An Experimental Investigation of Favour Exchange Under Monetary and Non-Monetary Incentives

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We study the role of monetary incentives in a system of favour exchange. Subjects are placed in small "local economies" and each period are further matched in subgroups of two where one player exerts costly effort, which generates a benefit for his/her match. That is, she does a favor. We show that monetary incentives lead to highest average efficiency and the least variability of behavior compared with our two non-monetary incentives treatments. However, under non-monetary incentives, those groups who score highly on the social value orientation are able to meet or exceed the efficiency level achieved under monetary incentives.

1. Introduction

Monetary compensation for products and services has been around for thousands of years. However, even in modern economies, there are many instances in which people eschew monetary compensation. For example, within families, among friends and neighbors, and within work organizations, it is common to do favours without monetary compensation. With increasing mobility, a larger fraction of the population living in cities, and flexible employment relations, social structures that encourage favour exchange are becoming more fragile. As a possible response to that, but also to disentangle economic activity locally from national economies to make products and services affordable for citizens with low income, systems of local currencies have emerged over the past decades (Michel and Hudon 2015). Their introduction seems to be driven in a belief in the positive effect of money on welfare, and the hope that introducing local money can stimulate exchange and fair trade in local, threatened communities. This seems to be driven by an idealistic search for independence from a globalized economy linked to the international monetary system where possession of money and being paid has an intrinsic value by itself, thereby crowding out pro-social behaviour.

The recent development of crypto-currencies based on blockchain technology, as well as the popularity of online platforms supporting a sharing economy can be viewed as reflecting this trend. Recently, there also exist groups that eschew any kind of money, and rely exclusively on favor exchange. One such example is the *Buy Nothing Project*, in which people from local communities form groups whose members make offers of goods/services to provide or requests of goods/services to receive. The rules of the project explicitly state, "We do not permit trading, bartering, buying or selling within our groups. Keep in mind that all gifts here must be given without any strings attached, and without any expectation of reward other than the joy of giving."[1] Thus, it seems fair to claim that parts of society are searching for systems that focus on serving the needs of its citizens, while looking beyond fiat currency as the medium of exchange, and some eschewing monetary exchange of any kind.

Motivated by these developments as well as literature on coordination devices, indirect reciprocity, and other regarding preferences, which we summarize in Section 2, this paper provides new experimental insights on the behavioural effects of two extreme forms of money on economies with favour exchange. The first is an economy where the experimental currency is reduced to a pure accounting device. Similar to Local Exchange Trading Systems (LETS) or Time Banks, the effort for providing a favour is translated into "compensation" on a record-keeping ledger available

[1] See `https://www.buynothingproject.org/the-fine-print-2/#Discussions` (accessed on 27 September 2018).

to all participants in the system. To emphasize this accounting role in our experiments, this "compensation" has no effect on the monetary payoffs of the participants, which are solely based on the benefit from favours received and the cost of favours given. The second is an economy with a fully-fledged experimental currency, in which subjects pay for the effort exerted on their behalf by other subjects, and costs and benefits that are fully convertible to fiat currency (in our case, Euro) at the end of the experiment. We counter these two treatments with a control treatment of an economy with pure favour exchange. Except for the monetary compensation, all three economies are otherwise identical. That is, the cost for providing a service and value for receiving a service is identical. The three economies have a social welfare maximizing level of trade generating strictly more welfare than the Nash equilibrium. The Nash equilibrium in the monetary treatment generates strictly positive welfare, while the Nash equilibrium in the control treatment generates zero welfare.

Our first question is which of these institutions is most efficient, and determine whether money is necessary. As we show in our experiment, money does promote exchange and, in general, acts as a strong coordinating device. However, we also show that favor exchange can be sustained even without money.

The second question is, what role does the record-keeping function of a traditional LETS system have on favor exchange? A natural hypothesis is that since the record-keeping system acts as a kind of reputation mechanism, it will promote greater favor exchange than a system without both direct monetary incentives and record-keeping.[2] Our second result is that this hypothesis turns out to be false. Absent monetary incentives, whether or not such public record-keeping is present, there is no difference in favor exchange.

One of the underlying motives for alternative currencies is the idea that they are beneficial to small, cohesive groups. This is because of the inherent difference between money and these alternative systems. One is always willing to provide a good or service to another (for the right price) in exchange for money because one can later use the money to purchase other goods or services. This obviates the need for trust in any given transaction. In the absence of any currency, if one does a favor today for one person, one trusts to be given a favor by the same person or other members of the community later. With a LETS or complementary currency (CCS) system, one needs only to trust that, in the future, one is able to exchange those units of alternative currency to

[2] For example, Camera and Casari (2009) show that cooperation in an infinitely repeated prisoner's dilemma game with random matching is possible with a sufficiently rich reputation mechanism (along with other conditions on the environment).

receive a good or service. Thus, these alternative systems are much more reliant on trust, meaning that they will have the best chance of success in more cohesive groups.

Although we did not set out to directly manipulate group cohesiveness in our experiments, due to random assignment of subjects to groups, we naturally have exogenous variation in this. Specifically, after the main experiment, and after a "cooling off" period to let any emotions from the main experiment dissipate, we elicited each subject's social value orientation which measures how individualistic/competitive versus altruistic/pro-social a subject is.

Our final, and most interesting result is to show the strikingly different effects of social value orientation depending on whether monetary incentives are present or not. First, in the absence of monetary incentives, there is a strong divergence in favor exchange between groups with high and low social value orientation. Specifically, groups with high social value orientation were able to sustain high levels of favor exchange that rivaled or exceeded even those groups who had direct monetary incentives. Furthermore, they were able to delay the onset of the usual end-game drop-off in pro-social behavior that is common in finitely repeated games. On the other hand, groups with low social value orientation were unable to sustain high levels of favor exchange and saw effort decline earlier and more substantially.

Second, when monetary incentives are present, the degree of favor exchange is not affected by social value orientation. This is despite the fact that the Nash equilibrium was not socially efficient. Therefore, one might have predicted that groups with high social value orientation achieve higher, more socially efficient, levels of favor exchange. The fact that this did not occur provides strong evidence that monetary incentives crowd out social preferences.

The next section briefly reviews the related literature. Section 3 outlines the experimental design and generates hypotheses, which we will subsequently test in Section 4. Finally, in Section 5 we provide some concluding remarks and discuss how our results may apply more broadly.

2. Related Literature

This paper is related to two broad streams of literature. The first is a set of papers that are concerned with the role and emergence of *fiat* money – that is, money that has no inherent value within the experiment and is not convertible to cash outside of the experiment – to facilitate exchange. Two notable examples are Duffy and Puzzello (2014) and Bigoni et al. (2014).[3] Duffy and Puzzello (2014) consider a game in which there is a monetary equilibrium and a continuum

[3] Other prominent examples are Camera et al. (2013) and Camera and Casari (2014). Duffy (2015) contains a more comprehensive review.

of non-monetary equilibria based on gift exchange. Some of the non-monetary equilibria Pareto dominate the monetary equilibrium; however, subjects play the monetary equilibrium. Moreover, welfare is higher when money is available than when it is unavailable.

More closely related is Bigoni et al. (2014). They are also interested in the role of "money" to promote the exchange of favors in economies of indefinite duration, who are further sub-divided each period into pairs with one player being a "helper" and the other player being a "receiver". They show that welfare is higher when subjects have access to money, which is in limited supply and where trade can only occur if the receiver has one unit of money. In contrast, welfare is lower in three other treatments which, respectively, (i) have no money or other record-keeping mechanism, (ii) have no money but a record-keeping mechanism and (iii) have money but trades are still allowed if the receiver has a zero or negative money balance. Our results complement these results by showing that the results also extend to finitely repeated games and, more importantly, by showing the fundamental role of social value orientation in sustaining favor exchange in the absence of direct monetary incentives.

Beyond the literature on money, there is a large literature that is concerned with both direct and indirect reciprocity. Two notable examples of papers focused on indirect reciprocity are Bolton et al. (2005) and Seinen and Schram (2006). Both papers study experimentally the image scoring game where groups of players are paired in each period with one being asked to give to the other. What makes the game interesting is that the same two players will never interact with each other again, and the players know this. Yet, Bolton et al. (2005) show that even with a known, finite, last period players frequently give and giving increases in the amount of past information players have about their current partners (e.g., did their previous partner give to someone who, when it was their turn to give, also gave?).

More recently, Jacobson and Petrie (2014) study favor exchange in a public goods game. In this setting groups of players play a series of public goods games. In each game, one player is selected such that it is her 'pet project' and she actually has a dominant strategy to fully contribute. For the rest of the players in the group, the usual public goods game logic applies and they have a dominant strategy to not contribute, though it is socially efficient to do so. Therefore, contributing to a non-pet project is akin to doing a favor for the player for which it is a pet project. The set-up allows for a test of direct and indirect reciprocity. Under direct reciprocity, a player contributes (or not) when it is not her pet project because others contributed (or not) when it was the players pet project. In one treatment, a subject in the group never has a pet project, allowing for a test of indirect reciprocity. For example, player A (who never has a pet project) may contribute to B's

project because she saw that B contributed to C's project. The authors document strategic and direct reciprocity but find no evidence of indirect reciprocity.

Cabral et al. (2014) study the indefinitely repeated veto game in which nature randomly selects a payoff vector for two players. Although the sum is positive, one player may receive a negative payoff that period. Upon seeing the proposed payoff vector, players can accept or veto it. If one player vetoes, then both players earn 0 in the period. Thus, efficiency requires that players accept negative payoffs in one period with the expectation that their partner will reciprocate (and not veto) a future period in which they receive a positive payoff and their partner gets a negative payoff. Their results show that players are motivated by a self-serving, forward-looking notion of reciprocity. That is, they reciprocate in period t because they expect reciprocation in periods $t' > t$ and not because their partner was nicer (i.e., declined to veto) in periods $t'' < t$.

Finally, our paper relates to literature that analyzes the emergence of alternative currencies from a socio-economic point of view. Seyfang and Longhurst (2013) and Michel and Hudon (2015) classify many examples where groups of people, communities or even regions seek to formalize system of non-monetary exchange by setting up what are often referred to as *Local Exchange Trading Systems*, Time Banks or *Community Currency Systems* (CCS). They emphasize the role such systems are meant to have for community-level sustainable development. Our results suggest that they have the risk of either having little effect (limiting them to pure accounting), or crowding out pro-social behaviour in the same way as established currencies do.

3. Experimental Design

The main experiment consisted of 30 periods. At the beginning of the experiment, subjects were placed into a group of 4 and were told that they would remain in that group for all 30 periods. In each period, the four group members were randomly paired into two subgroups, and within each subgroup, one subject was assigned the role of a receiver and the other was assigned the role of a sender. Each subject was assigned a unique ID number for the duration of the experiment. Subjects were shown the ID number of the person with whom they were matched with in each period. This creates the possibility of individual-specific reputation building and positive/negative reciprocity across periods. However, the history of previous actions was not displayed by the software, nor could players directly observe the behavior in the other sub-group. The experiment consisted of three main treatments, which we now describe.

Control Treatment (CT). In this treatment, after being matched with one of the other 3 group members and assigned the role of the receiver or sender, the receiver would first make a request

for effort from the sender. The request, r, was an integer between 0 and 16. The sender would then see this request and choose an effort level, e, that was also an integer between 0 and 16. The benefit to the receiver was given by $\pi^r(e,r) = 24 \times \min(e,r)$, while the cost to the sender was $\pi^s(e,r) = \min(e,r)^2$. At the end of 30 periods, a subject's final payoff would be the sum of all benefits received when they were in the role of the receiver minus the sum of all costs incurred when they were in the role of the sender.

Effort Account Treatment (EAT). In this treatment, we modified the control treatment to introduce an alternative currency (framed to subjects as tokens from a different account) that subjects could use to keep track of their debts/obligations to their other group members. Specifically, if the receiver received e units of effort from the sender, then she would transfer $12e$ units of the alternative currency to the sender. This transfer would not have any monetary consequences for subjects' final payoffs, but one's own and one's partner's current balance of the alternative currency was visible to subjects at the time decisions were made. Thus, a subject with a positive balance exerted more effort on behalf of others than had effort exerted by others on her behalf. Note also that the balances could be negative and the amount was automatically transferred at the end of each period, making this treatment similar to the *MEMORY* treatment of Bigoni et al. (2014). As in the control treatment, only $\pi^r(e,r)$ and $\pi^s(e,r)$ were used to determine their actual monetary payoff.

Monetary Treatment (MT). This treatment is exactly the same as the Non-Monetary Treatment, except that the transfer from the receiver to the sender had actual monetary consequences. Therefore, in each round the net payoff to the receiver was $\pi^r(e,r) = 24 \times \min(e,r) - 12 \times \min(e,r) = 12 \times \min(e,r)$, while the net payoff to the sender would be $\pi^s(e,r) = 12 \times \min(e,r) - \min(e,r)^2$.

3.1. Theoretical Predictions

It is not too difficult to see that in both the EAT and CT treatments, the unique stage-game Nash equilibrium outcome is for the sender to provide effort $e = 0$ (and for the receiver to make any request). Therefore, in the finitely repeated game, the unique subgame perfect equilibrium outcome is for the sender to always provide an effort of 0, leading to a surplus of 0.

In contrast, in the MT treatment, given a request of $r > 0$, the sender's optimal effort is easily seen to be $e^*(r) = \min(r, 6)$. Since the payoff to the receiver is increasing in effort received, her request will be any $r \geq 6$. The total surplus generated in the Nash equilibrium is then $24 \times 6 - 6^2 = 108$, with the sender earning $1/3$ of the surplus and the receiver earning $2/3$.

This leads to the following hypothesis:

HYPOTHESIS 1 **(Subgame Perfect Nash Equilibrium)**. *In the CT and EAT treatments, effort is 0 in every period and total surplus is 0. In the MT treatment, receivers request at least 6 units of effort and senders supply exactly 6 units of effort, generating a surplus of 108. Consequently, subjects in the MT treatment earn significantly more than subjects in either the CT or NMT treatments.*

Finally, observe that the social surplus generated is given by $\pi^s(e) = 24e - e^2$. Therefore, the socially efficient effort level is $e^s = 12$, leading to a surplus of 144. Thus, even the monetary treatment is socially inefficient.

3.2. Survey Questions and Social Value Orientation

The research cited above and an even larger literature, nicely reviewed by Cooper and Kagel (2016) show that many individuals are motivated by social preferences such as altruism and reciprocity, which can promote efficiency-enhancing exchange even in the absence of explicit incentives to do so. The literature on group identity (e.g., Goette et al. (2006) and Chen and Li (2009)) also shows that cooperation and social welfare maximizing behavior increase in cohesive groups. In order to investigate this, subsequent to the main experiment, we conducted a series of non-incentivized and incentivized survey questions to allow us to measure individual characteristics and how cohesive groups were in certain dimensions.

First, we had subjects complete the Big Five personality questionnaire (Goldberg 1992) and other non-incentivized measures. This was done primarily as a "cooling off" period between the main experiment and our next measurement of interest, which is subjects' social value orientation (SVO) (Murphy et al. 2011). The SVO survey consists of a series of questions in which subjects have to choose amounts of money to allocate to oneself and to another subject. Table B.1 in Appendix B.1 depicts two of the SVO elicitation problems to illustrate the types of allocation problems that subjects faced.

A subject's SVO measure is given by the angle relative to the horizontal axis in the space (payoff to self, payoff to other), with smaller angles (meaning the person allocated more to him/herself) indicating a more competitive/individualistic orientation and larger angles (meaning the person allocated relatively more to the other subject) indicating a more pro-social or altruistic orientation. We have the following hypothesis:

HYPOTHESIS 2 **(Behavioral Mechanisms)**. 1. *Groups in which members have higher SVOs will exchange more favors.*

2. *The relationship between SVO and effort will be stronger in the absence of monetary incentives.*

3. *Absent monetary incentives, the presence of an effort accounting system will lead to greater favor exchange.*

The second part of the hypothesis is motivated by the literature on incentives and social preferences. For example, Bowles and Polanía-Reyes (2012) argue that the presence of monetary incentives may crowd out social preferences. This is potentially relevant in our case because, while the MT treatment has a unique Nash equilibrium in the stage game, it is still not socially efficient. Thus, there is still scope for social preferences to lead to higher, social welfare-improving, effort unless the presence of monetary incentives crowds out such behavior. Finally, the third part of the hypothesis draws from the experimental literature on repeated games, which shows that strong reputation mechanisms promote cooperation (see e.g., Camera and Casari 2009).

Remark 1. It is possible that the outcome of the main experiment might influence subjects' responses in the SVO elicitation task. To reduce this possibility, subjects completed the SVO elicitation after the Big Five questionnaire. This introduces a non-negligible time between the main task and the SVO task, which provides an opportunity for any emotions from the main task to dissipate. In addition, the "other subject" in the SVO elicitation was drawn randomly from amongst all other subjects in the session and not just from the group of 4 that the subject was a part of in the main experiment. This should reduce any incentive one might have for any kind of retaliation since it is likely that the other person is drawn from a different group. Indeed, neither a $t-$test nor a Kolmorgorov-Smirnov test can reject the null hypothesis that the measured social value orientation are identical depending on whether or not monetary incentives for effort were given (respectively, $p_t = 0.879$ and $p_{KS} = 0.261$).

In total our experiment has 144 subjects, with each treatment consisting of 12 groups of 4 subjects.[4] The experiment was conducted in the BEELab at Maastricht University between December 2013 and March 2014 and was programmed in zTree (Fischbacher 2007). Subjects earned €18.96 on average and the experiment lasted approximately 90 minutes.

4. Results

In Table 1, we report the average effort within a subgroup consisting of a sender and a receiver, as well as the average profits earned within that subgroup. As our unit of independent observation, we take the average over all 30 periods for each group of 4 subjects. As can be seen, in strong contrast to the theoretical prediction, average effort is substantially greater than zero in both the

[4] We only collected the SVO measure for 4 groups in the control treatment. We have the SVO measure for all 96 subjects in the other two treatments.

Effort Accounting and Control treatments ($p < 0.01$; Wilcoxon test). Although not visible from the Table, fully 56% of effort choices in the Monetary treatment were for $e = 6$, which corresponds to the Nash equilibrium effort level. Somewhat surprisingly, average effort is highest in the control treatment, though the difference between either the Monetary or the Effort Accounting treatment is never significant ($p > 0.15$; Mann-Whitney test).

Table 1 Average Effort and Profits (Subgroup Level)

Treatment	Effort	Std. Dev.	Profits	Std. Dev
Control	7.76	2.11	99.44	24.78
Effort Accounting	7.02	2.12	93.30	18.78
Monetary	7.02	0.72	114.98	4.56

Note: The unit of independent observation is the 4-person group, averaged over all periods of their interaction.

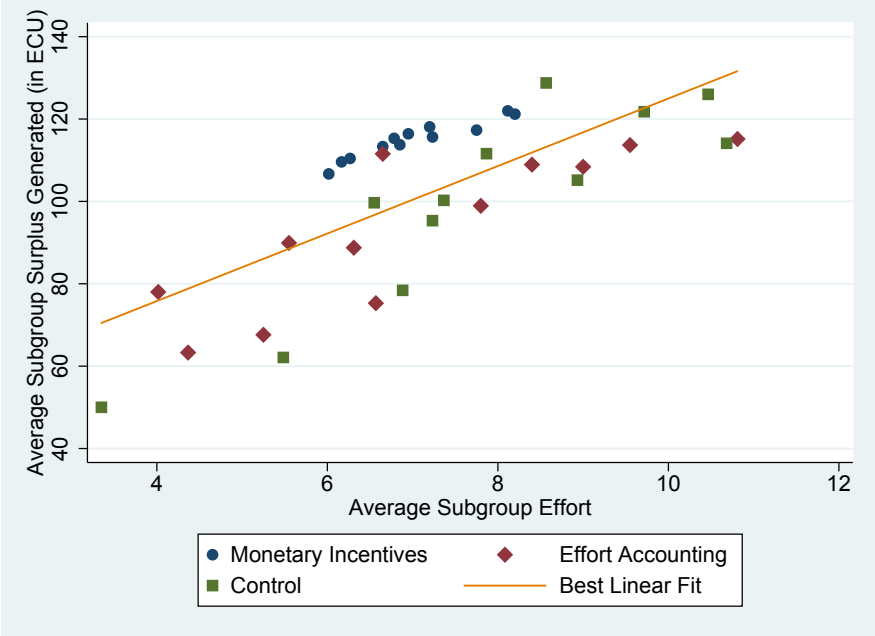
In terms of profits, subjects earned the most in the monetary treatment. Comparing the Monetary and Control treatments, the difference is only significant at $p = 0.094$, while comparing the Monetary and Effort Accounting treatments, the difference is significant at $p < 0.01$.

One counter-intuitive result is that despite effort being similar or even higher in the Control and Effort Accounting treatments than in the monetary treatments, profits are lower. The reason for this can be seen by looking at the standard deviations in Table 1. As can be seen, effort is much more variable in the former treatments. This variability in effort, when averaged over group-members and over periods leads to lower average earnings. Moreover, in the EAT and CT treatments, approximately 16.5% of effort decisions are *above* the social welfare maximizing effort level of 12, while 13.4% of effort decisions are exactly 0. In the MT, only 1.5% of effort decisions are higher than 12, *no* effort decisions are 0, and 56% are at the Nash equilibrium of 6. Thus, monetary incentives act as a strong coordination device.

The variability in effort and profits can be seen even more clearly in Figure 1, where we provide a scatter plot of the relationship between average effort and average profit as well as the best-fitting line through the data-points. For all three treatments, there is a positive relationship between effort and earnings, but the observations for the Monetary treatment are much more concentrated and shifted vertically upwards.[5] Indeed, while many groups in the EAT and CT treatments had lower earnings than in the Monetary treatment, there were some high performing groups that exerted both more effort and received higher earnings than in the monetary treatment. We will investigate this interesting observation below.

[5] We could also draw a separate best-fitting line for each of the three treatments. However, we cannot reject the null hypothesis that the slope coefficients are the same.

Figure 1 **Scatter Plot of Average Surplus Generated vs. Average Effort**



As can be seen from the analysis so far, there is very little to distinguish the Control and Effort Accounting Treatments. In fact, contrary to Hypothesis 2.3, subjects actually exert less effort and have lower earnings in EAT than in CT. Thus, an effort accounting system does not promote greater favor exchange. Henceforth, to ease the exposition, we will pool the data from our EAT and CT treatments and refer to these as treatments with *no monetary incentives* while our Monetary treatment will be said to have *monetary incentives*.

4.1. Dynamics of Behavior

We turn now to the dynamics of behavior. In Figure B.1 in Appendix B.2, we show that with and without monetary incentives, average effort across subgroups typically declines over time. However, while effort converges to the Nash equilibrium with monetary incentives, without such incentives, effort continues to fall, especially in the last five periods. Later, we will show how these dynamics are influenced by social value orientation.

Recall that in the Effort Accounting treatment, hypothetical points were transferred into an account when a player exerted effort on behalf of his/her match, and the person receiving the effort had an equal number of points deducted. Although these points had no direct monetary consequences, in the EAT, they were visible when decisions were made. Therefore, someone with a negative account balance could be identified as a person who has received relatively more effort from his/her matches than he/she has exerted on behalf of others. Ssubjects may infer that such a person has a *debt* to the other group members or that the subject is a free-rider. In this case, they

may be unwilling to exert costly effort on such a person's behalf. However, it turns out that subjects in the EAT do not condition their effort on the effort account balance of the person requesting a favor.[6]

In Table 2, we report a series of fixed effects regressions where the dependent variable is either the amount of effort requested or the amount of effort offered. We include as explanatory variables the average effort given up to the current period and the average effort received up to the current period. This allows us to investigate whether there is (backward-looking) reciprocity and altruism.[7]

Table 2 The Determinants of Effort Each Period (Fixed Effects Regression)

	Monetary Incentives				No Monetary Incentives			
	Request		Effort		Request		Effort	
Ave. Effort Given So Far	−0.095	(0.068)	0.138	(0.103)	0.231	(0.072)	0.012	(0.092)
Ave. Effort Received So Far	0.449	(0.201)	0.072	(0.095)	0.305	(0.050)	0.339	(0.098)
Period	−0.035	(0.029)	−0.041	(0.018)	−0.019	(0.021)	−0.112	(0.022)
Request			−0.068	(0.038)			0.259	(0.055)
Constant	9.838	(1.914)	6.926	(1.085)	9.099	(0.561)	3.352	(1.135)
R^2	0.106		0.140		0.139		0.191	
Observations	672		672		1338		1338	

Note: Dependent variable given in the column heading. Standard errors are clustered standard at the group level.

Consider first requests for effort. Regardless of whether monetary incentives are present, subjects who have received more effort in the past request significantly more effort ($p < 0.05$). However, in the absence of monetary incentives, subjects who have given more effort in the past, request significantly bigger effort ($p < 0.01$). Beyond this, in both cases, requests for effort decrease over time, though the effect is not significant.

Next turn to offers of effort. Here, things are very different depending on whether monetary incentives are present or not. With monetary incentives, there is no evidence of either altruism or reciprocity as the coefficients on average effort given so far and average effort received so far are quantitatively small and not significantly different from zero. Thus it appears that monetary incentives crowd out social preferences. We also see that subjects respond negatively to higher requests for effort, and that effort declines modestly over time. In contrast, in the absence of monetary incentives, we see evidence for reciprocity as subjects who have received more effort so far also give significantly more effort ($p < 0.01$), and that they respond positively to requests for effort ($p < 0.01$). The average effort given so far is quantitatively small and not significant, likely

[6] Results omitted in the interest of space.

[7] In the EAT, the difference between these variables is directly proportional to a subject's effort account balance (which was given to subjects). Although effort account balances were not shown in either the Control or Monetary treatments, it would be fairly straight-forward for subjects to keep track of cumulative effort given and received; therefore, we include them as possible explanatory variables.

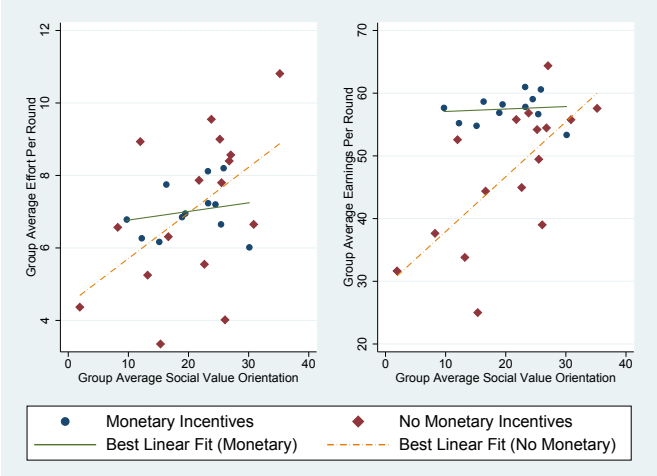
because giving effort represents a kind of altruistic type, which is captured by the fixed effects. Finally, consistent with Figure B.1, we see that effort declines over time.

4.2. The Differing Role of Social Value Orientation

Table 1 shows that the differences in average effort are small whether or not monetary incentives are present, while there are quite large differences in the variance of effort. Moreover, Table 2 already suggests that there are differences in the determinants of effort depending on whether or not monetary incentives are present. Hypothesis 2.1 conjectured that subjects who are more pro-social according to the social value orientation will exert higher effort, while Hypothesis 2.2 conjectured that this effect would be moderated by the presence of monetary incentives.

Figure 2 shows the relationship between social value orientation and effort in panel (a) and between social value orientation and earnings in panel (b). In both cases, we differentiate between whether monetary incentives are present (●) or absent (♦). The yellow dashed line is the best linear fit of the relationship between group effort/earnings and the group average social value orientation absent monetary incentives. The green solid line represents the same for when monetary incentives are present. As can be seen, there is a strong positive relationship between both effort and earnings and social value orientation in the absence of monetary incentives.

Figure 2 Group-Level Social Value Orientation



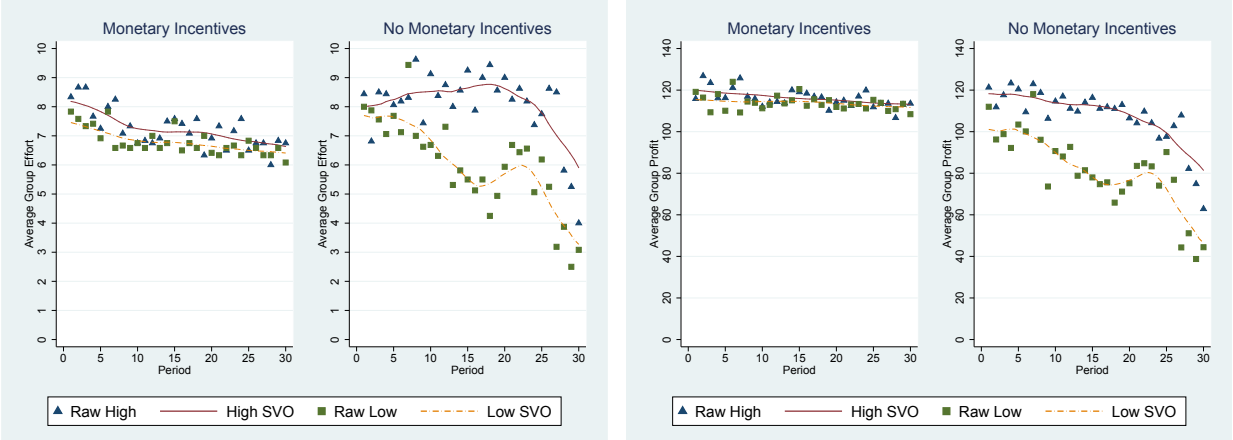
However, Figure 2 shows a markedly different pattern in the presence of monetary incentives. As can be seen, the relationship between group average effort/earnings and group average social value orientation is much flatter. Thus, effort and earnings do not differ much whether a group has a relatively high or relatively low SVO. In Table B.2, we report the results of regressions to statistically support the conclusions that are visually apparent in Figure 2. This holds whether

we look at group averages or individual averages and, in the individual averages case, whether we include various controls such as field of study, gender, nationality and Big 5 personality index scores. In all cases, there is a significantly positive relationship between effort and SVO *in the absence of monetary incentives* and, also in all cases, when monetary incentives are present, there is no significant relationship between effort and SVO.

A similar pattern emerges if we look at the dynamics of effort/earnings, differentiated by high and low SVO groups. As can be seen in Figure 3, when monetary incentives are present, high SVO groups have marginally higher effort (left side of panel (a)) across all periods and marginally higher earnings (left side of panel (b)). However, the differences are quite small. In contrast, in the absence of monetary incentives, there are substantial differences between high and low SVO groups. The high SVO groups actually see effort increase slightly until about period 20, and then decreasing thereafter, while the low SVO groups see effort declining from the very beginning. A similar pattern emerges with respect to profits. High SVO groups earn more and experience a less steep drop in earnings in the latter periods.

Figure 3 Effort and Earnings Across Periods

(a) Effort (b) Profits



5. Concluding Remarks

Our results have shown that a system of monetary exchange is the most efficient at capturing gains from trade. When money was present as a medium of exchange, on average, subjects earned significantly more money. However, when money is not present and, instead, subjects must rely on non-monetary exchange of favors, we found that some groups were able to sustain high levels

of favor exchange, and generate surplus on par with, or even exceeding, subjects who had monetary incentives. Moreover, our results were able to show that the distinguishing feature between successful and unsuccessful groups in the absence of monetary incentives was the social value orientation of the group. Those with high social value orientations sustained consistently high effort and substantially delayed the end-game drop off in effort than did those with low social value orientation.

This suggests several avenues for future research. For example, one could think about ways of building social value orientation within groups, such as via team-building exercises. Furthermore, allowing for endogenous selection into groups with monetary or non-monetary incentives would seem fruitful. It would be interesting to see if those subjects who had high social value orientation would select into non-monetary incentives and be even more successful than in our experiments where subjects were randomly assigned to a group. Both of these features seem to be at work in the start-up community. For example, one technology incubator speaks of the importance of building a community based on altruism, reciprocity strong relationships both at work and outside of work.[8] Beyond this, it would be interesting to explore the fraught nature of favor exchange. In particular, it seems natural that many people would rather pay money to avoid the obligation that comes with receiving a favor. This is just a small sample of the type of questions that could be fruitfully explored from our research.

[8] See, `https://atlantatechvillage.com/about/our-story/` where they speak of their mission to "pay it forward", "be nice" and "work hard; play hard" (Accessed on 14 Sep 2018).

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Appendix

A. Instructions for Control Treatment

General Instructions

Welcome to this experiment on decision-making! In this experiment you can earn money. The amount you earn depends on the decisions you and other participants make. Therefore please read these instructions carefully. In the experiment you will earn points. At the end of the experiment we will convert the points you have earned into euros according to the rate: 125 points equal €1. You will be paid your earnings privately and confidentially after the experiment.

Throughout the experiment you are not allowed to communicate with other participants in any way. If you have a question please raise your hand. An experimenter will come to your desk to answer it.

Your group

At the beginning of the experiment the computer will randomly assign you (and all other participants) to a group of 4 participants. Group compositions do not change during the experiment. Hence, you will be in the same group with the same people throughout the experiment. The composition of the groups is anonymous. Neither during nor after the experiment will you get to know the identities of the other people in your group. The other people in the group will also not get to know your identity. On your computer screen, you will see your randomly generated experiment ID, which stays the same throughout the experiment. When matched with another group member, you will see his or her experiment ID as well.

Number of rounds

The experiment consists of 30 rounds. You will receive a show-up fee of €5. In each round you can earn additional points. Your total earnings will be the sum of the show-up fee and your earnings converted from points in each of the 30 rounds.

The decision task

At the beginning of each round, you will get randomly paired with **one** of your three other group members. You will be able to see the experiment ID of your partner and he/she will get to see your experiment ID. One of you will be assigned the role of **receiver**; the other will be assigned the role of **sender**. Please note that your role and paired group member can change each round.

Every round, the receiver makes a request on how many tokens he or she would like to receive from the sender. The sender makes a decision on how many tokens to send to the receiver. The precise details are provided below.

As a receiver, you can choose a number between 0 and 16, which denotes the amount of tokens you would like to receive from the sender. When the sender receives your request, he or she can decide on the amount of tokens to send to you, by choosing a number between 0 and 16. The lower of the two numbers will determine the number of tokens created. For example, if you request 5 tokens but the sender chooses 3, then the number of tokens created will be 3. Likewise, if you request 5 tokens and the sender chooses 8, then the number

of tokens created will be 5. You will earn points for the tokens that you receive according to the following formula.

$$\text{Earnings} = 24 \times \text{Tokens Received}.$$

As a sender, you will decide on how many tokens to send to the receiver, based on the request you receive. This request is a number between 0 and 16. The amount of tokens that will be created is a number between 0 and 16 as well. The **lower** of the two numbers will determine how many tokens will be created. You will pay costs for the tokens created according to the following formula.

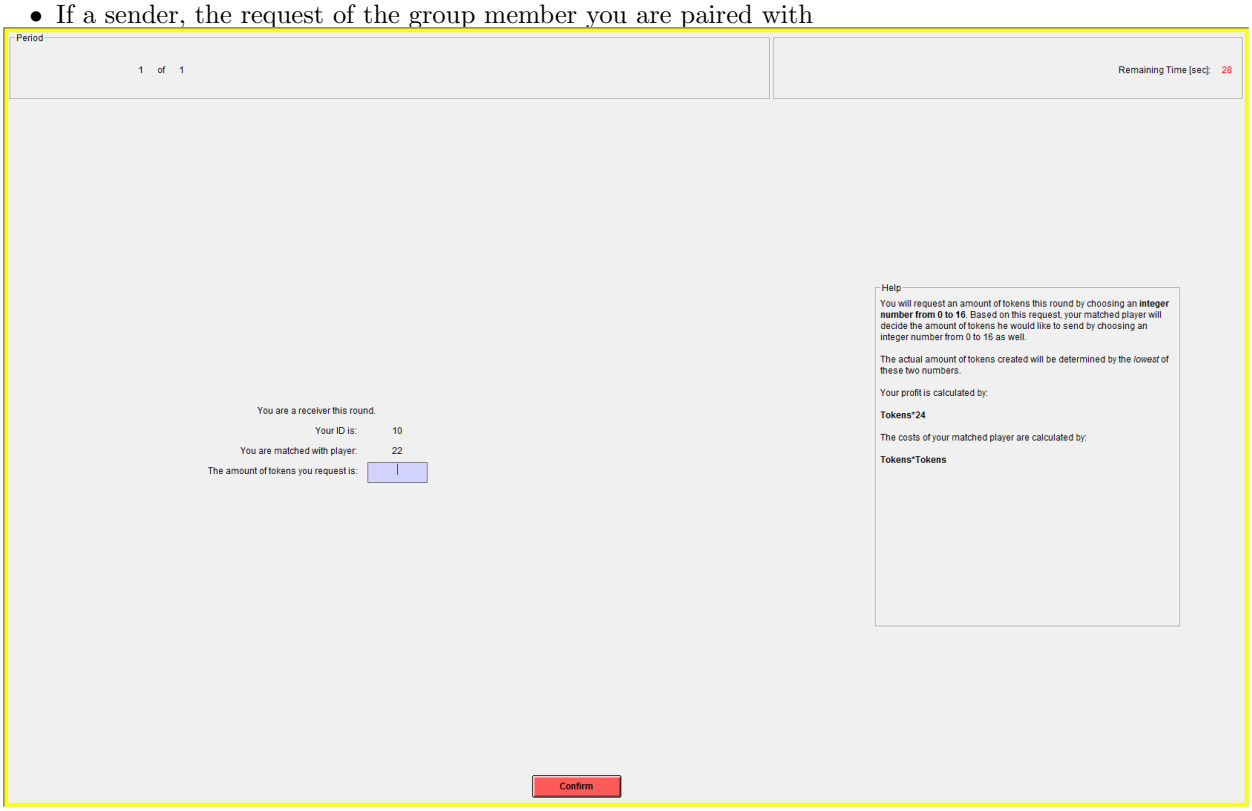
$$\text{Costs} = \text{Tokens} \times \text{Tokens}.$$

At the end of the experiment, you will be paid out the following: **initial show-up fee + points of Earnings points of Costs**. Minimum earnings will be 0 and therefore you cannot earn a negative amount.

Information

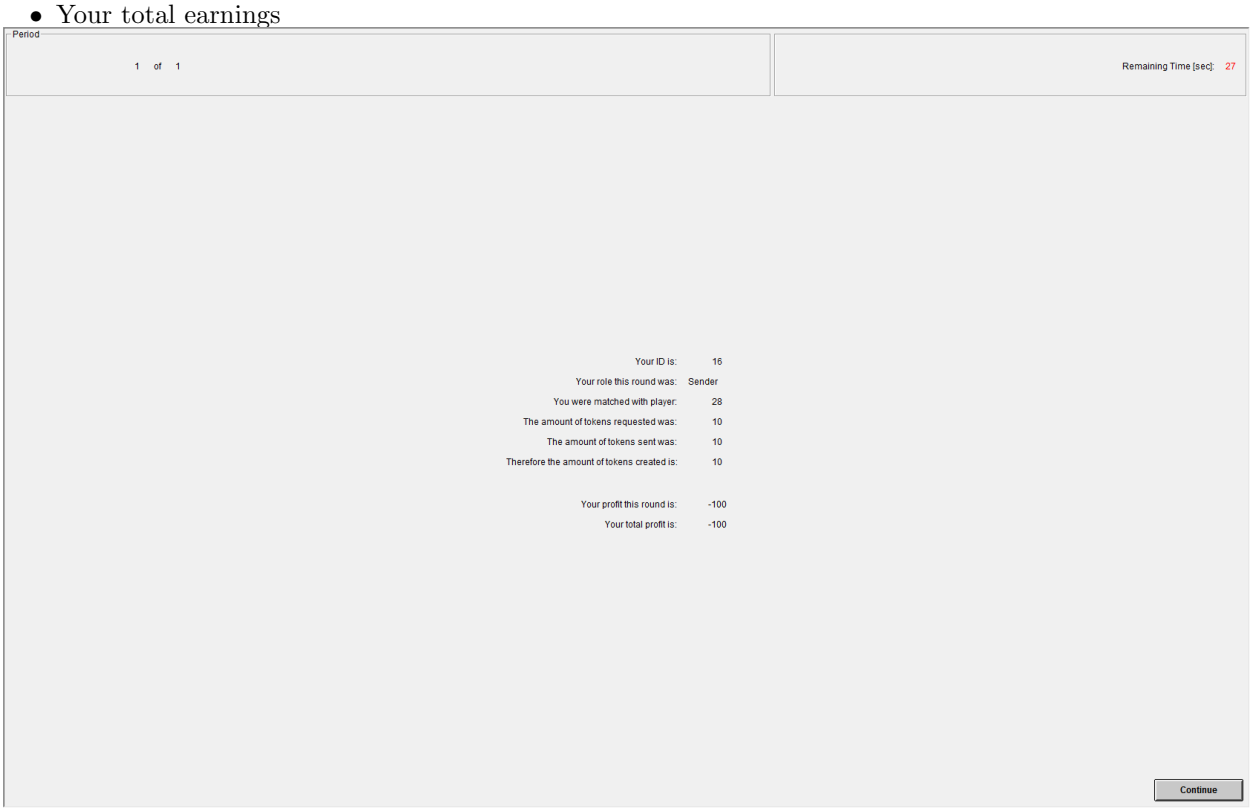
During the experiment, when making your decision, you will see the following information on your screen (see also the screenshot):

- Your role this round
- Your experiment ID
- The experiment ID of the group member you are paired with
- If a sender, the request of the group member you are paired with



During the experiment, when receiving the outcome of the round, you will see the following information on your screen (see also the screenshot):

- Your experiment ID
- Your role this round
- The experiment ID of the group member you were paired with
- Tokens requested/chosen to send
- The tokens requested/chosen to send of the group member you were paired with
- Amount of tokens created
- Your earnings/costs this round
- Your total earnings



Examples

Here are two examples of hypothetical play to make the instructions clear. Note that all numbers mentioned are points.

Example 1: Participant A is a receiver this round and requests 10 from the sender. Participant B is the sender who receives a request of 10 and decides to send 4 tokens. The number of tokens created will be 4. Participant A earns $24 \times 4 = 96$ and participant B pays $4^2 = 16$.

Example 2: Participant A is a receiver this round and requests 6 from the sender. Participant B is the sender who receives a request of 6 and decides to send 14 tokens. The number of tokens created will be 6. Participant A earns $24 \times 6 = 144$ and participant B pays $6^2 = 36$.

Control questions

To ensure that you understood the instructions we ask you to answer a few control questions. Please take the page with control questions in front of you. After all participants have correctly answered these questions,

the experiment will continue. Raise your hand when you have completed the control questions and an experimenter will come to your desk and check your answers.

Concluding remarks

You have reached the end of the instructions. If anything remains unclear to you or if you have any questions, please raise your hand.

B. Supplemental Materials

B.1. Examples of SVO Allocation Questions

Table B.1 depicts two SVO allocation questions drawn from our experiment. In each case, subjects were in the role of a dictator and had to pick one of 9 options, with each option representing an allocation of payoffs to oneself and to another subject. Panel (a) depicts a standard dictator game setting in which changing from option n to $n+1$ raises the payoff of the other subject, while lowering their own payoff by the **same** amount. Therefore, a purely selfish decision maker would choose option 1, while an altruistic decision maker, or someone who cares about inequality, may choose to allocate more to the other subject. Panel (b) represents a slightly different scenario. In this case, one's own payoff is maximized by choosing option 1, but the total surplus is maximized, and inequality is minimized, by choosing option 9.

Table B.1 Examples of an SVO Allocation Question

(a) Standard Dictator

Option	1	2	3	4	5	6	7	8	9
You receive	100	94	88	81	75	69	63	56	50
Other receives	50	56	63	69	75	81	88	94	100

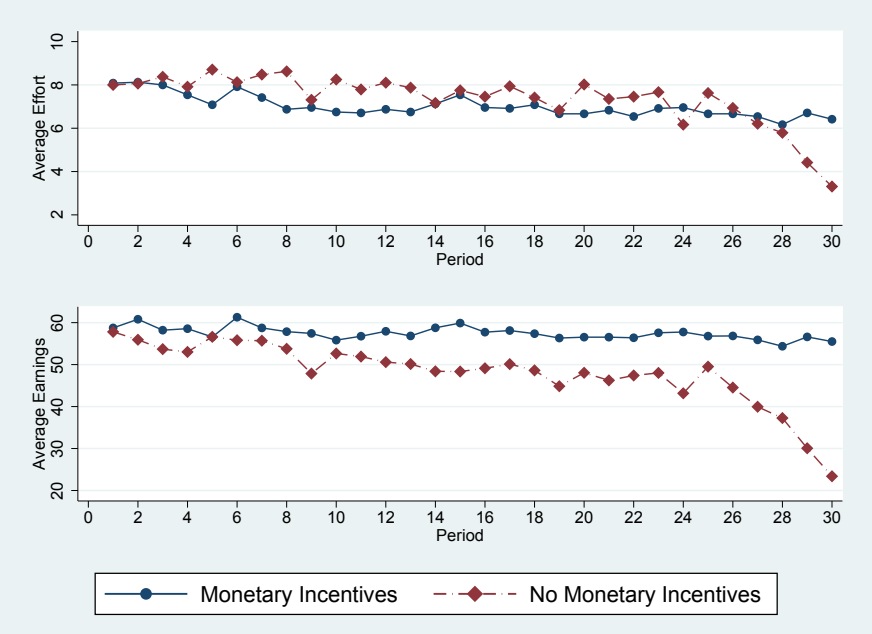
(b) Efficiency & Equality

Option	1	2	3	4	5	6	7	8	9
You receive	100	98	96	94	93	91	89	87	85
Other receives	50	54	59	63	68	72	76	81	85

B.2. Dynamics of Effort and Earnings

In Figure B.1 we plot the evolution of effort and earnings both for monetary and non-monetary incentives. Consider first effort. As can be seen, in both treatments there is a downward trend in effort. While in the monetary incentives treatment, average effort fairly quickly converges to a point just above the equilibrium prediction, without monetary incentives, effort continues to deteriorate and, indeed, there is a strong end-game effect with effort declining rapidly and substantially in the last five periods. In terms of earnings, which can be seen in the bottom panel, average earnings are fairly stable with monetary incentives but there is a distinct downward trend in earnings without monetary incentives, and the drop is particularly sharp, consistent with the drop in effort, over the last five periods.

Figure B.1 Effort and Earnings Across Periods



B.3. The Influence of Social Value Orientation

Here we provide some supporting regression analysis to complement Figure 2, which shows the differential role that social value orientation has depending on whether or not monetary incentives are present. We do so both at the group level (panel (a)) and at the individual level (panel (b)), which allows us to include a large set of additional control variables and, thus, demonstrates the robustness of our results.

In Table B.2(a), we regress average effort (earnings) on SVO, an indicator for whether there were monetary incentives and an interaction term. The averages are taken over the entire group of four's 30 period interaction. As can be seen, when there are no monetary incentives, the larger is the average SVO within the group (i.e., the more pro-social is the group), the higher is effort and the higher are earnings. In contrast, with monetary incentives, the baseline effort is higher (indeed, very close to the equilibrium) and the relationship between SVO and effort/earnings is not significant. Thus, an important result is that monetary incentives appear to crowd out the beneficial relationship between pro-social behavior and effort.

In Table B.2(b), we show that the individual average effort is significantly increasing in the individual's social value orientation, *only in the absence of monetary incentives*. The first column includes only SVO measures – allowing the coefficients to be different depending on whether or not monetary incentives were present – and an indicator for the monetary treatment, to allow for possible level effects. In the other columns we add controls for other characteristics, such as indicators field of study, indicators for nationality, gender and the scores on the Big 5 personality test. As can be seen, in all cases the coefficient on SVO is positive and significant in the absence of monetary incentives. Moreover, its value is nearly constant across all specifications. The evidence presented in Table B.2 and Figure 2 suggest that, *absent monetary incentives*, one's social value orientation is a robust predictor for a subject's willingness to do a favour for his/her group

Table B.2 Social Value Orientation

(a) Based on Group Averages (Effort & Earnings)

	Effort		Earnings	
Social Value Orientation (SVO)	0.126	(0.045)	0.876	(0.192)
1[Monetary Incentives × SVO]	−0.102	(0.088)	−0.837	(0.376)
1[Monetary Incentives]	2.083	(1.899)	27.535	(8.086)
Constant	4.448	(1.012)	29.160	(4.309)
R^2	0.248		0.608	
Observations	28		28	

(b) Based on Individual Averages (Effort)

	(1)		(2)		(3)		(4)		(5)	
SVO (Monetary)	0.020	(0.015)	0.024	(0.016)	0.022	(0.016)	0.020	(0.019)	0.014	(0.021)
SVO (No Monetary)	0.052	(0.018)	0.046	(0.021)	0.053	(0.019)	0.051	(0.019)	0.053	(0.018)
Monetary Indicator	Yes		Yes		Yes		Yes		Yes	
Field of Study	No		Yes		Yes		Yes		Yes	
Gender	No		No		Yes		Yes		Yes	
Nationality	No		No		No		Yes		Yes	
Big 5	No		No		No		No		Yes	
R^2	0.074		0.188		0.228		0.280		0.307	
Observations	112		108		108		108		108	

Note: In Panel (a), the unit of independent observation is the 4-person group, averaged over all periods of their interaction. In panel (b), we take the individual average. Panel (b) corrects for clustering at the group level.

member. Moreover, higher average SVO within the group translates (via the effect on effort) into higher earnings. The effect is sufficiently large such that the most pro-social groups without monetary incentives achieve earnings which are comparable to subjects in the monetary treatment.