Fairness Matters in Agent Relationships: A Comparison between Ultimatum Games, Dictator Games and Principal-Agent Problems

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Gustafsson, M., Gärling T., & Fujii, S., Fairness Matters in Agent Relationships: A Comparison between Ultimatum Games, Dictator Games and Principal-Agent Problems. Göteborg Psychological Reports, 2002, 32, No. 7. In agent relationships decisions made by a principal are assumed to be guided by self-interest and risk attitude. A number of studies has however found strong evidence for the role of fairness in the structurally similar ultimatum game. In two experiments we showed that fairness has an even stronger effect in principal-agent problems. In Experiment 1 fairness was also found to be moderated by whether the principal-agent relation is hierarchical or not. Another moderating factor demonstrated in Experiment 2 was whether outcome probabilities represent ability or task difficulty.

**Keywords:** Principal-agent relations, ultimatum game, dictator game, fairness

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In this article our focus is on decision makers (the principal) who decide about incentives or disincentives with the aim of changing the behavior of people (the agent). From the perspective of the normative principal-agent theory (e.g., Arrow, 1970; Eisenhardt, 1989; Wilson, 1968), the principal must find the agent’s reservation level of utility or disutility so that an offer can be made that is more attractive than that level. In a descriptive approach, an issue that needs to be investigated is the extent to which the principal is able to appropriately motivate the agent under different circumstances. We term this a principal-agent problem. Although, in a strict definition of principal-agent relationship, the agent has a choice of not performing in accordance with the contract to which he or she has agreed, we specify the probability that he or she will actually do so. In our case we assume that the probability for the agent to act in the manner the principal wishes increases with the size of the incentive offered, given that the outcome, for both principal and agent, is dependent on the decision of the agent. Thus, the type of principal-agent problem studied in the present research is one in where there exists no uncertainty on the behalf of the principal about whether the agent actually performs or not performs the task for which he or she is offered an incentive. As we will show, in this type of principal-agent problem, the principal is influenced by factors that are in conflict with effective allocations, at least in a narrow sense. In a complementary approach, Heath (1999) shows that the principal often has inaccurate perceptions of what factors motivate the agent.

An illustrative example of a principal-agent problem is how much extra salary an employer should offer employees to spur sufficient effort to finish an amount of work in time. Although we will use different variants of this scenario in our experiments to be reported below, in many respects it is similar to the ultimatum game (Güth, Schmittberger, & Schwarze, 1982). In the one-period ultimatum game, one player, the allocator, offers another player, the receiver, a share of a sum of money. If the receiver accepts the offer, he or she will obtain the offered share whereas the allocator will keep the remaining amount for himself or herself. However, if the receiver does not accept the offer, none of the players obtain anything. The prediction from game theory (Roth, 1995) that the allocator only needs to offer the receiver the smallest possible positive amount is generally found to be in error. There appears to be two reasons for this: (1) The allocator believes that the receiver will not accept a very small offer - the cost for punishing the allocator for being greedy is then not large enough; (2) The allocator is genuinely concerned about the welfare of the other player. In the latter case the allocator may however not act in a purely altruistic manner offering the receiver 100%. Instead, he or she is likely to make an offer considered to be fair, 50% or less if this can be justified on fairness grounds (Roth, 1995).

The frequent observation in studies of the ultimatum game that allocators propose more generous splits than game theory predicts has been taken as support for both hypotheses described above. A comparison of the ultimatum game with the so-called dictator game (Kahneman et al., 1986; Forsythe et al., 1994; Güth & Huck, 1997) provides a straightforward test that distinguishes between them. In the dictator game, just as in the ultimatum game, the allocator decides on how to split the sum of money. However, the receiver in the dictator game has no veto power, which means that whatever the allocator proposes will
be accepted. Findings from the dictator game suggest that the absence of veto power has some effect on the allocation. Allocators offer smaller shares, 20-30% compared to 40-50% in the ultimatum game, thus corroborating that strategic self-interested reasoning is involved. Still, the substantial offers that are made even with no risk of loss can be interpreted as a genuine concern for fairness.

If the results from ultimatum and dictator games showing an apparent consideration for fairness can be generalized to the type of principal-agent problems we conceive of, it is unlikely that the principal will make decisions with an effective outcome. The reason for this is that many proposed measures that are supposed to motivate the agent also include a fairness aspect.

We propose that conflicts between effectiveness and fairness are prevalent in many principal-agent relationships in the society, from the government through municipalities all the way down to organizations and firms. It is particularly harmful if the problems that economic incentives/sanctions are aimed at solving are serious threats to the future welfare of all human beings. The big problems of our time, the damage to the biosphere from pollution of air, pollution and overuse of water, and overuse of energy and material, are clearly of this magnitude (Hardin, 1968). At the same time we witness an inability of politicians to reach agreements about solutions.

The aim of two experiments reported in this article is to show that fairness matters in principal-agent problems. In fact, we hypothesize a stronger influence of fairness matters than in the one-period ultimatum game. The reason is that the principal-agent relation is in general less neutral than the relation between “two unknown persons who are unlikely to meet in the future”, which is standard in the ultimatum game. To test this hypothesis, in Experiment 1 a structurally identical ultimatum game is compared to two principal-agent problems. Also, in principal-agent problems the role of fairness may differ depending on different factors. One such factor investigated in both experiments is the hierarchical-role relations between the principal and agent. We hypothesize that the role of fairness will increase, the less hierarchical the role relations are. In contrast to the standard ultimatum and dictator games, in the present experiments the probability that the receiver (agent) accepts the offer is specified. In this way strategic or social uncertainty is eliminated. In Experiment 2 we investigate an effect of whether the specified probabilities represent some characteristic of the other person (ability) rather than situational factors (task difficulty). We hypothesize that fairness is related to ability.

**Experiment 1**

To investigate the extent to which fairness influences a principal’s allocation decisions, we devised a scenario where the participants in the roles of employer or employee offered an employee a sum of money for finishing a work task on time. In another condition the same allocation decisions were made in a one-period ultimatum game (Güth et al., 1982). As noted above, somewhat different to the standard ultimatum game, both conditions included information about the probability that the receiver would accept the offer as a function of the
amount offered. Our hypothesis is that participants will allocate more to the receiver (agent) in the principal-agent problems than in the ultimatum game. We base this hypothesis on the assumption that fairness plays a more important role in principal-agent problems where the receiver both accepts or rejects the offer, and does the job, and thus should be more deserving of a larger share than in the ultimatum game where the receiver does nothing more than accept or reject the offer.

The reason for including two different types of role relations, employer-employee or employee-employee, was to test whether this affects the emphasis on fairness in principal-agent problems. Previous research has indicated that hierarchical-role relations may affect resource sharing. For instance, Samuelson and Allison (1994) found that participants assigned to the role of supervisor allocated a larger share to themselves than those assigned a subordinate role. Thus, the label supervisor seemed to be perceived by participants as implying special privileges and thus resulting in smaller offers to “subordinates.” Similar effects were obtained by Hoffman and Spitzer (1985) who showed that participants who had “earned the right” to be allocator on the basis of the outcome of a preceding unrelated game offered less money. Apparently, some types of information and role labels lead to more self-interested allocation decisions. Thus, we predicted that participants assigned the role of employer would allocate less to the employee than those assigned the role of a fellow employee.

Method

Participants

Twenty male and 40 female undergraduates at Göteborg University volunteered to participate. Their mean age was 29.3 years (SD=6.9).

Materials and Procedure

All participants obtained a booklet describing the different tasks. An equal number of participants was assigned to either of three experimental conditions. In the employer-employee principal-agent problem participants were told to imagine that they were an employer whose task was to pay a maximum bonus of either Sw. Cr. 100,000 or 200,0001 (a Sw. Cr. is about US$ 0.10) to an employee for finishing a work task on time. The participant did not need to offer the whole sum to the employee but could keep what was left. If the employee did not finish the work task on time, no bonus would however be paid to any of them.

In the employee-employee principal-agent problem everything was the same except that participants were told to imagine that they were a fellow employee who had been authorized to make the decision to allocate the bonus.

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1 The reason for including the higher bonus was solely for the reason of obtaining a replicate.
In the ultimatum game participants were assigned the role of allocator. Their task was to decide how to split Sw. Cr. 100,000 or 200,000 between themselves and another unknown person (the receiver). All other things were identical to the other two conditions.

In all conditions decisions were made for different information about how the offered percentage share was related to the probability that the job was finished on time (the employer-employee and the employee-employee principal-agent problems) or that the offered share was accepted (the ultimatum game). The probabilities (expressed in percentages) were linear functions of the offered shares (varying from 0% to 100%). Five different functions were presented in a table on the same page, one page for Sw. Cr. 100,000 and another one for Sw. Cr. 200,000 in counterbalanced order. A share corresponding to each function was selected by the participants. The functions always started at the origin (0% offered share corresponding to a zero probability of a return). They differed with respect to for which share (20%, 40%, 60%, 80%, or 100%) the probability of return reached 1.0 (risk elimination).

The booklets were administered after a lecture and took approximately 15 minutes to complete.

Results and Discussion

Figure 1 plots mean offered shares for each function. The results are averaged across the two amounts to be split since no important differences were discernable ($F(1,57)<1$). Apparently, in all conditions participants on average neither selected the same share or the same probability across all functions. Instead they appeared to attempt to eliminate risk. Suggesting that they did not want to offer a too low share however, the lowest share was somewhat higher than the minimal share that eliminated risk. When risk elimination required that participants offered an increasingly higher share, they became risk seeking. The tendency to not increase the offered share was more pronounced in the ultimatum game than in the principal-agent problems which however did not differ from each other. The average offered shares were 43.5% in the ultimatum game, 50.4% in the employee-employee principal-agent problem, and 50.2% in the employer-employee principal-agent problem. Confirming these observations\(^2\), a 3 (condition) by 5 (payoff function) analysis of variance (ANOVA) with repeated measures on the last factor yielded a significant main effect of payoff function, $F(1.75, 99.98) = 125.06, p<.001, MS_e = 76.67$, as well as a significant interaction between condition and payoff function, $F(3.51, 99.98) = 2.38, p<.05, MS_e = 76.67$ (Greenhouse-Geisser correction). Post hoc $t$-tests at $p=.05$ showed that in all conditions there were significant decreasing linear trends that were reliably steeper for the ultimatum game than for the principal-agent problems. Also, the

\(^2\) We identified 8 participants who consistently offered 50% regardless of function and 3 participants who consistently eliminated risk. Excluding these participants had only a minor effect on the average results.
mean share in the ultimatum game differed reliably from the mean share in the principal-agent problems. The latter did not differ reliably in neither slopes or mean shares.

As expected, the results thus suggested that fairness is more important in principal-agent problems than in the standard ultimatum game. Even though the three scenarios were structurally identical, higher offers were made in the principal-agent problems than in the ultimatum game. Since risk of loss was specified, the difference cannot be related to differences in social or strategic uncertainty. Still, the different scenarios may induce different risk attitudes although it is difficult to conceive of a rationale for this.

Figure 1. Mean offered shares in each condition for each function.
Experiment 2

Experiment 1 demonstrated that fairness had a stronger influence on allocation decisions in a principal-agent problem than in the standard ultimatum game. In Experiment 2 we investigate another factor that is expected to influence the allocation decisions in the principal-agent problem that we devised, namely what the stated probabilities represent. For instance, Ruffle (1998) found that allocators in the ultimatum game made higher offers to skilled receivers who had increased the sum of money to be divided. In a similar manner we compare the effects of informing the principal that the stated probabilities either refer to the agent’s ability or to task difficulty. We hypothesize that probabilities that refer to ability justify placing weight on fairness. In contrast, participants may ignore probabilities referring to task difficulty.

A positive or negative risk attitude may however confound the expected effect in an ultimatum game. For this reason, we instead devised a principal-agent problem analogous to the dictator game. The allocators (in the role of employer or employee) were asked to split the sum of money between themselves and another person (an employee). They were informed about the probability that the other person would finish the work task on time. This probability was however independent of how much they offered.

We again investigate whether a hierarchical-role (employer-employee) relation would result in offering a smaller share than a non-hierarchical role (employer-employer) relation. A clear effect was not established in Experiment 1. Because the tasks in Experiment 2 included less information to process an effect may be easier to discover.

Method

Participants

Another 50 male and 30 female undergraduates at Göteborg University volunteered to participate. Their mean age was 25.3 years (SD=3.9).

Materials and Procedure

An equal number of participants were assigned to either of four experimental conditions. The same employer-employee and employee-employee condition as in Experiment 1 were used with the following changes. Participants were in different scenarios presented with the probabilities 0.25, 0.50, or 0.75 (expressed in percent) that the employee would complete the work on time. Half

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3 Note that this does not technically qualify as a principal-agent problem in that the decisions made by do not affect the probability that the outcome is realized.
of the participants in the employer-employee and the employee-employee conditions were told that these probabilities represented differences in the employee’s ability, the other half of the participants that they reflected differences in task difficulty. The instructions furthermore stressed that the amount of money they offered the employee did not influence the probability of the work being completed on time. They were also told that none would receive anything if the work was not completed on time.

The booklets were administered after a lecture. The scenarios with different probabilities were presented on the same page, one set for Sw. Cr. 100,000 to be split and another set for Sw. Cr. 200,000 to be split. The order between the sets was counterbalanced. Completing the booklet took about 15 minutes.

## Results and Discussion

The mean percent offered shares are given in Table 1. As may be seen, the percentages increase with increasing probability when reflecting the employee’s skill but not when reflecting task difficulty. Furthermore, it is evident that a higher percentage is offered in the employee-employee condition than in the employer-employee condition. These observations were confirmed by a 2 (role) by 2 (source of probability) by 3 (probability) by 2 (replicate) ANOVA with repeated measures on the two last factors yielding significant main effects of role, $F(1,77) = 5.40, p<.023, MSe = 2,653.3$, of probability, $F(1.58,121.72) = 14.56, p<.001, MSe = 246.78$, and of the interaction between probability and source of probability, $F(1.58,121.72) = 11.90, p<.001, MSe = 246.78$ (Greenhouse-Geisser correction). Post hoc $t$-tests at $p=.05$ showed that only probabilities representing skill had a significant effect on the offered shares.

<table>
<thead>
<tr>
<th>Type of role relationship and source of probability</th>
<th>Employee-employee</th>
<th>Employer-employee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>Task difficulty</td>
<td>Skill</td>
</tr>
<tr>
<td>0.25</td>
<td>36.1</td>
<td>25.6</td>
</tr>
<tr>
<td>0.50</td>
<td>37.9</td>
<td>38.2</td>
</tr>
<tr>
<td>0.75</td>
<td>37.1</td>
<td>44.2</td>
</tr>
</tbody>
</table>

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Table 1

*Mean percent offered share.*
The results thus confirmed that attributing the probability of a positive outcome to skill rather than to task difficulty moderated the extent to which fairness is taken into account. Even though the probability made no difference for the outcome, participants in both the employer-employee and employee-employee conditions were more willing to reward the other employee when the probabilities referred to ability. In contrast to Experiment 1, the expected effect of the hierarchical-role relation was observed in that participants in the role of employers offered smaller shares than did participants in the role of another employee.

**General Discussion**

A descriptive theoretical approach to principal-agent problems clearly must consider that fairness affects the principal’s allocation decisions. This was substantiated in both experiments although most impressively in Experiment 2 where allocation decisions varied despite that participants knew that it did not change the probability of a positive outcome. The results also demonstrate that hierarchical-role relations affect allocation decisions in Experiment 2. These latter results extend previous findings of hierarchical-role effects in resource allocation (e.g., Allison & Messick, 1990; Samuelson & Allison). A possible explanation is that the degree of hierarchical relation induces different perceptions of property rights and thereby contribute to the effect (e.g. Fahr & Irlenbusch, 2000). Thus, our results add to the generality of this effect, stressing that the framing of the same payoff structure is important.

The results of Experiment 1 also yielded an expected difference between the principal-agent problems and the structurally identical ultimatum game in that higher offers were observed in the former than in the latter. This difference may be related to another aspect of the role relationships, either that individuals identify themselves with the same group (e.g., Kramer & Brewer, 1984) or that they are unknown to each other. These results are similar to those of Eckel and Grossman (1996) who found that allocators in the dictator game were more generous to known receivers (such as charity organizations) than to unknown receivers. They are also consistent with the hypothesis of "manners" in social interaction (e.g. Camerer & Thaler, 1995). Research by Hoffman et al. (1994, 1996) found support for this hypothesis in that situations described in a social rather than an anonymous context trigger less self-interested behavior and more concern for the other party.

It may furthermore be noted that the offered (fair) share in Experiment 2 was on average much lower than what appeared to be a fair share in Experiment 1 (31.5% as compared to 48.1%). Since Experiment 2 employed an analogy to the dictator game, this difference replicates the difference observed in previous research between the ultimatum and dictator games suggesting an effect of the veto power in the ultimatum game (e.g., Kahneman et al., 1986).

From a strict economic viewpoint, fairness should not matter. However, previous research as well as the present research shows that it does to varying
degrees depending on the circumstances. In terms of maintaining good relations and avoid unfair distributions of resources among individuals, fairness considerations may sometimes be beneficial (e.g., Deutsch, 1985), for instance, in work organizations depending on what goals are emphasized (Howard, 1999). On the other hand, in solving environmental problems, the adverse long-term consequences for everyone necessitates that fairness is downplayed. The question that remains to be addressed is whether it really is? For instance, in a field study of municipality political decision making about road pricing (Johansson et al., 2002), it was found that fairness (avoiding to hurt lower income groups) was in conflict with the environmental goal of reducing car use. It could be argued that other means than economic incentives and sanctions (e.g., legislation) should instead be chosen by the principal (the government) in order to ensure cooperation from municipalities. This may however be premature until we understand better the interplay between the different motives of fairness, greed, and efficiency in agent relationships.
References


