.
- [60] McCabe K, Smith V, and LePore M (2000), “Intentionality detection and mindreading: Why does game form matter?” *Proceedings of the National Academy of Sciences of the United States of America*, 97(8), pp. 4404–4409.
- [61] Morita H and Servátka M (2016), “Does Group Identity Prevent Inefficient Investment in Outside Options? An Experimental Investigation,” in S.J. Goerg and J. Hamman eds., *Research in Experimental Economics: Experiments in Organizational Economics*, 19, pp. 105–127.
- [62] Morita H and Servátka M (2018), “Investment in Outside Options as Opportunistic Behavior: An Experimental Investigation,” *Southern Economic Journal*, 85, pp. 457–484.
- [63] Ortmann A, Fitzgerald J, and Boeing C (2000), “Trust, Reciprocity, and Social History: A Re-examination,” *Experimental Economics*, 3(3), pp. 81–100.
- [Ostrom1992] Ostrom E, Walker J, and Gardner R, “Covenants With and Without a Sword: Self-Governance is Possible,” *American Political Science Review*, 86, pp. 404–417.
- [65] Putnam R (1993), *Making Democracy Work: Civic Traditions in Modern Italy*, Princeton: Princeton University Press.
- [66] Rigdon M (2009), “Trust and reciprocity in incentive contracting,” *Journal of Economic Behavior & Organization*, 70(1-2), pp. 93–105.
- [67] Schlag KH, Tremewan J, Van der Weele JJ (2015), “A penny for your thoughts: A survey of methods for eliciting beliefs,” *Experimental Economics*, 18(3), pp. 457–490.
- [68] Schnedler W and Vadovič R (2011), “Legitimacy of Control,” *Journal of Economics & Management Strategy*, 20(4), pp. 985–1009.
- [69] Schotter A, Weiss A, and Zapater I (1996), “Fairness and Survival in Ultimatum and Dictatorship Games,” *Journal of Economic Behavior & Organization*, 31(1), pp. 37–56.
- [70] Servátka M (2018), “How Do Experiments Inform Collective Action Research?” *Research Agenda for New Institutional Economics*, C. Ménard & M. Shirley eds., Edward Elgar Publishing, pp. 260–268.
- [71] Servátka M, Tucker S, Vadovič R (2011), “Building trust - one gift at a time,” *Games*, 2(4), pp. 412–433.
- [72] Servátka M, Tucker S, Vadovič R, “Words speak louder than money,” *Journal of Economic Psychology*, 32(5), pp. 700–709.
- [73] Sheremeta RM, Zhang J (2014), “Three-Player Trust Game with Insider Communication,” *Economic Inquiry*, 52(2), pp. 576–591.
- [74] Smith VL (1962), “An experimental study of competitive market behavior,” *Journal of Political Economy*, 70(2), pp. 111–137.
- [75] Smith VL (1981), “An Empirical Study of Decentralized Institutions of Monopoly Restraint,” in G. Horwich and J. Quirk (eds.), *Essays in Contemporary Fields of Economics*, West Lafayette: Purdue University Press.

- [76] Smith VL (1982), “Microeconomic systems as an experimental,” *American Economic Review*, 72(5), pp. 923–955.
- [77] Smith VL (1994), “Economics in the Laboratory,” *Journal of Economic Perspectives*, 8(1), pp. 113–131.
- [78] Song F (2008), “Trust and Reciprocity Behavior and Behavioral Forecasts: Individuals versus Group-Representatives,” *Games & Economic Behavior*, 62(2), pp. 675–696.
- [79] Woods D, Servátka M (2016), “Testing psychological forward induction and the updating of beliefs in the lost wallet game,” *Journal of Economic Psychology*, 56, pp. 116–125.
- [80] Zak P and Knack S (2001), “Trust and Growth,” *Economic Journal*, 111(470), pp. 295–321.

Till Gross
Department of Economics, D-897 Loeb,
Carleton University, 1125 Colonel By
Drive, Ottawa, ON, K1S 5B6
till.gross@carleton.ca

Radovan Vadovič
Department of Economics, D-897 Loeb,
Carleton University, 1125 Colonel By
Drive, Ottawa, ON, K1S 5B6
radovan.vadovic@carleton.ca

Maroš Servátka
MGSM Experimental Economics Lab-
oratory, Macquarie Graduate School of
Management, 99 Talavera Rd., North
Ryde NSW 2113, Australia
maros.servatka@mgs.edu.au