# Trust, Trustworthiness and Cooperation:
# Social Capital and Community Resource Management

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**Abstract:** Social capital is considered one of the main determinants of community resource management success. Trust and trustworthiness are important measures of social capital. We combine experimental and household survey data from five rural villages in India to analyze (i) how these measures are correlated with socio–cultural community characteristics, and (ii) how social capital affects community resource management.

**Key words:** Social capital, sustainable development, water scarcity, participatory development programs, economic experiments, trust games.

**JEL codes:** O12, O19, Q01, Q25.

## 1. Introduction

A growing literature tries to relate economic development and good governance to social capital. While the exact definition of social capital is subject to debate, most analysts treat it as a characteristic of communities, and describe it in terms of trust, norms and networks that enable collective action (e.g. Putnam 1993, Fukuyama 1995, Woolcock and Narayan 2000, Bowles and Gintis 2002). Two of the key elements of social capital are trust and trustworthiness (Glaeser et al. 2000). Fukuyama (1995) describes trust as 'the expectation that arises within a community of regular, honest and cooperative behavior based on commonly shared norms on the part of other members of that society'. Social norms influence people's preferences and constraints, lower transaction costs (as it precludes the necessity to write contracts that capture all contingencies), and facilitate the exchange of information. Trustworthiness is based on one of these 'commonly shared norms' – the norm of reciprocal behavior (Sethi and Somanathan 2003, Fehr and Gächter 2000).

Most empirical work – be it based on cross section analysis or case studies – suggests a positive correlation between social capital, the quality of governance and economic growth (e.g. Putnam 1993, Knack and Keefer 1997, Knack 2002). However, there are various unresolved issues. First, empirical work has been plagued by problems that emerge when one attempts to measure social capital. For example, using trust as an indicator, analysts typically resort to survey questions to assess whether respondents feel that other people can be trusted or not. The potential divergence between stated versus actual preferences and beliefs has been elaborated elsewhere, and is a potential concern for trust surveys.[1] In addition, Glaeser et al. (2000) argue that the trust question measures trustworthiness rather than trust, and suggest developing alternative instruments to measure trust. Second, the finding that trust is conducive to faster growth appears not to be robust. For example, Beugelsdijk and van

[1] For example, refer to the long–standing debate on non–market valuation via stated preferences methods (e.g. Cummings et al. 1997). Problems may arise, for example, when socially accepted answers deviate from actual opinions.

Schaik (2005) find no such relation between growth in European regions and their measure of trust (see also Miguel et al. 2005). Partly this may reflect a certain degree of substitutability between social capital and formal institutions. But it is also likely that spatial scale matters as it is not obvious that there should exist a relation between social capital (a community–level characteristic) and regional or aggregate growth statistics. Analysis at a more decentralized level – linking local social capital to local economic performance and community resource management – appears to be more appropriate.

In this paper we attempt to advance the emerging theory on social capital by dealing with these issues. We interpret social capital as the set of norms and trust that shape the expectations of the behavior of others, a causal definition that allows for empirical interpretation (Durlauf 2002). We use data from a series of economic experiments (trust games) in five rural villages in India. Based on actual behavior of respondents (rather than stated beliefs) in these trust game experiments we construct two measures of social capital – one based on 'trust' and the other based on 'trustworthiness'. We then relate these measures of social capital to local contributions to a public good – something that few other studies have done (Gächter et al. 2004, Cramb 2005). Specifically, we test the predictive power of our measures of social capital in explaining individual agent's investments in soil and water conservation. These investments have important public goods characteristics, as investments undertaken by one agent implies increased availability of water as well as less soil runoff for other agents in the watershed.[2] If our experiment is indeed able to capture social capital, we expect higher levels of trust and trustworthiness to translate into higher propensities to invest in soil and water conservation.

The main objectives of the analysis are the following. First, we aim to explore the determinants of social capital – which conditions or factors are conducive to the emergence

[2] The study sites are defined at the scale of the watershed, or the hydrological area from which all water flows to a common drain, since it is at this scale that the impacts of investments in soil and water conservation are felt.

of social capital? Second, we want to improve the understanding of the potential link between social capital and the ability of villages to benefit from collective action in their fields (closely related to economic performance). Finally, and as an aside, we want to analyze to what extent easily observable community characteristics may serve as a proxy for social capital in empirical analysis. Improved understanding of such proxies might enable NGOs and government agencies implementing community based development projects to tailor their efforts in those areas where the returns to their investments are largest.

The policy relevance of these questions for countries like India is obvious. Communities are increasingly the focus for local development and community resource management initiatives.[3] A key element in most approaches is that village communities are supposed to maintain public investments and coordinate resource use. However, the sustainability of these approaches is being debated, as evidence exists that many communities fail to maintain investments in the long run (Mansuri and Rao 2004). In fact, to enhance effectiveness, some analysts have argued that investments should be targeted at homogenous communities (Kerr 2002), which are assumed to have higher levels of social capital and a superior ability to manage their collective resources in a sustainable way.

The paper is organized as follows. In section 2 we briefly summarize the behavioral literature on social capital, and outline the trust game. In section 3 we present key results from the experiment, and derive our measures of social capital. We also consider the relation between our measures and readily observable village variables. In section 4 we explain decisions with respect to soil and water conservation in the field using village variables and our social capital variables. Section 5 concludes.

[3] For example, the World Bank's portfolio for "community based and driven approaches" is roughly 7 billion dollars (Mansuri and Rao 2004). The strategy of community governance has been embraced for poverty alleviation and local resource management as the answer to situations where both markets and governments fail (Bowles and Gintis 2002). Community–based strategies try to exploit the small–group characteristics of communities, such as low monitoring and information costs, shared social norms, and the willingness to uphold these norms by means of peer enforcement in the form of sanctions or rewards (Baland and Platteau 1996, Ostrom 1990, Ostrom et al. 1992).

## 2. Measuring social capital in local communities

Standard economic theory assumes that individuals maximize their own welfare. However, evidence gathered in laboratories and the field is mounting that humans also care about the welfare and intentions of others (Fehr and Gächter 2000), and that there exist conditions under which communities may be able to overcome social dilemma situations and problems of collective action (Ostrom 1990). Crucial for the resulting level of welfare at the community scale is the availability of social capital (Bowles and Gintis 2002, Gächter et al. 2004). The availability of social capital partly depends on how the community is defined. If the community is defined at the level of a region or state, it probably comprises different social groups with possibly conflicting social norms (Alesina and La Ferrara 2000, Glaeser et al. 2000), and hence community resource management is likely to be less successful.

One of the important tenets of the literature on other–regarding preferences is that preferences are shaped by social interaction. This suggests a role for external environments in shaping preferences (e.g. Sigmund et al. 2002). In a research project covering fifteen small–scale societies around the globe, Henrich et al. (2004) test to what extent personal characteristics and social, economic and natural environments affect human behavior in games. They conclude that 'experimental play often mirrors patterns of interaction found in everyday life' (Henrich et al. 2004: 10–11). For example, individuals from societies depending on collective activities are more cooperative than those from societies in which the family is the key decision making unit. So, people use their experiences in everyday life to solve the problems they encounter in the experiment, and hence social capital built up in normal interactions is expected to be detectable in the laboratory.

To exploit this phenomenon we use a two–player trust game, where individuals play both the role of investor (sender) and trustee (receiver); Berg et al. (1995). There are two participants in the game, investor *i* and trustee *j*, who play the game anonymously. Investor *i*

receives an amount of money $\bar{S} > 0$ from the experimenter, and can "invest" any amount $0 \le S_i \le \bar{S}$ by sending it to trustee *j*. The experimenter triples the amount sent, so the trustee receives three times the amount sent ($R_j = 3S_i$). Next, the trustee can send back any amount $S_j$ between 0 and the amount received $R_j$ ($0 \le S_j \le R_j = 3S_i$). The sum of payoffs to the investor and the trustee is maximized if the investor sends the total endowment $\bar{S}$ to the trustee, so that the aggregate payoff is $3\bar{S}$. In the absence of sufficient trust that a share of the surplus will be returned that is at least as large (in absolute terms) as the amount initially sent, however, the investor sends nothing.

We used data from two–player trust games run in five villages spread over three different watersheds (Kosgi, Kalyanpur and Vaiju Babulgaon) which were selected from a larger set of 21 villages that are monitored as part of an overarching research project.[4] We defined the community at the scale of the village, in accordance with the scale at which community based project are implemented.[5] Experimental data were gathered during February 2005 in the selected villages. Earlier (in 2003), a random selection of households from the villages participated in a survey on soil and water conservation efforts. We invited these same households, some 100 in total, to send one member to participate in the experiment.

We closely followed the trust game instructions of Barr (2003) and Burks et al. (2000). The English version is in Appendix 1, but instructions were translated into the three local languages (Marathi, Telugu and Merwari). The experimenter read out the instructions in all villages, and was assisted by local assistants who had received extensive instructions and

[4] Study sites are part of the 'Livestock Environment Interactions in Watersheds' (LEAD) project, a project conducted by the International Water Management Institute (IMWI) with 5 partner organizations. The experiments conducted were not part of the LEAD project, as participants were explicitly told. Initially, experiments were conducted in 6 villages, but the results from one village (Dagawadi) were discarded as all participants turned out to be family–related.

[5] Especially in India, the concept of a village community is under debate as traditionally social interaction was confined to caste and not to village boundaries (Dumont 1970). Although formally the caste system has been abolished in India and local governance is organized at the village scale, in practice separate caste–based communities within the village boundaries sometimes still exist (see Das 2004). Hence, we use caste membership as the main determinant of village level homogeneity.

training beforehand. Transactions were performed with coded envelopes, and the experimenter was the only one with access to the codes. To ensure random selection and transparency, participants drew numbers from a box to select their (anonymous) partner. The investor's investment fund ($\bar{S}$) was Rs 50 (US$1.15), roughly equivalent to one day's wage. To induce participants not to communicate during the experiment, those who played by the rules received another Rs 50 after the experiment finished. This incentive proved to be highly effective as no communication occurred during the actual experiment.

Because of the low level of education of the respondents (33% was illiterate), instructing the participants posed a challenge. Instructions needed to be read out aloud but also acted out, and hence were expected to be time consuming. We calculated that we needed between 2 and 3 hours to explain the game, and also another 3 hours (i) to test each participant's understanding of the game[6], and (ii) to actually implement the game itself.

Adding up the time needed for instructions and for the actual experiment (including the test), we estimated the entire exercise to take 5–6 hours in total (which turned out to be roughly correct). To make sure that the participants remained concentrated, we decided to separate the instructions from the actual implementation of the experiment. The instructions were provided on one day, and the test and the experiment itself took place on the next. This implied a loss of control, as respondents were able to discuss strategies before the start of the actual experiment. Such group discussions took place in two villages: Kadampally and Bicchawara. This did not compromise our approach to measuring trust, because agents in the experiment were anonymous and any agreements were not enforceable. Potential agreements are cheap talk, and agents will only respect the joint strategy in case of sufficient trust – which is exactly what we intend to measure. To the best of our knowledge no ex–post transfers took place. But, since it is known that communication can affect the outcomes of

[6] We allowed all participants to complete the game (to prevent uproar as the stakes – in local real income– were high), but the data from seven participants are not used in the analysis as these respondents failed to answer the test questions correctly.

play (for an overview, see Ledyard 1995), we do control for ex ante group discussions by including a dummy variable for Kadampally and Bicchawara in the regression analysis below.

In the instructions we gave the generic explanation of the game without announcing what role a particular participant was going to play.[7] The experiment was set up such that each subject played both the role of the investor as well as that of the trustee, but we did not inform the participants about this on beforehand. By letting participants play both roles, we increased the number of observations, and gained information about each subject's characteristics because we could use a subject's play as a trustee to explain his/her decisions as an investor (and vice versa). Previous research suggests that having participants play both roles but without informing them about this on beforehand should not affect the participants' play as compared to their actions when playing just one role (Burks et al. 2000).

Finally, the fact that people's behavior may be influenced by contextual variables as well as household and village characteristics, posed some methodological difficulties. To determine the magnitude of social capital effects from individual data requires that the impact of contextual variables on behavior is properly addressed. While ideally this requires that group averages are included for each individual variable together with other contextual effects (Durlauf 2002), this was not possible due to multi–collinearity problems. Hence, we estimate two models: one with watershed fixed effects and one with village averages. The social capital measures we employ are based on the amount sent by the investor (the trust component) and the amount returned by the trustee (trustworthiness).

To analyze the determinants of the amount returned by the trustee we estimated the following Tobit regression[8]:

[7] Even though the wording was generic and to some extent abstract, post–game evaluations revealed that subjects understood the game, and that they compared the game to situations from daily life.

[8] Because our dependent variable is a share, analysis is by means of Tobit with lower and upper bounds of 0 and 1, respectively (Greene 2003).

(1) $R_{jk}/3S_{ik} = \text{constant} + \beta_1 X_{jk} + \beta_2 G_{jk} + \beta_3 C_k + \varepsilon_{jk}$,

where j indexes the trustees in village *k* (and *i* the investor this particular trustee was matched with), $X_{jk}$ a vector of trustee characteristics (caste group membership, literacy, dependency on agriculture, income per capita)[9], $G_{jk}$ a vector of game specific events (the amount received by the trustee and existence of village level pre–game communication), $C_k$ a vector of contextual variables (watershed fixed effects or village level homogeneity, income inequality, and relative village income compared to that of the region). Finally, $\varepsilon_{jk}$ is the error term.

Barr (2003) found that the amount sent by the investor was a positive function of expected trustworthiness, or the behavior of the trustee. Expected trustworthiness can be measured in two ways. The participant may have a notion of the average trustworthiness in the village, or she may base her expectations on her own personal behavior (introspection). We use both indicators to estimate the determinants of investor behavior using interval regression since participants were confined in their decision making to Rs10 notes (Greene 2003). The trust equation reads as follows:

(2) $S_{ik} = \text{constant} + \beta_1 X_{ik} + \beta_2 G_{ik} + \beta_3 C_k + \varepsilon_{ik}$,

where *i* indexes investors in village *k*. The only difference compared to (1) is that in the vector $G_{ik}$, instead of the amount received by the trustee we now account for expected trustworthiness (average share returned) and own behavior as a trustee. Summary statistics of the explanatory variables are provided in Table 1.

*<< Insert Table 1 about here >>*

[9] We also considered age, gender and family size, but these variables were not significant.

## 3. Results of the trust game: Determinants of trust and trustworthiness

Table 2 presents a comparison of the results of the original trust game (Berg et al. 1995), the trust game played by Barr (2003) with Zimbabwean farmers, and our results. The behavior in all three studies is rather similar.

*<< Insert Table 2 here >>*

Substantial variation underlies the average numbers in our study; see Table 3 and Figure 1. While investments in the villages where pre–game discussions took place (Kadampally and Bicchawara) appear somewhat higher than in other villages, this difference is not significant. This gives some credence to the notion that such discussions are to a large extent cheap talk.

*<< Insert Figure 1 and Table 3 about here >>*

With respect to trustee behavior, the share returned is very similar in all five villages. If we categorize participants that return less than 1/3 of the amount received as self–interested (i.e., they send back less than they received), participants that return 1/3 as reciprocal and participants that return more than 1/3 as rewarding or altruistic, the picture as in Figure 2 emerges. Comparing Figures 1 and 2, at first glance there appears to be little correlation between investments and the share returned across villages. This is an important issue to which we return later.

*<< Insert Figure 2 about here >>*

In what follows we consider the determinants or drivers of trust and trustworthiness. First we consider trustworthiness, which we measure as the share returned by the trustee; see equation (1). Results are presented in Table 4.

*<< Insert Table 4 about here >>*

Consistent with Barr (2003) we find that the share returned does not depend on the amount received. Regardless of investments, the trustee returns a fixed share. Also, pre–game group discussions did not significantly impact the share returned. But this share is affected by other factors – both at the household and village level. We find that participants from more homogeneous villages tend to return a larger share than participants from heterogeneous villages, which confirms the hypothesis that socio–economic homogeneity positively influences reciprocal behavior (Poteete and Ostrom 2005, Alesina and La Ferrara 2000). Per capita income is another positive and significant determinant of the share returned. Interestingly, literate subjects return less than illiterate ones, even when controlling for income. Perhaps this is indicative of the idea that literate people are more calculating in their actions. Note that these results are robust with respect to estimating a fixed effects model.

Next, we turn to explaining investor or trust behavior, as specified in equation (2). Results are presented in Table 5.

*<< Insert Table 5 about here >>*

First, contrary to Barr (2003), the average share returned does not significantly influence the amount sent. For one, the variance in average trustee behavior is relatively low, as was evident from Figure 2. In Barr's study, both the average share returned and its variance were

higher, possibly because that experiment was not double blind (as ours was). Alternatively, participants in a non–repeated trust game may base their expectations on their own behavior (and have an imperfect understanding of the average behavior of the group). This is what our analysis indicates; a 10% increase in share returned by the participant translates into a little less than a 1.8 rupees increase in the amount sent (or 4% of the initial endowment of Rs 50). Second, group discussions significantly impact the amount sent. When pre–game discussions had taken place, the amount sent is 8 rupees (or 16% of the endowment) higher than if no group discussions took place. Hence, as no post–game transfers occurred, we hypothesize that group discussions allow for an exchange of knowledge and a sharing of expectations regarding cooperative behavior that increase individual levels of trust (Ostrom et al. 1992). Also, the fact that some villages got together whereas others did not may be regarded as an indicator of social coherence. Third, participants who do not depend on agriculture for their livelihood send, on average, just over 10 rupees less than participants who are dependent on agriculture, and this difference is highly significant. Similarly, the participant belonging to a majority social group has a positive impact on trust: majority group participants can be expected to send 9.7 rupees (or 18% of the endowment) more than participants from minority castes. Fourth, participants from relatively richer villages sent less than participants from "poor" villages. This suggests that economic development reduces trust at the village scale. However, since the amount sent decreases with only 3% of the endowment (less than 1 rupee) for every Rs 1000 (US$18) increase, this is a small effect.

The explanatory power of the model is rather low, which may indicate omitted variables. For example, the 'fundamental differences in religion, culture and institutions' on which trust levels are also said to depend (e.g. Fukuyama 1995, Willinger et al. 2003) are not explicitly accounted for in the analysis, although to some extent they may be captured in the watershed fixed effects.

## 4. Social capital and resource management

In this section we analyze whether the results of the trust game are useful in explaining behavior of participants in terms of voluntary provision and maintenance of a public good (in our case soil and water conservation). Based on the analysis of trust and trustworthiness we define two indicators of social capital: one representing an aggregate measure of trustworthiness (the average share returned) and one based on an aggregate measure of trust (the average amount sent). In addition, since conducting economic experiments and household surveys is expensive and time–consuming, the question naturally arises whether directly observable village characteristics would not perform equally well in serving as a proxy for social capital. Hence, we test whether social homogeneity explains participation in community resource management as well as trustworthiness and trust.

How does social capital affect the incentives of people to contribute to soil and water conservation? To address this issue we distinguish between two different types of community development activities: investments in soil and water conservation (*SW*), and efforts to uphold and maintain existing conservation infrastructure (operations and maintenance, *OM*), both measured as dummy variables. For our purposes there exists a crucial difference between these activities. While *SW* is heavily subsidized (by NGOs or government agencies) and therefore privately rational to undertake (e.g. Kerr et al. 2002), operation and maintenance efforts reflect a contribution to a public good. We therefore hypothesize that social capital is important for household participation in *OM*, but that it may not play a role for household investment in *SW*.

For both the *SW* and *OM* models we use a specification with watershed fixed effects. Since the dependent variables are discrete variables, all equations are estimated by means of a Probit regression.

$$(3) \qquad Z_{ik} = \text{constant} + \beta_1 S_k + \beta_2 X_{ik} + \beta_3 I_k + \beta_4 C_k + \varepsilon_{ik},$$

where i indexes households in village k. $Z_{ik}$ is measured as either $SW_{ik}$ or $OM_{ik}$ (with values 0 or 1), $S_k$ is a vector of social capital indicators at the village scale (average trust, average trustworthiness, or social homogeneity), $X_{ik}$ a vector of individual household characteristics (caste group membership, income per capita, landholding size, household access to irrigation, soil type and the households perceived influence on decision making)[10], $I_k$ is a village level dummy reflecting whether investments in soil and water conservation were undertaken by an NGO[11] and $C_k$ a vector of watershed level fixed effects. The *SW* results are provided in Table 6, with marginal effects for the significant variables only.

*<<Insert Table 6 about here>>*

Consistent with intuition we find that social capital, be it proxied by trust or trustworthiness, is *not* a significant determinant for household investment in soil and water conservation when such investments are subsidized.[12] Households undertake such efforts regardless of whether they expect their peers to contribute or not. In contrast, per capita income has a significant positive effect, possibly reflecting the fact that richer households have more means to invest in resource conservation. Access to irrigation has a negative effect, which might capture the fact that households with access to irrigation depend less on investments in resource conservation to improve the productivity of their land. In terms of observables, social

[10] Landholding size, soil type, income per capita, access to irrigation and the households perceived ability to influence decision making have been shown significant for household participation in soil and water conservation (Bouma et al. 2005).

[11] Investments undertaken by an NGO tend to be more participatory and more community focused than investments by the government (Kerr et al. 2002, Bouma et al. 2005, Farrington et al. 1999). Besides, in the selected villages, NGO's installed a maintenance fund to maintain the collective investments.

[12] To control for potential endogeneity, we also estimated both equations with the predicted values for trust and trustworthiness (with prediction on the basis of the fixed effect models presented in Tables 4 and 5). This did not affect the outcomes in a significant way.

homogeneity does not play a significant role. This is not inconsistent with the idea that villagers are primarily motivated by private gains when contributing to *SW*.

*<<Insert Table 7 about here>>*

Turning to our main results, Table 7 documents how social capital impacts on the intention to maintain community resource infrastructure when labor is not subsidized. Consistent with Gächter et al. (2004) we now find that our social capital proxy based on trust has a significant and positive impact on the provision of the public good.[13] In other words, when villagers expect that their efforts are 'rewarded' by voluntary contributions of their peers, they are more likely to contribute to soil and water conservation themselves. Surprisingly, we find that trustworthiness is negatively associated with the provision of the public good. We did not expect such an effect, and consider it an anomaly, possibly reflecting that the variance of trustworthiness between localities is low (see Table 3 and Figure 2). As such it is a poor measure of social capital as it fails to capture the intricate differences that exist between communities when it comes to investing in the public good. This could be an important finding in the light of the remark by Glaeser et al. (2000: 811) that currently most social capital surveys measure trustworthiness (rather than trust).

In terms of observables, village homogeneity seems a relevant proxy for social capital when experimental data lack. Like trust, village homogeneity is positively significant and like trust, a 2%–point increase in village homogeneity increases the probability of household participation with 4%–points. Other significant variables are again per capita income and the household belonging to a majority group. The negative impact of project intervention by a NGO reflects the fact that in villages with NGO intervention a village maintenance fund

[13] Our main results are robust to changes in the set of explanatory variables. Replacing social homogeneity with income inequality, including extra variables in the analysis (number of household members, education) and using predicted instead of actual variables does not significantly change the results.

exists. Previous research has shown that this significantly reduces the incentive for voluntary participation (Bouma et al. 2005). Finally, the households perceived ability to influence decision–making has a significant positive influence on household participation too.

Whether the impact of trust and social homogeneity on the probability of household contribution to soil and water conservation is high or low is open for debate. Our results indicate that the availability of a maintenance fund, households' membership of a majority group, and the households' perceived influence on decision making affect the probability of household contribution with, respectively, –61, +42 and +53%–points. This means that village level trust and/or social homogeneity would need to change with 25–30% to reach a similar effect. Whether this could be feasible in the implementation of community–based development assistance projects remains to be seen, but it could help target investments to increase effectiveness on the long run.

**5. Conclusions**

We have undertaken an experimental study and a household survey in rural India to uncover the inter–linkages between social capital, (community) characteristics, and the provision of a local public good (investments in soil and water conservation maintenance). We obtain several interesting results. Consistent with expectations, trust and trustworthiness – measured as amounts sent and shares returned in a trust game – are higher in homogeneous communities. We also find that trust is a significant determinant of household participation in community resource management. Whether the impact of trust on community resource management should be considered high or low is open for debate, but the results indicate that the importance of social capital is comparable to that of other factors in fostering participation in community resource management.

We obtained unexpected results for trustworthiness – another key dimension of social capital. First, we found that the variance of trustworthiness between communities is very

low, and that the shares returned were unrelated to the amounts received ("investments"). Here, trust does not depend on average village trustworthiness, but rather on the subjects' own characteristics. So, the indicator of trustworthiness does not reflect the social norm of village level reciprocity, as expected, but just the subject's own personal norms. Hence, we conclude that with low variance in trustworthiness between the study sites, trustworthiness is not a suitable indicator for social capital at the community scale. In light of the emerging empirical literature on social capital (that for an important part depends on trustworthiness) this is an important issue, and one worthy of future research.

Finally, our results suggests that when information about social capital – an unobservable variable – is not available, analysts and project implementers may employ easily observable village characteristic like "social homogeneity" instead, which turns out to be equally informative as the trust–based social capital variable we employ.

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Table 1: Summary statistics of the study sites

| Village | Kadampally | Sampally | Bicchiwara | Karji | V.Babulgaon |
|---|---|---|---|---|---|
| Watershed | Kosgi | | Kalyanpur | | V.Babulgaon |
| Total number of households | 187 | 164 | 243 | 115 | 264 |
| Number of participants | 20 | 19 | 19 | 21 | 20 |
| Gini income | .32 | .56 | .48 | .20 | .38 |
| Village homogeneity (% participants from same caste) | 70% | 47% | 100% | 86% | 90% |
| Income per capita (Rs '000) | 3.47 | 5.24 | 2.12 | 2.93 | 9.27 |
| | (2.08) | (9.99) | (2.50) | (1.04) | (8.57) |
| Landholding size (acres) | 6.5 | 6.3 | 1.9 | 7.3 | 8.1 |
| | (8.3) | (11.4) | (.95) | (11.3) | (5.7) |
| % female participants | 15% | 26% | 37% | 24% | 25% |
| % participants not dependent on agriculture | 10% | 32% | 21% | 14% | 10% |
| % illiterate participants | 45% | 47% | 32% | 29% | 10% |
| % HH with access to irrigation # | 67% | 87% | 53% | 57% | 100% |
| % HH with black soil # | 39% | 33% | 5% | 0 | 40% |
| % participants member of a minority high caste (MinOc) # | 5% | 37% | 0 | 5% | 0 |
| % participants member of a minority lower caste (MinRc) # | 25% | 16% | 0 | 9% | 10% |
| % participants member of a majority caste group (Majority) # | 70% | 47% | 100% | 86% | 90% |
| % HH able to influence decision–making # | 25% | 42% | 42% | 10% | 50% |

Standard deviations in parenthesis; # indicates dummy variable.

Table 2: Comparison of trust games between US students, Zimbabwean farmers and rural households in India

| | US students[1] | Zimbabwean farmers[2] | Indian rural households[3] |
|---|---|---|---|
| Number of playing pairs | 32 | 141 | 92 |
| Initial endowment: local currency (US$ equivalent) | US$ 10.00 | 20.00 Zimb $ (US$0.80) | 50.00 Rs (US$1.15) |
| Relative value initial endowment | Two hour's wage | Half day's wage | Full day's wage |
| Proportion of 'investors' investing zero | 0.06 | 0.09 | 0.13 |
| Mean investment by investor ($S_i$) | 0.52 | 0.43 | 0.49 |
| Mean share returned by trustee (*Rj/Si*) | 0.89 | 1.28 | 0.87 |

[1]Berg et al. (1995); [2]Barr (2003); [3] This study.

Table 3: Means and standard deviations of investor and trustee behavior per site

| | Kadampally | Sampally | Bicchiwara | Karji | V.Babulgaon |
|---|---|---|---|---|---|
| Investor's share of endowment sent ($S_i$) | 0.61 (0.23) | 0.35 (0.23) | 0.66 (0.37) | 0.52 (0.36) | 0.33 (0.22) |
| Trustee's share returned of amount received ($R_j/3S_i$) | 0.25 (0.20) | 0.29 (0.18) | 0.32 (0.27) | 0.27 (0.21) | 0.32 (0.19) |

Standard deviations in parenthesis.

Table 4: Determinants of the share returned to investor *i* by trustee *j* ($R_j/3S_i$)

| Variable | Village characteristics | Fixed effects |
|---|---|---|
| Constant | 0.06 (0.17) | 0.41 (0.10)*** |
| Kosgi # | | –0.12 (0.08) |
| Kalyanpur# | | –0.01 (0.08) |
| Gini income (%) | 0.15 (0.22) | |
| Village homogeneity (%) | 0.36 (0.17)** | |
| Average income of the region ('000) | –0.00 (0.01) | |
| Amount received ($R_j$) | –0.00 (0.00) | –0.00 (0.00) |
| Pre–game group discussions# | –0.01 (.06) | 0.07 (0.06) |
| Trustee is member of a majority caste# | 0.04 (0.08) | 0.05 (0.08) |
| Trustee is member of a minority higher caste# | 0.18 (0.12) | 0.19 (0.12) |
| Trustee is not dependent on agriculture# | –0.05 (0.07) | –0.04 (0.06) |
| Income per capita of trustee *j* ('000) | 0.01 (0.005)* | 0.01 (0.005)* |
| Literate# | –0.17 (0.06)*** | –0.17 (0.06)*** |
| No. of observations | 90 | 90 |
| Log Likelihood | –7.2 | –7.3 |
| LR Chi (df) | 17.3 (10) | 17.1 (9) |
| Pseudo R2 | 0.54 | 0.54 |

# dummy variable; *90% significant ** 95% significant ***99% significant. Standard errors in parentheses.

Table 5: Determinants of the amount sent by investor i ($S_i$)

| Variable | Village characteristics | Fixed effects |
|---|---|---|
| Constant | 19.77 (16.50) | 18.23 (21.87) |
| Kosgi# | | 8.28 (6.18) |
| Kalyanpur# | | 12.98 (4.89)*** |
| Gini income (%) | –11.87 (15.77) | |
| Average income region (Rs '000) | –1.52 (0.55)*** | |
| Average share returned ($R_j/3S_i$); | 15.72 (72.75) | –45.29 (67.35) |
| Own subject's reciprocal behavior (%) | 17.85 (7.80)** | 17.85 (7.80)** |
| Pre–game group discussions # | 8.01 (3.43)** | 8.07 (3.45)** |
| Investor is member of majority caste# | 9.68 (4.82)** | 9.68 (4.82)** |
| Investor is member of a minority high caste# | 1.08 (7.22) | 1.08 (7.22) |
| Income per capita of investor (Rs '000) | 0.06 (0.32) | 0.06 (0.32) |
| Investor is not dependent on agriculture # | –10.23 (4.00)** | –10.23 (4.00)** |
| Literate# | 3.59 (3.57) | 3.59 (3.57) |
| No. of observations | 90 | 90 |
| Log Likelihood | –143.0 | –143.0 |
| LR chi2 (df) | 36.3 (10) | 36.3 (10) |
| Pseudo R2 | 0.11 | 0.11 |

# dummy variable; *90% significant ** 95% significant *** 99% significant. Standard errors in parentheses.

Table 6: Household investment in soil and water conservation (SW)

| | Coefficient (Std error) | | | Marginal effects | | |
|---|---|---|---|---|---|---|
| | Trust | Trustworthiness | Observables | Trust | Trust–worthiness | Obser–vables |
| Constant | 1.05 (0.97) | 1.48 (3.15) | 0.87 (1.94) | | | |
| Kosgi# | –1.39 (0.98) | –1.30 (0.69)* | –1.27(0.74)* | | –0.48 | –0.47 |
| Kalyanpur# | –0.75 (0.93) | –0.65 (0.60) | –0.69 (0.66) | | | |
| Average amount sent (Rs) | 0.01 (0.04) | | | | | |
| Average share returned (%) | | –1.49 (11.55) | | | | |
| Homogeneity community (%) | | | 0.30 (2.31) | | | |
| Participant majority caste# | –0.34 (0.49) | –0.34 (0.49) | –0.34 (0.49) | | | |
| Participant minority higher caste# | –0.59 (0.79) | –0.59 (0.79) | –0.59 (0.79) | | | |
| WSD implementation by NGO/maintenance fund # | –0.51 (0.56) | –0.39 (0.77) | –0.51 (0.59) | | | |
| Income per capita (‘000) | 0.15 (0.07)** | 0.15 (0.07)** | 0.15 (0.07)** | 0.06 | 0.06 | 0.06 |
| Total landholding (acres) | 0.05 (0.04) | 0.05 (0.04) | 0.05 (0.04) | | | |
| Access to irrigation # | –0.66 (0.36)* | –0.66 (0.36)* | –0.66 (0.36)* | –0.23 | –0.23 | –0.23 |
| Black soil # | –0.23 (0.40) | –0.23 (0.40) | –0.23 (0.40) | | | |
| Influence decision making# | 0.10 (0.34) | 0.10 (0.34) | 0.10 (0.34) | | | |
| No. of observations | 92 | 92 | 92 | | | |
| Log likelihood | –49.6 | –49.6 | –49.6 | | | |
| LR chi2 (df) | 27.2 (11) | 27.2 (11) | 27.2 (11) | | | |
| Pseudo R2 | 0.21 | 0.21 | 0.21 | | | |

# dummy variable; *90% significant ** 95% significant *** 99% significant. Standard errors in parentheses.

Table 7: Household contribution to soil and water conservation maintenance (OM)

| | Coefficient (Std error) | | | Marginal effects | | |
|---|---|---|---|---|---|---|
| | Trust | Trustworthiness | Observables | Trust | Trust–worthiness | Obser–vables |
| Constant | –1.14 (1.27) | 6.97 (4.13)* | –4.43 (2.73) | | | |
| Kosgi# | –4.76 (1.43)*** | –3.14 (0.95)*** | –2.44 (0.96)** | –0.94 | –0.82 | –0.73 |
| Kalyanpur# | –3.62 (1.23)*** | –1.77 (0.73)** | –2.58 (0.83)*** | –0.91 | –0.61 | –0.78 |
| Average amount sent | 0.10 (0.05)* | | | 0.04 | | |
| Average share returned | | –27.78 (15.79)* | | | –10.99 | |
| Homogeneity community | | | 5.55 (3.15)* | | | 2.19 |
| Participant majority caste# | 1.27 (0.72)* | 1.27 (0.72)* | 1.27 (0.72)* | 0.42 | 0.42 | 0.42 |
| Participant minority higher caste# | –0.62 (2.41) | –0.62 (2.41) | –0.62 (2.41) | | | |
| WSD implementation by NGO/maintenance fund # | –1.77 (0.75)** | 0.48 (0.97) | –1.90 (0.80)** | –0.61 | | –0.64 |
| Income per capita (‘000) | 0.14 (0.07)** | 0.14 (0.07)** | 0.14 (0.07)** | 0.06 | 0.06 | 0.06 |
| Total landholding (acres) | –0.04 (0.04) | –0.04 (0.04) | –0.04 (0.04) | | | |
| Access to irrigation # | 0.70 (0.44) | 0.70 (0.44) | 0.70 (0.44) | | | |
| Black soil # | 0.72 (0.56) | 0.72 (0.56) | 0.72 (0.56) | | | |
| Influence decision making# | 1.46 (0.45)*** | 1.46 (0.45)*** | 1.46 (0.45)*** | 0.53 | 0.53 | 0.53 |
| No. of observations | 92 | 92 | 92 | | | |
| Log likelihood | –32.5 | –32.5 | –32.5 | | | |
| LR chi2 (df) | 60.9 (11) | 60.9 (11) | 60.9 (11) | | | |
| Pseudo R2 | 0.48 | 0.48 | 0.48 | | | |

# dummy variable; *90% significant ** 95% significant *** 99% significant. Standard errors in parentheses

Figure 1: Distribution investor behavior per village

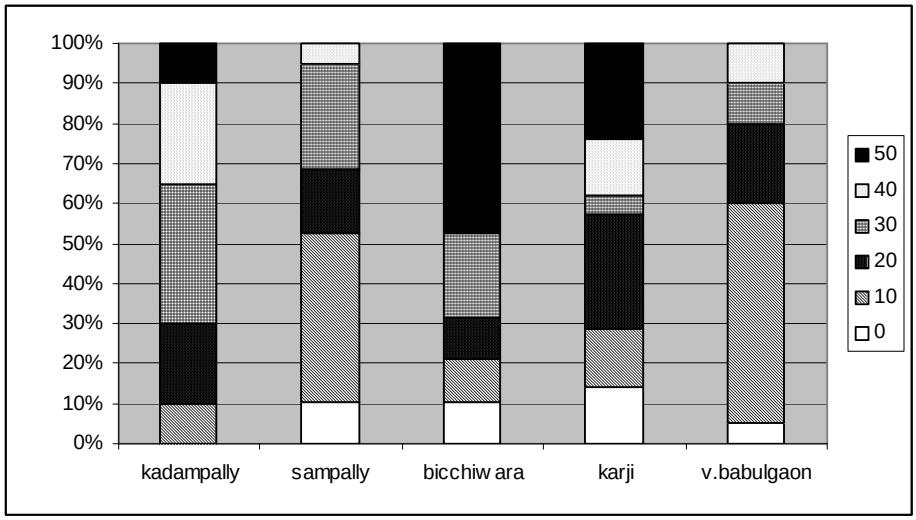
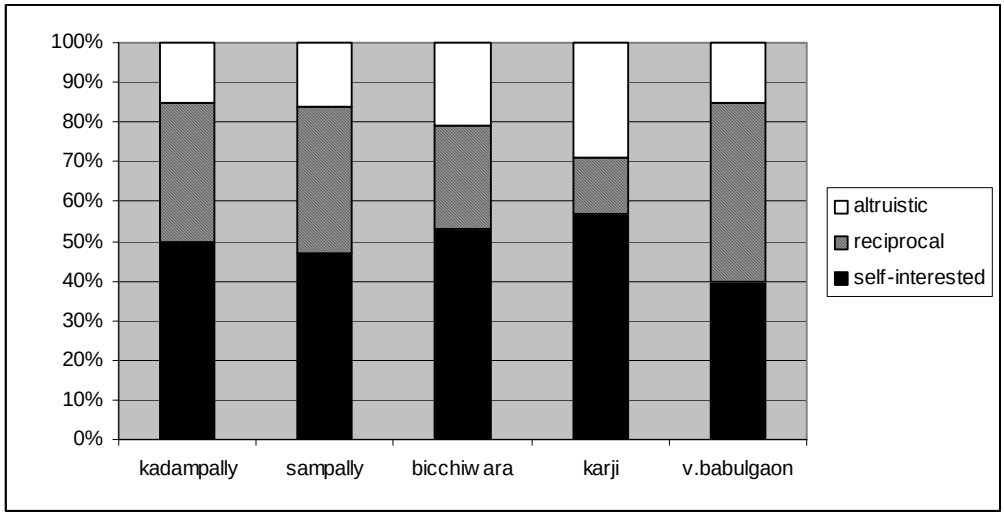



Figure 2: Distribution trustee behavior per village



## Appendix 1 Instructions (NOT FOR PUBLICATION, FOR REFEREES ONLY)

### *Day 1: Instruction day*

Welcome to all of you. Today we will give instructions about a game you will play tomorrow. In the game you may earn some money. There are no winners and losers in the game, but how much you earn will depend on how you play the game. Today, you will not earn any money. However, only the people that attend the full session today are allowed to play for real money tomorrow. The objective of the game is purely research and the money for the game comes from Europe, from a Dutch university. Seva Mandir/WOTR has no role in this event, they are only facilitating.

Before I explain the game to you, I would like to introduce the research team. My name is Jetske Bouma. I come from Holland and I work at the International Water Management Institute in Hyderabad. My translator you all know, his name is Pradhumn Jagtap and he has been doing research for me in this area for the last 3 months. My other two assistants are Bhim Raj Suthar and Srinivas Rao. They also form part of the research team, and are based in Rajasthan and Andhra Pradesh.

Now I would like to explain the game to you. Tomorrow, this group will be divided into two groups. In the one group, everybody will be assigned the role of PLAYER 1 in the other group everybody will be assigned the role of PLAYER 2. You will play the game with somebody from the other group. So, if you are assigned the role of PLAYER 1 you will play with somebody in the other group who has been assigned the role of PLAYER 2. If you are PLAYER 2, you will play the game with somebody in the other group who has been assigned the role of PLAYER 1. To make sure you do not know with whom you play the game, the person you play the game with will be in another room. So tomorrow, one group will stay in this hall, another group will go to another room. You will not learn who the person is with whom you play the game and the other person will not learn your identity either. Nobody will know with whom you play the game.

To both players we give Rs 50. Now suppose you are assigned the role of PLAYER 1. That means you have to start the game and decide how much of the Rs 50 you send to the person in the other room. All the money you send to the person in the other room, we will triple. All the money you keep is for yourself. So, if you send Rs 10, the person in the other group receives Rs 30 and you keep Rs 40.

If you send Rs 20, the person in the other group receives Rs 60, and you keep Rs 30.

If you send Rs 30, the person in the other group receives Rs 90, and you keep Rs 20.

If you send Rs 40, the person in the other group receives Rs 120, and you keep Rs 10.

If you send Rs 50, the person in the other group receives Rs 150, and you keep Rs 0.

You also have the option to send nothing and keep the Rs 50 to yourself. The person in the other group then receives nothing. (all on the blackboard)

Now, the second part of the game starts. Suppose you are PLAYER 2. That means you receive money that has been sent to you by somebody in the other group. You have to decide how much of this money you want to send back to PLAYER 1.
Suppose Player 1 has sent you 10 Rs. That amount is tripled, and so you receive Rs 30. Of these Rs 30 you can send back 0, 10, 20 or 30 Rs.
Suppose Player 1 has sent you 20 RS. That means that you receive Rs 60. Of these RS 60 you can send back 0,10,20…60 Rs.
Suppose Player 1 has sent you 30 Rs. That means that you receive Rs 90. Of these Rs 90 you can send back 0, 10, 20….90 Rs.
Suppose PLAYER 1 has sent you 40 Rs. That means you receive Rs 120. Of these Rs 120 you can send back 0, 10, 20…120 Rs.
Suppose PLAYER 1 has sent you 50 Rs. That means that you receive Rs 150. Of these Rs 150, you can send back 0, 10,20….150 Rs.
PLAYER 1 can also decide to send you nothing, which means you cannot send anything back.

Your total earnings if you are assigned the role of PLAYER 1 then equals the amount of money you started out with (Rs 50), minus the amount of money you decided to send to PLAYER 2, plus the amount of money PLAYER 2 decided to send back to you.
Your total earnings if your are assigned the role of PLAYER 2 equals the amount you started out with (Rs 50), plus the amount of money you received from PLAYER 1, minus the amount of money you decided to send to PLAYER 1.
If PLAYER 1 sends nothing, PLAYER 2 is not able to send anything back, so from the game both players earn Rs 50.
If PLAYER 1 sends 10 Rs and PLAYER 2 sends Rs 10 back, PLAYER 1 earns Rs 50 and PLAYER 2 Rs 70 ETC. (all on the blackboard)

To make sure you understand the game, we will now show with paper money how the game is played. (On one side of the room PLAYER 1 and on the other side of the room PLAYER 2. Both receive an envelope, PLAYER 1 a colored envelope, PLAYER 2 a brown envelope. Both players show there is Rs 50 inside. PLAYER 1 takes money from the colored envelope and gives the rest to the experimenter. The experimenter walks to the middle, takes it out of the envelope, triples it and puts it in a different envelope. This envelope he brings to PLAYER 2. PLAYER 2 opens the envelope and takes out what he wants to keep for himself. The experimenter collects the colored envelope with the remaining money. The experimenter takes it out of the envelope, puts it in the original envelope and

gives it back to PLAYER 1. PLAYER 1 and PLAYER 2 now both show how much money they have). REPEAT 6 times for the options PLAYER 1 has (0,10,20,30,40,50)

Tomorrow we will test each of you individually to see whether you understand the game. Only if you understand the game are you allowed to play. If you have any doubts, please clear them now.

This is the end of the instruction day. Tomorrow we will play for real money. Please come your self and come on time. If you don't come yourself, the person you sent will not be allowed to play the game. Only if you come yourself and if you are on time, are you allowed to play the game.

***Day 2: Implementation of the game***

WELCOME to all of you. Today we will play the game. We would like you to take the game seriously and we would like to ask you not to talk to other participants during the entire event. Today we will play for real money. You might earn a substantial amount of money, but it is also possible that you do not. There are no winners and losers in this game but how much you earn, will depend on how you play the game. To make sure none of you goes home empty handed, we will give each one of you Rs 50 at the end of the game. This is additional to what you earn in the game. However, if during the game you talk to other participants or do not follow the rules in any other way, we will not pay the Rs 50 at the end.

To you refresh your memory, I will now recapture the instructions we gave yesterday. This group will be divided into two groups. Some of you will stay in this room, some of you will go to another room. The game you play will be with somebody from the other group (in the other room). You will not learn whom the other person is with whom you play the game, and neither will the other person know that he/she has played the game with you.

All participants, no matter what role they play, receive Rs 50.If you are assigned the role of PLAYER 1, you start the game by deciding how much money you send to PLAYER 2. You leave the amount that you want to send to PLAYER 2 in the colored envelope, and you take out the amount you want to keep yourself. We collect the envelope and triple the money we find inside. This amount we give to PLAYER 2. If you are assigned the role of PLAYER 2, you now receive the colored envelope, with inside the money somebody has sent you from the other room. You take out of the colored envelope the money you want to keep. The money you leave inside the colored envelope will go back to PLAYER 1. We collect the envelope and bring it back to PLAYER 1.

Now I would like you to come forward and pick a piece of carton from this box. It is either marked orange or green. My assistants will ask you to show the carton to them, so that they can register it.

Please do not show to the other participants what number or letter you have. Those of you with a letter on the carton will form the red group, those of you with a number are the green group. The people who draw an orange card will stay here, those who draw a green card will go to another room. Are there any questions or doubts? If not, I would like to ask you one by one to come forward and draw a carton.

**Instructions 1: Orange (Green) group**

Welcome to the orange (Green) group. I am the facilitator of this group and I request you to follow my instructions. Please do not communicate during the game. Anybody who does communicate during the game will be punished by not receiving Rs 50 at the end.

First, we want you to pick a carton from this box (orange (green) box 1). On the carton there is a letter (number). We will ask you to show us this letter (number), so that we can register it. Please don't show your letter (number) to any of the other participants: it is your personal letter (number).

Now, all the orange (green) people have been assigned to play the role of PLAYER 1. We will again explain to you what this means. We will give you two envelopes. One envelope is brown and unmarked. It is empty and you can use it for the money you want to keep for yourself. So, all money that you put in the brown envelope you keep for certain. The second envelope is orange (green) and is marked with a **letter (number).** The mark on the envelope matches with your personal letter (number) on the carton. When we give you the orange (green) envelope, please check if it has your personal letter (number) or not.

The orange (green) envelope contains Rs 50 and this is the money you may send to PLAYER 2. Any amount you decide to send to PLAYER 2 we will triple. So,
If you leave Rs 10 in the orange(green) envelope, PLAYER 2 will receive Rs 30, and you keep Rs 40.
If you leave Rs 20 in the orange(green) envelope, PLAYER 2 will receive Rs 60, and you keep Rs 30.
If you leave Rs 30 in the orange(green) envelope, PLAYER 2 will receive Rs 90, and you keep Rs 20.
If you leave Rs 40 in the orange(green) envelope, PLAYER 2 will receive Rs 120 and you keep Rs 10.
If you sent Rs 50 in the orange(green) envelope, PLAYER 2 will receive Rs 150, and you keep Rs 0.
If you decide to send nothing, PLAYER 2 receives nothing and cannot sent anything back.

PLAYER 2 might decide to send money back to you. The money you earn at the end of the game is the money you have kept to yourself plus the money PLAYER 2 has sent back to you.
For example, if you send Rs 10 and PLAYER 2 sends back Rs 20, you earn Rs 40 + Rs 20= Rs 60.
For example, if you send Rs 40 and PLAYER 2 sends back Rs 60 you earn Rs 10 + Rs 60 = Rs 70.

For example, if you send Rs 40 and PLAYER 2 sends back nothing you earn Rs 10 + Rs 0 = Rs 10.
As promised, we add Rs 50 to the amount of money you earn in the game IF you do not talk to other participants during the event.

We will now ask you one by one to come forward and draw a carton from the orange (green) box. Show us the carton and check if the orange (green) envelope we give you has the same letter (number) on it. Then, take out of the orange (green) envelope the money you want to keep for yourself. This money you put in the brown envelope, your personal 'wallet'. Don't show others the money you have in the brown envelope, this is your personal money. The money you leave in the orange (green) envelope will be tripled by us and sent to the person in the other group. If you are done, give the closed orange (green) envelope to my assistant.

Before we start the game, my assistant and me will ask each of you individually a few questions to check your understanding of the game. Only if you understand the game you will be allowed to participate. Before my assistant and me check your understanding, are there any questions?

Then I would like you to come forward one by one so that we can ask you some questions.
(While asking the questions, write the examples down on paper)

- If, out of the Rs 50 in the orange (green) envelope you decide to send Rs30 to PLAYER 2, how much do you have left yourself [Answer: Rs 20]
- If you sent Rs 30 to PLAYER 2, how much does PLAYER 2 receive? [Answer: Rs 90}
- If PLAYER 2 receives Rs 90, what is the maximum amount of money he/she can send back to you? And what is the minimum amount? [Rs90, or Rs0]
- Suppose that you sent PLAYER 2 Rs 30 and that PLAYER 2 decides to send Rs 50 back to you. What are your total earnings? [You: Rs 20 + Rs 50 = Rs 70].

Now, we will start the game. If you have any questions during the game, please raise your hand and we will come to you. Are there any questions now? If not, let us start the game.

**Instructions 2: Orange (green) group**

So, we have now completed the first part of the game. In fact, the participants in the other room also played the role of PLAYER 1. That means that now you will play the role of PLAYER 2.

As PLAYER 2 you will receive a green (orange) envelope from somebody in the other group. In this envelope you will find the money somebody from the other group has sent you. You have to decide how much of this money you want to send back to that person in the other group. The money you

take out of the green (orange) envelope you keep for yourself. The money you leave in the green (orange) envelope will go back to the person who sent you the money from the other group.

To decide which envelope you receive, we will ask you to pick a carton from this box (orange (green) box 2). On this carton a number (letter) is written. This number (letter) belongs to somebody in the other group. The money you receive will be from that person. Any amount you decide to send back, will go to the same person in the other group. This will most probably not be the same person you sent money to in the first part of this game: it will be a different person.
Now, we will ask you one by one to come forward and pick a piece of carton from the box. You have to give this carton to us and we will give you the corresponding envelope. Please open the green (orange) envelope and take out the amount of money that you wish to keep for yourself. This money you put in your own brown envelope. The money you want to send back you leave in the green (orange) envelope. If you are finished, give the closed green (orange) envelope back to my assistant.

We will give the green (orange) envelope back to the person to whom it belongs in the other group. At the same time, we collect the orange (green) envelopes you sent, from the persons who received it in the other group. We then give you back your own orange (green) envelope. The money you find inside is yours.

Are there any questions? If not, let us continue with the game.

**Instructions 3**

The game is now finished and the money you hold is yours. Please do not tell other people how much money you have earned, this is personal information you should keep to yourself.

Thank you