

**Investment in Outside Options as Opportunistic Behavior:  
An Experimental Investigation**

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**Abstract:** We contribute to the theory of the firm by experimentally investigating a bilateral trade relationship in which standard theory assuming self-regarding preferences predicts that the seller will be better off by investing in the outside option to improve his bargaining position. The seller's investment, however, might negatively affect the buyer's other-regarding preferences if the investment is viewed as opportunistic. We find overall support for our hypotheses that arise from the link between other-regarding behavior and opportunism. In our experiment the seller can become worse off by investing, suggesting that costly solutions to opportunistic behavior such as vertical integration may be unnecessary.

**JEL Classification:** C91, L20

**Keywords:** altruism, experiment, relationship-specific investment, opportunistic behavior, other-regarding preferences, outside option, theory of the firm

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## 1. Introduction

How does opportunistic behavior associated with investment in an outside option affect the split of appropriable quasi-rents? In bilateral trade relationships, relation-specific investment often creates a surplus to be shared between two parties because the value of trade within the relationship exceeds the value of outside trading opportunities. The surplus, often referred to as appropriable quasi-rents, plays a critical role in the theory of the firm literature. Appropriable quasi-rents open up possibilities for *ex-post* opportunistic behavior, which can be prevented by costly remedies such as vertical integration or contracts (Williamson, 1979, 1985; Klein, Crawford, and Alchian, 1978). Investment in an outside option is an important example of *ex-post* opportunistic behavior, as pointed out, for instance, by Klein et al. (1978). In their example of bilateral trade between a printing press company and a publisher, Klein et al. argue that the publisher may decide to hold its own standby press facilities (an investment in an outside option) in order to increase its bargaining position against the printing press company.<sup>1</sup> If agents are selfish and care only about their monetary return, investment in outside options will be made whenever the monetary return from doing so is positive. It is well known, however, that agents often care for others to some degree rather than being completely selfish (see Camerer, 2003 and Cooper and Kagel, 2010 for nice surveys). The presence of other-regarding preferences makes it difficult to predict actions that agents take regarding investment in outside options.

One party's investment in an outside option may crowd out its trade partner's other-regarding preferences. We experimentally investigate this link by analyzing the following interaction between a seller and a buyer. A potential gain from trade between the seller and the buyer, denoted by  $G$ , is available, where  $G$  is interpreted as appropriable quasi-rents. First, the seller decides whether to invest in an outside option at the cost  $F$  in case he later rejects the buyer's offer. If the seller invests, then his outside option is  $X$ , where  $G > X > F$ . If the seller does not invest, then his outside option is 0. Next, the buyer makes a take-it-or-leave-it offer  $p$  to the seller to divide the gain  $G$ . The buyer gets to keep the remainder  $G - p$  only if the seller accepts the offer. Finally, the seller learns about the offer and decides whether to accept or reject it. If the seller accepts the offer, he receives  $p$  and his outside option becomes irrelevant in this case. If the seller rejects the offer, he receives the outside

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<sup>1</sup> See also Baker and Hubbard (2004), who analyze the U.S. trucking industry and show that, when a driver owns a truck, the truck ownership may encourage the driver to engage in a costly search for alternative hauls, in order to strengthen his bargaining position with the dispatcher. Holmstrom and Tirole (1991) study transfer pricing and the organization of trade between a selling unit and a buying unit. When the unit managers are allowed to trade with outsiders, they will spend resources to improve outside offers in ways that do not contribute to overall efficiency. Cai (2003) also points out that, in bilateral trade relationships, a party may want to exert efforts in searching for alternative business partners in order to enhance his bargaining position, even if it does not add value to the trade with his partner.

option of  $X$  if he invested, and receives 0 otherwise. The buyer receives 0 regardless of the investment.

The standard economic theory predicts that the seller will invest in the outside option if agents care only about their own monetary payoffs. To see this, suppose that the seller did not invest at Stage 1. The buyer then offers  $p = 0$ , which is accepted by the seller under the tie-breaking assumption that the seller behaves in favor of the buyer when the seller is indifferent between accepting and rejecting the offer. Similarly, if the seller invested at Stage 1, the buyer offers  $p = X$ . Anticipating this, the seller will invest in the outside option at Stage 1 because  $X > F$ . The seller's investment is opportunistic in the sense that it increases the seller's payoff from 0 to  $X$  by effectively reducing the buyer's payoff from  $G$  to  $G - X$ . The investment is inefficient because it adds no value to the seller's trade with the buyer.

In reality, agents often behave in other-regarding ways. The seller's investment in the outside option might have a negative impact on the buyer's other-regarding behavior if the buyer views the investment as opportunistic. Consequently, the seller may become worse off by investing in the outside option, and hence he may decide not to invest in it. If other-regarding behavior prevents inefficient investment in outside options, costly solutions aimed at mitigating opportunism, such as vertical integration or contracts, are unnecessary.

The connection between other-regarding behavior and *ex-post* opportunistic behavior can therefore yield important implications for the design of a governance structure. To the best of our knowledge, however, no previous papers have studied this link. This paper attempts to take a first step towards understanding of this link by experimentally investigating conjectures that arise in our setup. We derive conjectures based on the logic of Revealed Altruism theory (Cox, Friedman, and Sadiraj, 2008). First, consider the case in which the seller invested to establish the outside option of  $X$ . When dividing gain  $G$ , an altruistic buyer may offer more than  $X$ , even if the seller accepts any offer greater than or equal to  $X$ . Let  $p_I \equiv X + Z$  denote the buyer's offer following the seller's investment, where  $Z$  is a premium price on top of the outside option, resulting from the buyer's altruistic preferences. Next, consider the case when the seller did not invest in the outside option. Let  $p_{NI}$  denote the buyer's offer following the seller's non-investment, where an altruistic buyer may offer  $p_{NI} > 0$  even if the seller accepts any non-negative offer.

We postulate that the buyer views the seller's investment as opportunistic behavior. The lack of investment in an outside option means that the seller chose not to engage in opportunistic behavior even though there was a chance to do so. Hence, we postulate that the buyer views non-investment as kind behavior. This logic yields three conjectures. First, we conjecture that the premium price  $Z$  is

smaller than the offer following non-investment  $p_{NI}$ . The seller's (opportunistic) investment reduces the degree of the buyer's altruism towards the seller, whereas the seller's (kind) non-investment increases it. This implies that  $Z$  (which is a measure of the buyer's altruism following investment) is less than  $p_{NI}$  (a measure of the buyer's altruism following non-investment). Second, we conjecture that  $Z$  is decreasing in  $X$ . As the level of the outside option increases, the buyer views the seller's investment as increasingly more opportunistic. This reduces the buyer's altruism towards the seller, implying that the buyer offers a lower premium price to the seller. Third, we conjecture that  $p_{NI}$  is increasing in  $X$ . This third conjecture hinges on the buyer's perception of non-investment being kind behavior, where the degree of perceived kindness increases as the forgone outside option increases. This implies that  $p_{NI}$  increases as  $X$  increases.

We design a laboratory experiment that allows us to test our conjectures in a basic setup, focusing on the underlying mechanism that drives the behavior of economic agents. This approach enables us to study the interaction of opportunistic and other-regarding behavior in a situation in which we are able to control details that affect behavior in the field in an uncontrolled manner and thus allows us to draw causal inferences. In the experiment, we vary the size of the outside option  $X$ , and observe the following results, which suggest that there is a significant link between other-regarding behavior and investment in an outside option. Consistent with the first conjecture, we find that the premium price  $Z$  is smaller than the offer following non-investment  $p_{NI}$  for all three levels of  $X$  that we have implemented in our design. We also find evidence supporting our second conjecture that  $Z$  is decreasing in  $X$ . Regarding the third conjecture, our data show that (i)  $p_{NI}$  is increasing in  $X$  when  $X$  is high; and (ii)  $p_{NI}$  is not affected by changes in  $X$  when  $X$  is low.

Our finding yields a new implication for the theory of the firm. In our setup, standard economic theory assuming self-regarding preferences predicts that the seller's investment in the outside option, although inefficient, is profitable as long as  $X > F$  holds, and hence the seller invests in it. Costly remedies to prevent the inefficient investment such as vertical integration or contracts will be valuable if the cost of the remedy is relatively small (i.e., less than  $X - F$ ). Our experimental results suggest that such remedies may be unnecessary because the investment may not be profitable in the presence of the link between other-regarding behavior and investment in the outside option. Since the seller's investment reduces the buyer's other-regarding preferences, the buyer's offer following investment may not be sufficiently high compared to his offer following non-investment in order for the seller to recover the investment cost. In fact, in our experiment, we find that the seller becomes worse off on average by investing in relatively low outside options.

## 2. Relationship to the literature

The literature on the theory of the firm, which originated with Coase's (1937) seminal essay, now spans a large body of research. Gibbons (2005) clearly defines and compares four strands of this literature. The relation-specific investment plays an important role in two of these strands: the property-rights theory (Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995) and the rent-seeking theory (Williamson, 1971, 1979, 1985; Klein et al., 1978). In the property-rights theory, the surplus (appropriable-quasi rents) created by relation-specific investment is shared between two parties through efficient bargaining. The surplus-sharing leads to inefficiency in relation-specific investment when contracts are incomplete, and the theory studies the roles of asset ownership in mitigating this *ex-ante* inefficiency. In contrast, the rent-seeking theory focuses on *ex-post* inefficiency, where appropriable quasi-rents open up possibilities for *ex-post* opportunistic behavior, which can be prevented by vertical integration or contracts. A key hypothesis in the rent-seeking theory is that a larger return from opportunistic behavior makes integration more likely (see Klein et al., 1978; Whinston, 2003; Gibbons, 2005).<sup>2</sup>

The aim of the present paper is to contribute to the rent-seeking theory of the firm by studying the link between investment in an outside option and other-regarding behavior. While we are not aware of any previous research that studies this link directly, it bears a certain similarity to the relationship between implementation of a minimum performance requirement and a worker's intrinsic motivation studied by Falk and Kosfeld (2006), referred to as FK hereafter. In their experimental principal-agent game, the agent chooses a productive activity  $x$ , which is costly to him but beneficial to the principal. The cost for the agent is  $x$ , while the benefit to the principal is  $2x$ . The agent has an initial endowment of 120, while the endowment of the principal is 0. Before the agent chooses  $x$ , the principal decides whether or not to force a minimum requirement  $\underline{x} > 0$ . The agent's choice set is  $x \in [\underline{x}, 120]$  with the minimum requirement, and  $x \in [0, 120]$  without it. FK implement three control treatments: a low ( $\underline{x} = 5$ ) treatment; a medium ( $\underline{x} = 10$ ) treatment; and a high ( $\underline{x} = 20$ ) treatment. For all three treatments, they find that most agents choose smaller values of  $x$  when minimum requirements are enforced. Their results suggest that the use of control entails "hidden costs" that should be considered when designing employment contracts and workplace environments.

The seller's investment in the outside option in our setup plays a role in a certain sense similar to enforcement of a minimum payment requirement. This is because, if the seller invests, the buyer may think that he must offer a price at least equal to the outside option,  $p = X$ . The

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<sup>2</sup> See Shelanski and Klein (1995) for a survey of studies testing this hypothesis empirically.

requirement, however, is indirect because the seller may accept an offer  $p < X$ , whereas the requirement in FK is direct. Furthermore, investment in outside options is costly, whereas a minimum performance requirement is costless in FK. Our focus is to study the aforementioned conjectures regarding the link between investment in an outside option and other-regarding behavior, whereas the focus in FK is to show that most agents reduce their performance as a response to the principal's control decision.

Implementation of the minimum performance requirement in FK has an effect similar to investment in rent-seeking activities in Oosterbeek, Sloof, and Sonnemans (2011), referred to as OSS hereafter. OSS experimentally study the link between productive incentives and rent-seeking incentives in a multi-tasking environment. In their extension of the trust game, a seller chooses two investment levels, a productive one and an unproductive (rent-seeking) one. A buyer then decides how much money to transfer back to the seller, where back-transfers should be in between a minimum amount  $M$  and the overall surplus  $S$  (with  $M < S$ ). Unproductive investments only affect  $M$ , whereas productive investments increase  $S$  and  $M$ . OSS find that subjects typically choose higher rent-seeking levels when the marginal returns to rent-seeking increase, but the observed increases are much smaller than the levels predicted by standard theory. Moreover, the investments in productive activities are typically higher than the levels predicted by standard theory and the investments in rent-seeking are usually lower. OSS point out that reciprocity considerations seem to mitigate the adverse effects of rent-seeking opportunities.<sup>3</sup>

Despite certain similarities in experimental designs, the three studies are significantly different and their contributions are complementary. We contribute to the theory of the firm by studying the link between investment in an outside option and other-regarding behavior. Our finding suggests that costly remedies for *ex-post* opportunistic behavior, such as vertical integration or contracts, may be unnecessary in the presence of other-regarding behavior. FK contribute to labor/personnel economics by studying the link between implementation of a minimum performance requirement and a worker's intrinsic motivation, and their findings yield implications for the design of employment contracts and workplace environments. OSS contribute to the analysis of incentives in multi-tasking environments by studying the link between productive and rent-seeking activities in the presence of intension-based reciprocity.

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<sup>3</sup> For a related experimental paper, see Oosterbeek, Sonnemans, and van Velzen (2003), who study a marriage situation in which a spouse who invests in relationship-specific human capital increases the surplus. Such an investment decreases her outside option, which might in turn result in underinvestment in relationship-specific human capital. They find that although underinvestment occurs, it is less frequent than game theory predicts. Unlike unproductive investments in OSS, relationship-specific investment decreases the outside option in Oosterbeek, Sonnemans, and van Velzen.

### 3. Theoretical framework, experimental design, and hypotheses

#### 3.1. Theoretical framework

We analyze the interaction between a seller and a buyer presented in the introduction. As a benchmark, consider the case in which the seller has no option to invest in the outside option. To split the gain  $G$ , an altruistic/inequality-averse buyer would offer a strictly positive price, even if the seller accepts any non-negative offer  $p \geq 0$ . The seller, however, may in fact reject low-price offers because of his own inequality aversion. This would work in the direction of further increasing the buyer's offer, because by doing so, the buyer can reduce the probability of rejection. Let us now introduce the seller's option to invest in the outside option. If the seller invested to establish the outside option of  $X$ , the buyer may offer more than  $X$  for reasons analogous to the reasons for a strictly positive price offered in the benchmark case. Recall that  $p_I \equiv X + Z$  denotes the buyer's offer following the seller's investment, where  $Z (\geq 0)$  is a premium price on top of the outside option  $X$  resulting from buyer's altruistic preferences, and that  $p_{NI}$  denotes the buyer's offer when the seller did not invest in Stage 1.

The focus of our experiment is the interaction of opportunism with other-regarding behavior. Revealed Altruism theory (Cox, Friedman, and Sadiraj, 2008) has been quite successful in predicting outcomes in various experimental settings testing for the presence and nature of other-regarding behavior and has recently received increased attention in the related literature. We derive our conjectures based on the logic of the theory.

The key elements of the theory are a partial ordering of opportunity sets, a partial ordering of preferences, and two axioms about reciprocity. The partial ordering of opportunity sets is defined as follows. Let  $b$  denote the buyer's money payoff and let  $s$  denote the seller's money payoff. Let  $b_H^*$  denote the buyer's maximum money payoff in opportunity set  $H$  and let  $s_H^*$  denote the seller's maximum money payoff in opportunity set  $H$ . Opportunity set  $G$  is 'more generous than' opportunity set  $F$  for the buyer if: (a)  $b_G^* - b_F^* \geq 0$ ; and (b)  $b_G^* - b_F^* \geq s_G^* - s_F^*$ . In the original version of the theory, our three treatments include the same opportunity sets,  $[0, 100]$ , for the buyer, regardless of whether or not the seller chooses to invest in the outside option. To see this, suppose that the seller decides to invest in the outside option. Our setup does not rule out the possibility that the buyer offers  $p = 0$  and the seller accepts the offer instead of rejecting it and receives the outside option of  $X$ . Hence, the buyer's maximum money payoff is 100, regardless of the seller's investment decision.

We modify the definition of the opportunity set based on the idea that the seller's investment imposes *de facto* restrictions on the buyer's opportunity set. Let  $G = [0, 100]$  denote the buyer's opportunity set if the seller chooses not to invest. If the seller decides to invest in the outside option, the buyer thinks that he must offer at least  $p = X$ , anticipating that any offer  $p < X$  would be rejected by the seller. This, in turn, *de facto* restricts the buyer's opportunity set to be  $F_X = [0, 100 - X]$ . According to our modified definition, opportunity set  $G$  is more generous for the buyer than opportunity set  $F_X$  for all  $X > 0$ , meaning that investment in the outside option is less generous. By the same logic, the higher the outside option, the less generous the investment in it is. That is, for any  $X$  and  $X'$ , such that  $X \geq X'$ ,  $F_{X'}$  is 'more generous than'  $F_X$ .

The partial ordering of preferences is defined as follows. The buyer's willingness to pay to increase the seller's dollar payoff can depend on the absolute and relative amounts of their respective payoffs. Two different preference orderings,  $A$  and  $B$ , over allocations of dollar payoffs might represent the preferences of two different buyers or the preferences of the same buyer in two different situations. For a given domain, preference ordering  $A$  is 'more altruistic than' preference ordering  $B$  if the buyer's willingness to pay to increase the seller's payoff in situation  $A$  is greater than or equal to his willingness to pay in situation  $B$ .<sup>4</sup>

Revealed Altruism theory postulates that an individual's preferences can become more or less altruistic depending on the choices of another agent. Axiom R (for reciprocity) states that if the seller provides a more (less) generous opportunity set to the buyer, then the buyer's preferences will become more (less) altruistic towards the seller.<sup>5</sup> In our setup, when the seller invests in the outside option, he provides a less generous opportunity set to the buyer ( $F_X = [0, 100 - X]$  instead of  $G = [0, 100]$ ), and hence the buyer's preferences will become less altruistic. The buyer's willingness to pay to increase the seller's payoff is then smaller following the seller's investment than following non-investment. This leads to our first conjecture that the premium price  $Z$  is smaller than  $p_{NI}$ , the offer following non-investment. Furthermore, notice that the buyer's opportunity set following investment,  $F_X = [0, 100 - X]$ , becomes less generous as the outside option  $X$  increases. Given this, we postulate that the higher the outside option, the buyer offers a lower premium price following the seller's investment, meaning that  $Z$  is decreasing in  $X$ . This is our second conjecture.

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<sup>4</sup> The formal definitions of the two partial orderings and the two axioms can be found in Cox, Friedman, and Sadiraj (2008), sections 2- 4.

<sup>5</sup> Axiom S (for the *status quo*) then states that the buyer's altruistic response will be stronger if the seller overturns the *status quo* budget set than when the *status quo* is upheld, making a distinction between acts of commission and omission. See Cox, Servátka, and Vadovič (2014) for a detailed discussion of Axiom S's implications.

Our third conjecture concerns the seller's non-investment decision. When the seller chooses not to invest in the outside option, he provides a more generous opportunity set ( $G = [0, 100]$ ) instead of  $F_X = [0, 100 - X]$ ) to the buyer, and hence the buyer's preferences will become less altruistic. Since  $F_X = [0, 100 - X]$  becomes increasingly less generous as  $X$  increases, we postulate that the higher the foregone outside option, the more generous non-investment is.<sup>6</sup> This, in turn, will make the buyer's preferences more altruistic, meaning that he will offer a higher  $p_{NI}$  as  $X$  increases.

### 3.2. Experimental design and testable hypotheses

The objective of the current experiment is to investigate the link between investment in outside options and other-regarding behavior. When calibrating our experiment, we relied on the previous findings from the ultimatum bargaining literature. Camerer (2003), who surveys the literature on ultimatum games, states that, on average, the proposers offer between 30-40 percent of the pie, and offers of 40-50 percent are rarely rejected. Offers below 20 percent or so are rejected about half the time (p. 49). Based on these results, we chose to implement three treatments in which we vary the outside option to be  $X = 25, 35,$  and  $65$  tokens. 25 percent of the total pie is below the average offer and 35 percent is about average. 65 percent, on the other hand, represents a significant portion (almost two-thirds) and the change is likely to trigger the behavioral response that we set out to study. We decided to include the above three treatments in order to test for robustness of our findings with respect to small and large changes in the outside option.

Within this setup, our three conjectures that (1) the premium price  $Z$  is smaller than the offer following non-investment  $p_{NI}$ ; (2)  $Z$  is decreasing in  $X$ ; and (3)  $p_{NI}$  is increasing in  $X$  translate into the following testable hypotheses.

*Hypothesis 1:*  $Z^X < p_{NI}^X$  for  $X = 25, 35,$  and  $65$ .

*Hypothesis 2:*  $Z^{25} > Z^{35} > Z^{65}$ .

*Hypothesis 3:*  $p_{NI}^{25} < p_{NI}^{35} < p_{NI}^{65}$ .

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<sup>6</sup> A similar argument is presented in Dufwenberg and Gneezy (2000) and Cox, Servátka, and Vadovič (2010) with respect to behavior in the lost wallet game and in Brandts, Güth, and Stiehler (2006) in a three-player, pie-sharing game.

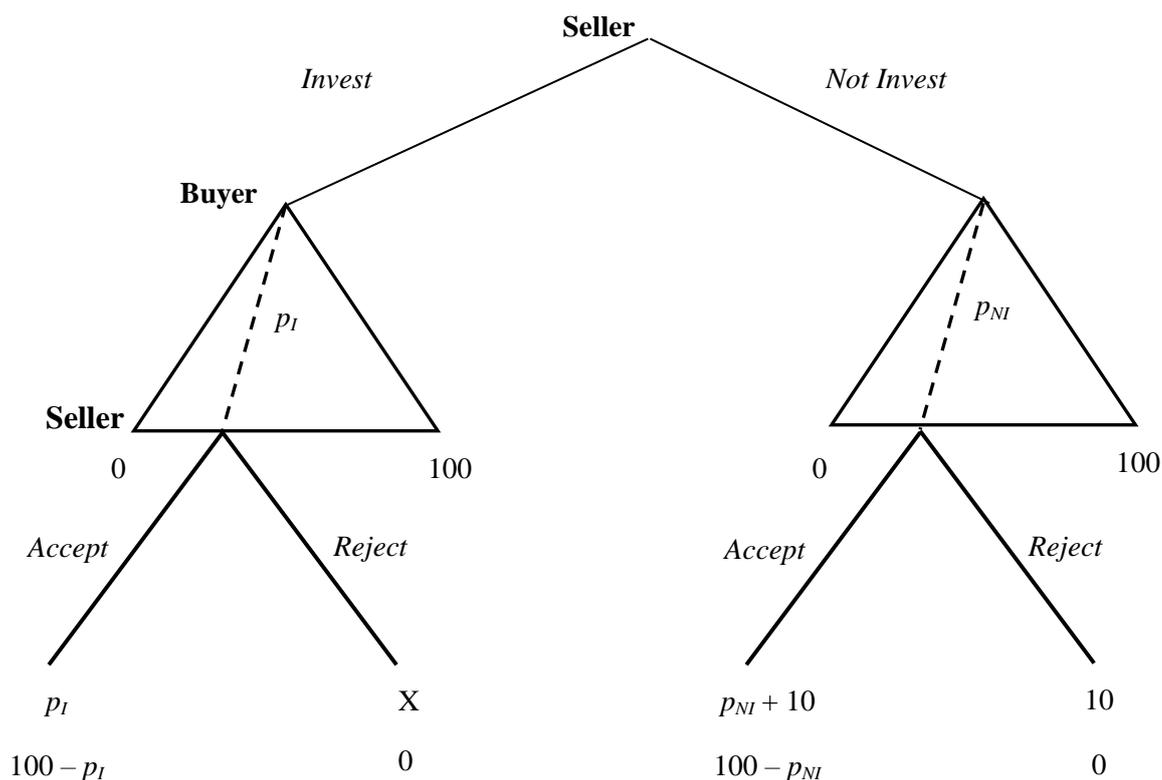
The experiment took place in the New Zealand Experimental Economics Laboratory (NZEEL) at the University of Canterbury, with 202 undergraduate students serving as subjects. The participants were selected randomly from the NZEEL database using the ORSEE recruitment system (Greiner, 2004). Each subject only participated in a single session of the study. All sessions were run under a single-blind social distance protocol, meaning there was full anonymity between the participants; the experimenters, however, could track subjects' decisions and identities. An experimental session lasted 60 minutes on average, including the initial instruction period and the payment of subjects. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007). The subjects earned an average of NZD 17.61 (New Zealand dollars) including a NZD 5 show up fee.

Upon entering the laboratory, all participants were seated in cubicles. Neutrally framed instructions (provided in the Appendix) were handed out, projected on a screen, and read aloud. The subjects were informed that their earnings would be denoted in experimental currency units, referred to as *tokens*, and at the end of the experiment exchanged into New Zealand dollars using the following exchange rate: 1 token = NZD 0.30. The instructions explained that each participant would be randomly and anonymously paired with another person and that within each pair, one person was going to be randomly assigned to be the seller (in the subject instructions referred to as the 'First Mover') and the other person to be the buyer (the 'Second Mover'). The seller started the experiment with an endowment of 10 tokens and the buyer with 0 tokens.

The decisions were divided into three stages. In Stage 1, the seller had to decide whether to invest his 10 tokens in order to create an outside option of  $X$  tokens for himself in case he later rejected the buyer's offer made in Stage 2. If the seller invested, then his outside option was  $X$  tokens. If the seller did not invest, then his outside option was 0 tokens, but he got to keep the initial 10 tokens. In Stage 2, 100 tokens were made available to be split between the pair. The buyer decided how much out of 100 tokens to offer to the seller. The buyer got to keep the remainder only if the seller accepted the offer. We used the strategy method (Selten, 1967; Brandts and Charness, 2011) to elicit the buyer's behavior. Therefore, the buyer was not notified of the seller's investment decision until the end of the experiment and made an offer for both of the two possible scenarios, i.e., one if the seller had invested and his outside option was  $X$  tokens and the other if the seller had not invested and his outside option was 0 tokens. The two scenarios were presented to each buyer by the software in a random order. In Stage 3, the seller learned about the offer (either following investment or non-investment, depending on his own Stage 1 decision) and decided whether to accept it or reject it. If the seller accepted the buyer's offer, the 100 tokens were split according to the offer and the seller's outside option was irrelevant in this case. If the seller rejected the buyer's offer, the buyer

received 0 tokens. The seller received the outside option of X tokens if he had invested in Stage 1, and received 0 tokens if he had not invested.<sup>7</sup>

The parameterization of the game is presented in Figure 1. This game tree was *not* shown to the subjects.



**Figure 1. The game**

In order to minimize confusion in the minds of subjects in this three-stage game, we opted to include four control questions, which all participants had to answer correctly before proceeding to the decision-making part.<sup>8</sup> While the subjects were answering the control questions, the experimenters privately answered any questions and, if necessary, provided additional assistance and

<sup>7</sup> Note that, this way, both movers made exactly two decisions. Asking the seller to accept/reject an offer under investment if he had not previously invested (or *vice versa*) would be unintuitive and could lead to confusion. Furthermore, asking the seller to provide a full strategy would be burdensome and time consuming, and could potentially dilute his attention to the decision that truly mattered for his payoffs.

<sup>8</sup> The control questions along with subject instructions are provided in the Appendix.

explanation until the subject calculated all answers correctly. Then, the four scenarios were reviewed publicly by the experimenter and correct answers projected on the screen. Finally, during the decision-making part, the buyers had on their screens a calculator that would display their own as well as their paired seller's payoffs following acceptance and rejection of any offer they decided to input. At the end of the session, the subjects were asked to complete a short post-experiment questionnaire. Upon completion, all subjects were privately paid their earnings for the session.

## **4. Results and implications**

### *4.1. Investment in the outside option and other-regarding behavior*

Table 1 presents summary statistics of subject behavior in our three treatments. Since we used the strategy method to elicit the behavior of buyers (but not of sellers), we provide a detailed explanation of how the statistics were calculated. We use treatment  $X = 25$ , presented in the first column, as an example. Thirty-four subject pairs participated in this treatment. Fifteen out of thirty-four sellers invested, yielding an investment rate of 44.1%. The thirty-four buyers offered, on average, 39.68 tokens, contingent upon their paired seller's investment. The average premium price,  $Z$ , is equal to  $39.68 - X = 14.68$ . The fifteen sellers who actually invested in Stage 1 learned about their paired buyers' offers following investment, and thirteen of them accepted their respective offers, resulting in an average accepted offer of 44.00 tokens. Two of the fifteen sellers rejected their respective offers, resulting in a rejection rate of 13.3% and the rejected average offer of 28.00 tokens.

The buyers offered, on average, 37.94 tokens contingent upon non-investment (again, averaged over all thirty-four of them due to the strategy method). Nineteen sellers who chose not to invest in Stage 1 learned about their paired buyers' offers following non-investment, and eighteen of them accepted their respective offers, resulting in an average accepted offer of 37.83 tokens. One of the nineteen sellers rejected his/her paired buyer's offer of 20.00 tokens, resulting in a rejection rate of 5.3%. The distributions of offers following investment and non-investment are presented graphically in Figures 2a and 2b, respectively.

**Table 1. Summary statistics**

<b>Treatment</b>	<b>X = 25</b> (34 obs.)	<b>X = 35</b> (35 obs.)	<b>X = 65</b> (32 obs.)
Investment rate	15/34 (44.1%)	20/35 (57.1%)	27/32 (84.4%)
<b>Behavior following investment</b>			
Average offer: $p_I$	39.68 (st. dev. = 9.91)	43.94 (st. dev. = 8.92)	56.22 (st. dev. = 15.70)
Median offer	40	45	65
Average premium price: $Z = p_I - X$	14.68	8.94	-8.78
Average accepted offer	44.00 (st. dev. = 5.55)	45.78 (st. dev. = 3.46)	64.11 (st. dev. = 3.29)
Median accepted offer	45	45	66
Rejection rate	2/15 (13.3%)	2/20 (10%)	9/27 (33.3%)
Average rejected offer	28.00 (st. dev. = 1.41)	39.00 (st. dev. = 1.41)	46.11 (st. dev. = 15.16)
<b>Behavior following non-investment</b>			
Average offer: $p_{NI}$	37.94 (st. dev. = 11.29)	38.09 (st. dev. = 12.23)	45.13 (st. dev. = 21.87)
Median offer	40	40	50
Average accepted offer	37.83 (st. dev. = 11.00)	40.08 (st. dev. = 10.68)	28.00 (st. dev. = n/a)
Median accepted offer	40	40	28
Rejection rate	1/19 (5.3%)	2/15 (13.3%)	4/5 (80%)
Average rejected offer	20.00 (st. dev. = n/a)	12.50 (st. dev. = 3.54)	16.25 (st. dev. = 9.46)

The average offer is averaged over decisions of all buyers due to the strategy method. The average accepted offer following investment (non-investment) is averaged only over the accepted offers by the sellers who actually chose to invest (not to invest). The average rejected offer is calculated analogously.

Hypothesis 1 states that the premium price  $Z$  is smaller than the offer following non-investment  $p_{NI}$ . A quick look at the average values of  $Z$  and  $p_{NI}$  presented in Table 1 reveals that  $p_{NI}$  is indeed greater than  $Z$  for all treatments. The Wilcoxon signed-rank test for paired samples detects that this difference is statistically significant for all three within-treatment comparisons (p-value < 0.001 in all three cases).

**Result 1:** The measure of the buyer’s altruism following the seller’s investment ( $Z$ ) is smaller than the measure of the buyer’s altruism following non-investment ( $p_{NI}$ ).

Hypothesis 2 states that the offer following investment minus the outside option ( $Z$ ) is decreasing in the outside option, that is,  $Z^{25} > Z^{35} > Z^{65}$ . The sixth row of the “Behavior following investment” panel in Table 1 presents the average value of  $Z$  for the three treatments. It is evident that  $Z$  decreases as the outside option increases. The Jonckheere-Terpstra non-parametric test confirms that this is indeed the case (p-value < 0.001).<sup>9</sup> The non-parametric Mann-Whitney ranksum test, presented in the third row of Table 2, provides further support that  $Z^{25}$  is significantly higher than both  $Z^{35}$  and  $Z^{65}$  (p-value = 0.013 and < 0.001, respectively) and  $Z^{35}$  is significantly higher than  $Z^{65}$  (p-value < 0.001).<sup>10</sup> These test results are robust to using the accepted offers only. The Jonckheere-Terpstra test detects that  $Z^{25} > Z^{35} > Z^{65}$  at p-value < 0.001.  $Z^{25}$  is significantly higher than both  $Z^{35}$  and  $Z^{65}$ , and  $Z^{35}$  is significantly higher than  $Z^{65}$ , all at p-value < 0.001. The summary statistics for accepted offers are presented in Table 1.<sup>11</sup>

**Result 2:** The buyer’s offer following the seller’s investment minus the outside option is decreasing in the size of the outside option.

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<sup>9</sup> The Jonckheere-Terpstra test is a test for ordered hypotheses for an across-subject design that allows for *a priori* ordering of the populations from which the samples are drawn.

<sup>10</sup> An interested reader might be curious about the statistical comparison of offers ( $p_I$ ’s) themselves. We find that offers following investment in treatment  $X = 25$  are significantly lower than in  $X = 35$  (p-value = 0.055) and in  $X = 65$  (p-value < 0.001) and that offers in  $X = 35$  are significantly lower than in  $X = 65$  (p-value < 0.001).

<sup>11</sup> Regarding accepted offers themselves (rather than premium prices) following investment, we find no statistical difference between accepted offers in treatments  $X = 25$  and  $X = 35$  (p-value = 0.455). The accepted offers in  $X = 65$  are higher than in  $X = 25$  as well as in  $X = 35$  (p-value < 0.001 in both cases).

**Table 2. Statistical tests for treatment differences**

	<b>X = 25 v. X = 35</b>	<b>X = 25 v. X = 65</b>	<b>X = 35 v. X = 65</b>
<b>Investment rate <sup>a</sup></b>	(0.339)	(0.001)	(0.018)
<b>Offers following investment (<math>p_I</math>)</b>	$z = 1.92$ (0.055)	$z = 4.89$ (0.000)	$z = 4.58$ (0.000)
<b>Offers following investment minus outside option (<math>p_I - X</math>)</b>	$z = -2.48$ (0.013)	$z = -6.27$ (0.000)	$z = -6.43$ (0.000)
<b>Offers following non-investment (<math>p_{NI}</math>)</b>	$z = -0.16$ (0.870)	$z = 1.94$ (0.053)	$z = 2.06$ (0.040)

<sup>a</sup> Fisher's exact test; z-statistic for Mann-Whitney ranksum test; p-values in parentheses.

Our third hypothesis concerns the effect that a foregone outside option has on the buyer's offer, i.e., whether  $p_{NI}$  increases as the outside option increases. We begin by testing the ordered hypothesis that  $p_{NI}^{25} < p_{NI}^{35} < p_{NI}^{65}$ . The Jonckheere-Terpstra test provides strong overall support for this hypothesis (p-value = 0.030).

**Result 3:** The buyer's offer following the seller's non-investment is increasing in the size of the outside option.

Next, we investigate whether the relative change in the size of the outside option has any effect on  $p_{NI}$  by performing pair-wise treatment comparisons. First, we compare offers following non-investment in  $X = 25$  and  $X = 35$  treatments and observe that the Mann-Whitney test, presented in the fourth row/first column of Table 2, finds no statistical difference between the two treatments (p-value = 0.870). This result is robust to comparing the accepted offers following non-investment only (p-value = 0.761).

**Result 4:** For a low outside option, the buyer's offer following non-investment is unaffected by an increase in the size of the outside option.

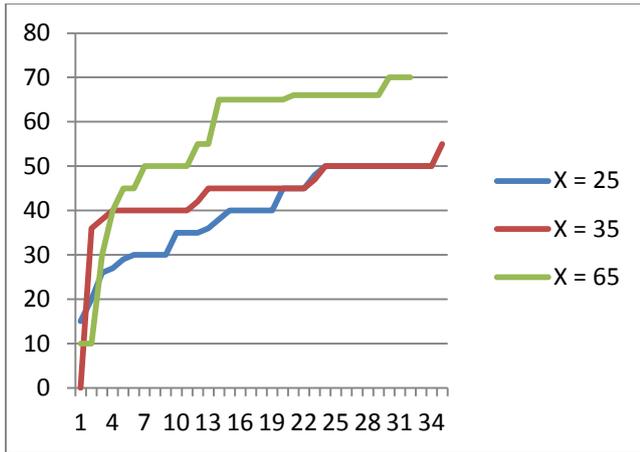
Finally, we test whether the offer following non-investment is higher in treatment  $X = 65$  than in treatment  $X = 35$ , i.e., whether  $p_{NI}^{65} > p_{NI}^{35}$ . The Mann-Whitney test presented in the fourth

row/third column of Table 2 reports that the difference is statistically significant ( $p$ -value = 0.040). Note that we cannot meaningfully conduct the robustness check on accepted offers, as following non-investment there is only one accepted offer in  $X = 65$ .

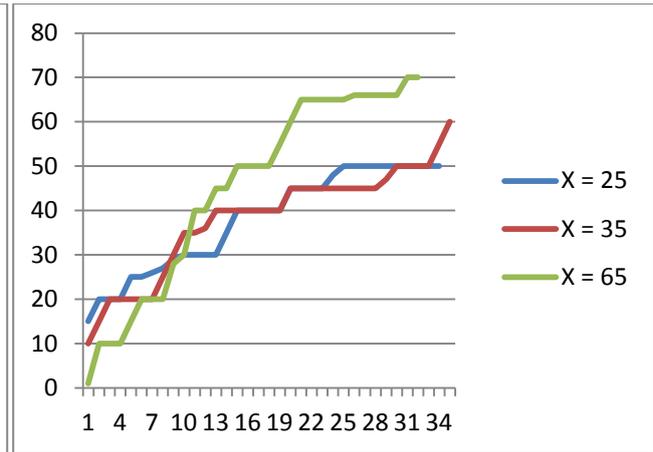
**Result 5:** For a high outside option, the buyer's offer following non-investment increases with the size of the outside option.

Our data thus provide some support that as the foregone outside option increases, the buyer's conditional altruism increases, which in turn results in a higher offer being made to the seller. The evidence, however, is not as strong as with the premium price offered on top of the outside option. There are at least a couple of (*ex-post*) explanations for why this is the case. The first explanation is tied to Axiom S of Revealed Altruism theory, which draws a distinction between acts of commission and acts of omission. Axiom S states that if a decision of an agent overturns the *status quo* (which is an act of commission), then for individuals with preferences consistent with Axiom R (i.e., reciprocal people), the reciprocal response will be stronger than when the *status quo* is upheld (an act of omission). While in our experiment we have not taken any steps to make the *status quo* particularly salient, one might argue that the *status quo* is the lack of investment, meaning that a person who does not invest commits an act of omission as opposed to investment, which would be considered an act of commission. For a more detailed discussion, see Cox, Friedman, and Sadiraj (2008) and Cox, Servátka, and Vadovič (2014).

The second explanation is related to the fact that in the presence of other-regarding preferences, the buyer would offer a strictly positive price, denoted  $p'$ , even in the absence of the seller's decision to invest in the outside option (the benchmark case discussed above). It is then possible that the seller's non-investment conveys no sense of generosity when the foregone outside option is less than  $p'$ . This is quite plausible, especially in light of the already mentioned observation by Camerer (2003), who concludes that in ultimatum bargaining the proposers offer between 30-40 percent of the pie on average. Given that, investment in the outside option in our  $X = 25$  treatment might not be "salient" in the sense that the buyers do not view it as bindingly restricting their opportunity set.



**Figure 2a. Offers following investment**



**Figure 2b. Offers following non-investment**

We conclude this subsection with one final observation. When one inspects the increase in average offers following investment across treatments (from 39.68 to 43.94 and 56.22), this increase is not commensurate with the increase in the outside option (from 25 to 35 and 65, respectively). This observation is in line with the result of Anbarci and Feltovich (2013), who study the responsiveness to changes in bargaining position and find that an exogenous increase in the disagreement payoff in a Nash demand game and Unstructured bargaining game leads to a smaller increase in the final payoff than predicted by the standard theoretical techniques used for analyzing bargaining situations.

In our experiment, the outside option is created endogenously, as it is the seller who decides whether to invest in the outside option or not. A key idea of our paper is that the seller's investment in the outside option decreases the buyer's (conditional) altruism if the buyer views the investment as opportunistic. Based on this idea, we test behavioral hypotheses derived from the logic of Revealed Altruism theory. In contrast, in Anbarci and Feltovich's setup the disagreement payoffs are given exogenously to test the predictions of standard bargaining theories. Anbarci and Feltovich find that their experimental results do not support these predictions and then illustrate that a model of other-regarding preferences can explain their main experimental results.

#### 4.2 Profitability of investment in the outside option

We next analyze the profitability of investment in the outside option. The seller's net return from investment is  $\max\{X + Z, X\} - F$  as he can accept the buyer's offer or, if the offer is smaller

than the outside option, take the outside option. The investment is therefore profitable when  $\max\{X + Z, X\} - F > p_{NI}$ . The standard economic theory assuming self-regarding preferences predicts that  $Z = p_{NI} = 0$ , and hence  $X > F$  implies  $p_I - p_{NI} > F$ . The link between investment in the outside option and other-regarding behavior, however, suggests that  $Z - p_{NI}$  can be negative because  $Z$  is decreasing and  $p_{NI}$  is increasing (at least weakly) in  $X$ , implying that  $p_I - p_{NI}$  may be less than  $F$ , even though  $X > F$ .

In what follows, we investigate whether the seller becomes worse off by investing.<sup>12</sup> Let us start with treatment  $X = 25$ . The average  $p_{NI}$  is 37.94 tokens, while the average  $p_I$  is 39.68 tokens. Since the average  $p_I$  is greater than the outside option  $X = 25$ , the seller's average net return from investment is  $39.68 - 10 = 29.68$  tokens, which is lower than the average  $p_{NI}$  (p-value  $< 0.001$ ; Wilcoxon signed-rank test for paired samples). This means that the seller is worse off by investing in the outside option if the outside option is low. When  $X = 35$ , the average  $p_{NI}$  is 38.09 tokens, while the average  $p_I$  is 43.94 tokens, which is greater than the outside option  $X = 35$ . Hence, the seller's average net return from investment is  $43.94 - 10 = 33.94$  tokens, which is lower than the average  $p_{NI}$  (p-value = 0.014; Wilcoxon signed-rank test for paired samples). Treatment  $X = 35$  thus provides further evidence that it is not profitable to invest in a low outside option.

Finally, when  $X = 65$ , the average  $p_{NI}$  is 45.13 tokens, while the average  $p_I$  is 56.22 tokens. The difference,  $56.22 - 45.13 = 10.09$ , is roughly equal to  $F = 10$ , suggesting that the offer following investment is just high enough to recover the investment cost. In fact, the Wilcoxon signed-rank test for paired samples does not detect a statistically significant difference between  $p_I - p_{NI}$  and  $F$  (p-value = 0.280). Rather than accepting  $p_I$ , however, the seller can choose to reject it and pocket  $X = 65$ . The net payoff of  $X - F = 55$  is weakly statistically significantly greater than  $p_{NI}$  (p-value = 0.097).

Our findings can be summarized as follows.

**Result 5:** It is not profitable for the seller to invest in a low outside option. If the outside option is high, the offer following investment is just high enough to recover the investment cost. The seller can, however, choose to exercise the outside option and become better off than if he had not invested.

If the seller becomes worse off, or does not become better off by investing in the (relatively low) outside option, then costly solutions such as vertical integration and contracts to prevent *ex-post*

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<sup>12</sup> In the analysis that follows, we abstract from rejections and consider all offers made by the buyers, as this is a more accurate test of whether investment pays off. Nevertheless, we also conducted the tests on accepted offers only and found the result that the seller is not better off by investing to be robust for  $X = 25$  and  $X = 35$  treatments (the Mann-Whitney test p-value = 0.254 and 0.062, respectively). Recall that in  $X = 65$  there was only one accepted offer following non-investment, and hence we cannot perform any meaningful test for this treatment.

opportunism may be unnecessary. To better understand this point, let us consider the following variant of our setup. Suppose that, prior to Stage 1, in Stage 0, the seller decides whether or not to sign a fixed-price contract that forces the buyer to offer  $p = X$  and the seller to accept the offer. If the seller signs the contract, there is no point for him to invest in the outside option because he must accept the buyer's offer  $p = X$ . To sign the contract, the seller must incur a fixed cost  $K < F$ . If the seller decides not to sign the contract, the rest of the interaction remains exactly the same as above. If agents care only about their monetary payoff, the seller's net return will be  $X - K$  if he signs the contract, and  $X - F$  otherwise. Given  $K < F$ , the seller will sign the contract. That is, the contract, although costly, is a useful tool to prevent the opportunistic behavior because the contracting cost is less than the cost to invest in the outside option.

Our experimental findings, however, suggest that the seller may not sign the contract when agents are other-regarding. As an illustration, let us consider the case of  $X = 35$ . Suppose that, if the seller does not sign the contract, the buyer's offer following investment is  $p_I = 43.94$  and the offer following non-investment is  $p_{NI} = 38.09$ . Notice that  $p_I = 43.94$  and  $p_{NI} = 38.09$  are the average values we found in our experiment when  $X = 35$ . If the seller does not sign the contract, he will not invest in the outside option and his net return will be 38.09. If the seller signs the contract, his monetary return is  $35 - K$ , which is less than 38.09. Hence, in this example, the costly contracting is not needed to prevent the opportunistic behavior in the presence of other-regarding preferences. Note, however, that this is just an example of a possibility based on the assumption that the buyers choose average values found in our experiment if the seller does not sign the contract in Stage 0. The presence of Stage 0 itself, however, might affect their behavior in subsequent stages even if the seller chooses not to sign the contract in Stage 0. Although a natural progression of the current study, this part is outside of the scope of this paper and we leave it for future research.

## 5. Summary and conclusion

An agent often invests in an outside option in bilateral trade relationships to improve his bargaining position. In our setup, the standard economic theory predicts that the buyer will capture the entire trade surplus by making a take-it-or-leave-it offer to the seller, and, anticipating this, the seller will invest in the outside option as long as the net return on investment is positive. It is well known, however, that agents often care for others to some degree rather than being completely self-regarding, as the standard theory assumes. The seller may then become worse off by investing in the outside option if the investment has negative impacts on the buyer's other-regarding behavior towards the seller.

This paper offers a new perspective on the analysis of *ex-post* opportunistic behavior, a key concept in the theory of the firm, by experimentally investigating its link to other-regarding behavior. In our laboratory experiment, we test conjectures based on the idea that the seller's investment in the outside option weakens the buyer's altruism towards the seller, whereas the seller's non-investment strengthens it. Our results provide overall support for our conjectures, and suggest that the seller may become worse off by investing in the outside option, even though the standard theory predicts otherwise. In fact, in two out of three implemented parameterizations, sellers become worse off on average by investing in the outside option. Costly means, such as vertical integration or contracts, to prevent *ex-post* opportunistic behavior may therefore be unnecessary in the presence of other-regarding behavior.

We conclude the paper by pointing out three directions for future research. First, as mentioned in the previous section, one can study an extension of our setup in which the seller and the buyer have an option of writing a contract or vertically integrate themselves to prevent *ex-post* opportunism. Such experimental studies would yield useful implications for roles that other-regarding behavior can play in the design of governance structures. Second, one might argue that while our experimental design perhaps applies to one-person firms (e.g., the trucking industry example studied by Baker and Hubbard, 2004), in everyday life, there also exist firms with complicated organizational structures and sophisticated decision-making processes. While in laboratory experiments it is possible to use groups as decision-makers as first approximations, it is not obvious how these groups are supposed to make decisions, whether this is done by unanimous/majority voting, selecting a leader who has the final word, etc. We view this as a fruitful avenue for future experimental research on firms' governance structures and resulting behavior. Third, carefully designed field experiments to address our research questions would strengthen real-world relevance of the present paper's findings.

## References

Anbarci, N. and N. Feltovich. 2013. "How sensitive are bargaining outcomes to changes in disagreement payoffs?" *Experimental Economics* 16 (4), 560-596.

Baker, G. and T. Hubbard. 2004. "Contractibility and asset ownership: on-board computers and governance in U.S. trucking," *Quarterly Journal of Economics* 119, 1443–1479.

Brandts, J. and G. Charness. 2000. "Hot and cold decisions and reciprocity in experiments with sequential games," *Experimental Economics*, 2(3), 227-238.

Brandts, J., W. Güth, and A. Stiehler. 2006. "I want YOU! An experiment studying motivational effects when assigning distributive power," *Labour Economics* 13, 1–17.

- Cai, H. 2003. "A theory of joint asset ownership," *Rand Journal of Economics*, 34, 62-76.
- Camerer, C. 2003. *Behavioral Game Theory: Experiments in Strategic Interaction*, Princeton University Press.
- Cooper, D. J. and J. H. Kagel. 2010. "Other regarding preferences: A selective survey of experimental results." In *Handbook of experimental economics* (eds Roth A., Kagel J. H.). Princeton, NJ: Princeton University Press.
- Cox, J. C., D. Friedman, and V. Sadiraj. 2008. "Revealed altruism." *Econometrica*, 76, 31-69.
- Cox, J. C., M. Servátka, and R. Vadovič. 2010. "Saliency of outside options in the lost wallet game," *Experimental Economics*, 13(1), 66-74.
- Cox, J. C., M. Servátka, and R. Vadovič. 2014. "Status quo effects in fairness games: Reciprocal responses to acts of commission vs. acts of omission," University of Canterbury working paper.
- Dufwenberg, M. and U. Gneezy. 2000. "Measuring beliefs in an experimental lost wallet game," *Games and Economic Behavior*, 30, 163-82.
- Falk, A. and M. Kosfeld. 2006. "The hidden Costs of Control," *American Economic Review*, 96(5), 1611-1630.
- Gibbons, R. 2005. "Four Formal(izable) Theories of the Firm?" *Journal of Economic Behavior and Organization*, 58(2), 200-245.
- Greiner, B. 2004. "An Online Recruitment System for Economic Experiments." In: Kurt Kremer, Volker Macho (Eds.): *Forschung und wissenschaftliches Rechnen 2003. GWDG Bericht 63*, Göttingen : Ges. für Wiss. Datenverarbeitung, 79-93.
- Holmstrom, B. and J. Tirole. 1991. "Transfer Pricing and Organizational Form," *Journal of Law, Economics, and Organization*, 7, 201-228.
- Klein, B., R. G. Crawford, and A. A. Alchian. 1978. "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process." *Journal of Law and Economics*, 21(2), 297-326.
- Oosterbeek, H., J. Sonnemans, and S. van Velzen. 2003. "The Need for Marriage Contracts: An Experimental Study." *Journal of Population Economics*, 16, 431-453.
- Oosterbeek, H., R. Sloof, and J. Sonnemans. 2011. "Rent-seeking Versus Productive Activities in a Multi-task Experiment," *European Economic Review* 55, 630-643.
- Selten, R. 1967. Die Strategiemethode zur Erforschung des eingeschränkt rationale Verhaltens im Rahmen eines Oligopol-experiments," in H. Sauer mann (ed.), *Beiträge zur experimentellen Wirtschaftsforschung*, Tübingen: Mohr, 136-168.
- Shelanski, H. A. and P. G. Klein. 1995. "Empirical Research in Transaction Cost Economics: A Review and Assessment." *Journal of Law, Economics, and Organization*, 11(2): 335-361.
- Whinston, M. 2003. On the transaction cost determinants of vertical integration. *Journal of Law, Economics, and Organization* 19, 1-23.
- Williamson, O. 1979. "Transaction-Cost Economics: The Governance of Contractual Relations." *Journal of Law and Economics*, 22(2): 233-261.
- Williamson, O. 1985. *The Economic Institutions of Capitalism*. Free Press.

## **Appendix: INSTRUCTIONS (*Treatment X = 25*)**

### **No Talking Allowed**

Thank you for coming. The purpose of this session is to study how people make decisions in a particular situation. From now until the end of the session, unauthorized communication of any nature with other participants is prohibited. If you violate this rule we will have to exclude you from the experiment and from all payments. If you have a question after we finish reading the instructions, please raise your hand and the experimenter will approach you and answer your question in private.

### **Earnings**

Every participant will get \$5 as a show up fee and, in addition, have the opportunity to earn money in the experiment. Your final experimental earnings will depend on your decisions and on the decisions of others. The earnings will be denoted in experimental currency referred to as *tokens*. Upon completion of the experiment, all tokens will be exchanged into dollars using the following exchange rate: 1 token = \$0.30. Notice that the more tokens you earn, the more dollars you will receive. All the money will be paid to you in cash at the end of the experiment.

### **Anonymity**

You will be randomly paired with another person. No one will learn the identity of the person (s)he is paired with. Because your decision is private, we ask that you do not tell anyone your decision or your earnings either during or after the experiment.

### **Pairing and Roles**

Within each pair, one person is going to be randomly assigned to be the First Mover and the other person to be the Second Mover. 100 tokens are made available to be split between the First and the Second Mover. The 100 tokens are split only if the First Mover accepts the Second Mover's offer but the 100 tokens disappear if the First Mover rejects. The First Mover starts the experiment with 10 tokens. The Second Mover starts the experiment with 0 tokens. The decisions are divided into three stages:

#### **Stage 1: The First Mover's Investment Decision**

The First Mover decides whether or not to invest his/her 10 tokens in order to create an outside option of 25 tokens for himself/herself in case (s)he rejects the Second Mover's offer which will be made in the next stage.

- If the First Mover invests, then his/her outside option is 25 tokens.
- If the First Mover does not invest, then his/her outside option is 0 tokens. (However, the First Mover gets to keep the 10 tokens.)

#### **Stage 2: The Second Mover's Offer**

The Second Mover decides how much out of 100 tokens to offer to the First Mover. The Second Mover keeps the remainder only if the First Mover accepts the offer.

The Second Mover is not yet notified of the First Mover's investment decision. Hence each Second Mover makes a decision for both of the two possible First Mover's decisions:

- If the First Mover has invested and his/her outside option is 25 tokens.
- If the First Mover has not invested and his/her outside option is 0 tokens.

Note that the First Mover's decision will determine which decision of the Second Mover will be relevant. Therefore, please think about your decisions carefully.

### **Stage 3: The First Mover's Acceptance/Rejection**

The First Mover learns about the offer, and either accepts it or rejects it.

- If the First Mover accepts the Second Mover's offer, the 100 tokens is split according to the offer. The outside option is irrelevant in this case.
- If the First Mover rejects the Second Mover's offer, the Second Mover receives 0 tokens. The First Mover receives the outside option of 25 tokens if (s)he invested at Stage 1, and receives 0 tokens if (s)he did not invest at Stage 1 (in which case (s)he keeps the original 10 tokens).

### **Payment of Experimental Earnings**

Once all participants have made their decisions, you will be shown a summary of your payoffs. Then you will be asked one by one to approach the experimenter in the room in the back of the lab for the payment of your experimental earnings. Are there any questions?

### **Practice Questions**

Please answer the following questions:

1. If the First Mover invests his/her 10 tokens and the Second Mover offers 40 tokens which is accepted by the First Mover, what are the First Mover's final earnings? .....  
What are the Second Mover's final earnings? .....
2. If the First Mover invests his/her 10 tokens and the Second Mover offers 40 which is rejected by the First Mover, what are the First Mover's final earnings? .....  
What are the Second Mover's final earnings? .....
3. If the First Mover does not invest his/her 10 tokens and the Second Mover offers 40 tokens which is accepted by the First Mover, what are the First Mover's final earnings (including the starting 10 tokens)? .....  
What are the Second Mover's final earnings? .....
4. If the First Mover does not invest his/her 10 tokens and the Second Mover offers 40 which is rejected by the First Mover, what are the First Mover's final earnings? (including the starting 10 tokens) .....  
What are the Second Mover's final earnings? .....