Effective equity experiences from an ultimatum experiment

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Abstract

Fairness like other social norms is usually stabilized by punishing norm deviations. Reward uncertainty, however, questions whether norm deviations can be detected and thus punished. By investing in information acquisition, a responder in an ultimatum experiment determines endogenously whether unfair offers are detected and sanctionable. In our experiment a proposer and a responder can distribute among themselves 12 black and 12 white chips where the monetary value of a white chip for the proposer can be rather high ('high payoff mode') or low ('low payoff mode'). The responder can buy information about the proposer's reward type, resulting in commonly known monetary rewards.

According to our results more than half of the responders did not buy reward information (30 out of 55). Buying reward information on average did not help the responder nor did it improve efficiency. Surprisingly, commonly known reward information resulted in a lower share of efficient offers. A possible explanation is that mistrust distracts attention.[1]

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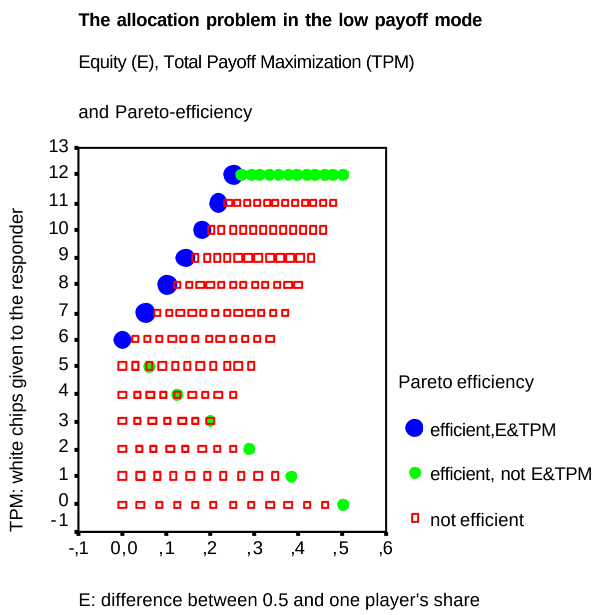
1. Introduction

Equity and efficiency can be conflicting concerns. If partners aim at fair cooperation, they should maximize total monetary reward and split it evenly. However, if side payments are excluded, efficiency and equity can be conflicting since even the most efficient allocation can be very inequitable. In a binary lottery game experiment, *Roth and Malouf* (1979) observed a clear-cut information effect. Bargainers knowing both monetary rewards tended to reach agreement in which the bargainer with the smaller reward obtained a higher winning chance, while bargainers who were uninformed about the other's reward tended to divide winning chances evenly. According to the idea of hierarchically ordered reward standards (*Güth*, 1988, 1994) monetary earnings are equalized only when values are commonly known (i.e., when the superior reward standard of monetary expectations is applicable).
The study of *Roth and Malouf* is concerned with a symmetric bargaining environment. For the asymmetric ultimatum game *(Kagel, Kim, and Moser* (1996) and *Gneezy and Güth* (2004)) the experimental results are less clear-cut. Both studies confirm that in the case of full information proposers claim more than the half of the pie, e.g., the maximal total monetary reward when they have the higher value per chip. But the results differ when proposers have the smaller value per chip. *Kagel, Kim , and Moser* report mean proposals, which are consistent with the equal earnings prediction, but *Gneezy and Güth* observe mean proposals claiming less than half of the pie and conclude that efficiency concerns matter for proposers even when they favor responders.

In our study two stacks (one white, one black) of chips had to be distributed. The white chips had different monetary values for the bargaining partners, whereas black chips yielded the same monetary reward per chip for both partners. Efficiency and equity are compatible when the proposer uses black chips for compensation. Actually, in our experiment 12 black chips and 12 white chips had to be allocated among two parties (X and Y). Both part ies get 100 monetary units (HUF) for one black chip. For one white chip party Y receives 300 and party X either 100 (low payoff mode) or 500 (high payoff mode) monetary units (HUF). Both players always know their own chip's value. X, furthermore, also knows the value of both (black and white) chips for Y. Thus, the proposer can always guarantee efficiency and/or equity. Y, however, does not know the value of a white chip for X, which can be either low or high. By buying reward information, Y can also judge the efficiency and fairness of the proposed allocation. The price of information was 200 HUF. When offering an allocation to Y, X knows whether or not Y has bought information (see *Gehrig, Güth, and Levinsky*, 2003, who refer to this as transparency and compare it experimentally with intransparency). Thus, monetary incentives are commonly known when Y buys reward information.

2. Pareto-efficient allocations

Some proposers might want to maximize the total payoff of both X and Y and to reach equal payoffs, others might want to earn as much as possible, whereas some rare altruists might want to give to the other as much as possible. Independently of the dominating motive, however, the allocation should be Pareto-optimal by giving all white chips to the responder (proposer) in the low (high) payoff mode and compensate by first distributing black chips.
Figure 1 nicely illustrates the problem (for the low payoff mode, but it could be easily visualized for the high payoff mode in a similar manner). All possible offer combinations are listed and characterized. The two dimensions are equity (difference between 0.5 and a player's share) and total payoff maximization (how many white chips are given to the responder). We distinguish between Pareto-efficient (filled dots) and not Pareto-efficient offers (empty squares). Large dots stand for the most equitable Pareto-efficient offers.



Let us take the right-hand bottom dot as a starting point: it stands for the offer "0 white and 0 black chips" and is extremely unfair and inefficient but most favorable for the proposer (if the responder accepts). If we go up step by step along the line outlined by the filled dots, we gradually decrease first X's advantage and then induce a growing disadvantage for X until we reach the right-hand upper dot (12 white and 12 black chips to Y). The curve has two prominent points: one is where we reach the equal distribution (6 white chips and 0 black chips to Y), and the other where the total payoff (12 white chips and 0 black chips to Y) is maximal.

3. Hypotheses

Let us now discuss the likely effect of common reward information on equity and efficiency of allocation proposals and monetary outcomes. Accepting the idea of hierarchically ordered reward standards, we predict equal chip assignments (splitting both piles of chips equally) to be more frequent when the monetary value of chips is not common knowledge.

In our view this is supported by the effect of transparency on efficiency: common knowledge of rewards guarantees common understanding and interpretations. Transparency helps to prevent conflicts due to misunderstandings. *Gehrig, Güth, and Levinsky (2003)* observed higher acceptance rates in an ultimatum experiment with a priori unknown outside options when responders noticed whether proposers had acquired information about the respondents' outside options (compared to when responders did not know about investments in information or when not investing).
In our study a proposer whose partner does not invest might rely on primitive fairness norms (equal split of chips) since an equal split does not reveal greed unambiguously. More specifically, we want to test the following hypotheses:

H1: Efficiency

There are more Pareto-efficient offers when the responder asks for payoff information.

H2: Equity

There are more equitable offers when the responder asks for payoff information.

Furthermore, we are also interested in how many proposers in low payoff mode claim equal earnings or less than half of the pie. When there is only one kind of commodity with competing reward standards, equity and efficiency are fully competing. The standard reward (black chips) might question the results of *Kagel et al. (1996*) and *Güth and Gneezy* (2004). Naturally, we are also interested in whether responders invest in reward information and whether such investments pay both for the responder personally and also in terms of total monetary earnings.

In the case of private information - here in the form that only the proposer is aware of all chip values - investing in information acquisition depends, of course, on the prior probabilities. If these are very biased, one had better not invest since one knows what to expect anyhow. If information acquisition is rather frequent, reliable or fair individuals fare better than those trying to exploit or cheat; otherwise this is reversed. In their (indirect) evolutionary analysis, *Güth and Kliemt* (2000) show that this may imply two evolutionarily stable population compositions, a monomorphic one with only exploiting, here unfair, types, and a bimorphic population consisting both of fair and unfair types. Here we do not analyze how the population composition may change but rather whether the precondition for a bimorphism, namely that individuals/people in information acquisition, is fulfilled/ met or not.

4. Experimental procedure

We collected the data in the period November 2003 through January 2004. Altogether 110 participants of the University of Debrecen (Hungary) with different backgrounds took part (voluntarily) in six sessions. A session lasted on average one and a half hours. Participants earned on average 3000 HUF including a 500 HUF participation fee. We assigned to the participants randomly the role of proposer (X) and responder (Y).First they read the instructions carefully. After the instructions participants had to calculate the earnings for some hypothetical offers for both payoff modes. Questions were answered privately, and results corrected privately as well. This phase of the experiment lasted approx. 40 minutes.
The responders then decided whether to buy payoff information or not. We informed proposers how their partners had decided. Then proposers chose two offers: one for the case of low, and another for the case of high payoff mode.
Afterwards the experimenter determined by lot whether proposers with odd code numbers or with even code numbers were in the high payoff mode. (We told responders in advance that odd and even numbers were paired as X-Y partners randomly). After the payoff mode was determined, we informed responders about the offers and revealed the payoff mode information if they had asked for it before. They finally decided whether to accept or reject the offer. After informing their partners about the decision, participants were asked to fill out a postexperimental questionnaire about their motives and ways of thinking.

5. Results

5.1 Responders' decisions

Slightly more than half of the responders did not buy payoff information (Table 1). Since equity is a (very) powerful social norm and the price of payoff information is low, this might be disappointing. But the fact that a responder does not ask for information does not mean that she does not care about fairness. A responder might think that the offer reveals the payoff mode. Furthermore, according to *McKnight et al.* (1998), in the first interaction a majority of individuals/people basically approach others with trust. If the proposer's partner is a fair individual, buying payoff information would be a waste of money.

	Yes		No	
Payoff information	25		30	
	Yes	No	Yes	No
Acceptance of offer	22	3	29	1

Table 1. Responders' decisions

The postexperimental questionnaire helped us to distinguish between those who bought and those who did not invest in payoff information. The reasons for buying reward information were elicited and classified as follows:

Motives: Responders made their decisions by marking a figure on a scale of 1 to 5 where 1 denoted 'strongly disagree.' K stood for KNOWLEDGE, T for TRUST, and M for MONEY, being the three significant main components of the analysis. 1. Responders buy information because they would like to learn what they accept or refuse. (K) 2. The offer basically speaks for itself. The information does not add(too) much. (K) 3. The responder buys payoff information in the hope of triggering a better offer. (M) 4. Buying information is a waste. (M) 5. I wanted to earn as much money as possible. (M) 6. I did not plan to refuse any offer. (M) 7. I wanted to have a clear picture about how my partner decided. (K) 8. I thought proposers cheat on the responders who do not buy information. (T) 9. I hoped for an offer which was good for me and good for her. (M)

The main components' analysis resulted in three main aspects based on our questions asking for information. The strongest component, which explains 30% of the total variance, was "Knowledge." We got different answers for all three items (1.,2.,7.), consisting of the knowledge component (tested with Mann-Whitney-U test, p=0.1). Asking for information means that one is uncertain and has less insight into the problem, e.g., difficulties to understand the task.

The two groups differed in their answer to the "Trust" item, too: whoever asked for information trusted the partner less (tested with Mann-Whitney-U test, p=0.1). We could not detect any difference in the answers to the questions inquiring about the own monetary incentives (M).

In sum, responders who asked for information were more uncertain, needed more orientation, and trusted the proposer less.

5.2 Does it pay to be informed?

The responder's decision to invest in payoff information signals, due to transparency, that she cares about fairness. This should discourage meager offers. Table 2 presents average earnings (in HUF) from the offered distribution of chips. (Participation fee and the price of information are not included.)

	High Payoff Mode		Low Payoff Mode	
Investment in payoff information	No	Yes	No	Yes
X	4276	3740	1386	1400
	(1129)	(1117)	(292)	(267)
Y	2096	2340	2160	1944
	(653)	(617)	(711)	(765)

Table 2. Average and standard deviations of earnings.

The hypothesized effect is present only in the high payoff mode (Mann-Whitney-U test, $p<0.05$). Remarkably, in low payoff mode proposers do not claim more if the partner does not invest in information. Proposers claim definitely less than half of the pie regardless whether rewards are common knowledge or not.

5.3 Total chip value orientation

The more white chips are given to the party with the higher white chips' value, the more efficient is the allocation. Table 3 presents the averages and standard deviations of white chips given to Y (X) in the low (high) payoff mode. Total chip value neglects, of course, the cost of information, which is justified, however, since these costs are reduced when the proposer decides about the offer, and which is a waste of money if the proposer wants to play fair anyhow.

Investment in information	Yes	No	The difference is significant (according to the M-W-U test, one-tailed)

Low Payoff Mode	4.7 (3.2)	5.7 (2.6)	$p<0.1$
High Payoff Mode	6.4 (2.6)	7.9 (2.4)	$p<0.05$

Table 3. Averages and standard deviations of white chips given to Y (X) in the low (high) payoff mode

Total payoff maximization demands that all white chips are given to one party. In our hypothesis we argued that, when a common background for interpretations is lacking, differentiation is less probable. If the responder invests and the low payoff mode applies, the average of white chips given to Y deviates more from the half split than in the other case: but the difference lies in the opposite direction! Y gets fewer white chips, although she should get more. The latter is consistently observed for both payoff modes, although inconsistent with our hypothesis: The allocation is significantly more efficient when the responder does not invest even though we do not subtract the price of information.

5.4 Constrained efficiency

We suggest the following constraints for efficiency: (y_w-white chips, given to Y, y_b-black chips, given to Y):
Low Payoff Mode: $10 = y_w$ and/or $y_b = 2$

High Payoff Mode: $y_w = 2$ and/or $y_b = 10$

	High $y_w = 2$ and/or $y_b = 10$		Low $10 = y_w$ and/or $y_b = 2$		?	
Information	No	Yes	No	Yes	No	Yes
No constrained efficiency	15 (50%)	20 (80%)	18 (60%)	19 (76%)	33 (55%)	39 (78%)
Constrained efficiency	15 (50%)	5 (20%)	12 (40%)	6 (24%)	27 (45%)	11 (22%)

Table 4. Frequency of constrained efficient allocations

One may draw several conclusions from Table 4: First, there are more constrained and efficient allocations when the responder does not ask for payoff information, both in high and low payoff mode. This result is definitely not in line with our hypothesis. Second, 72 out of 110 proposals are not constrained and efficient. Not shown in the table are Pareto-optimal offers which compromise perfectly between efficiency and equity (TPM & E, large filled dots in Figure 1). Their proportion is 90% out of all Pareto-efficient offers in both payoff modes. This is especially interesting in the low payoff mode, confirming the results of *Gneezy and Güth* (2004) that efficiency is an important concern of the proposer even when it favors the responder.

Because observations in Table 4 are not independent (one player is represented by two observations), we present another table which shows proposers who offer constrained and efficient allocations at least once. According to Table 5, 60% of responders choose such an offer at least once if the responder does not invest, whereas this ratio is only 32% if the responder invests in payoff information. The difference is significant according to the chi-square test ($p= 0.05$/ $p=0.05$)

	The responder invests	The responder does not invest
At least one of the two offers is constrained and efficient	8	18
Neither offer is (not)?constrained and efficient	17	12

Table 5. Frequency of proposers who offer constrained and efficient allocations at least once

5.5 Equity

In Hypothesis H2 we expected more equitable offers when the responder invested in reward information. We argued that common reward information (1) induces less "primitive equal chip assignments" and (2) that investment in payoff information puts equity of earnings into the focus of attention. The second point of the argument proved to be right - at least for the high payoff mode: see the results in section 5.2, where the proposers learned more when the responders did not invest.

5.5.a The frequency of 'primitive chips equity offers'

As in the case of constrained efficiency, we set up limits for the behavioral category of "primitive chip equity" in the following way: an offer fulfills the notion of an equal split of chips if
$4 = y_w$ and $y_b = 8$ either for the high or low payoff mode. Table 6 presents the frequency of 'primitive chip equity offers':

Equity	The responder invests in payoff information (50 offers of 25 proposers)	The responder does not invest in payoff information (60 offers of 30 proposers)
Primitive chip equity $4 = y_w$ and $y_b = 8$	20 (40%)	23 (38%)

Table 6. Frequency of primitive chip equity

Here the investment does not make any difference. Primitive chip equity offers are rather frequent, and their relative frequency is almost the same in the two conditions. The lower frequency of constraint efficiency does not go along with more frequent equal chip offers when the responder invests. When the responder asks (does not ask) for payoff information, there are 19 (9) allocations satisfying neither the requirements of constrained efficiency nor those of primitive chip equity. The majority (21) of these 28 observations were made in the low payoff mode. This means that for the low payoff mode 21 out of 55 decisions do not fall into our two behavioral categories.
We analyzed these cases thoroughly and found a common feature: 18 out of these 21 decisions give to Y no more than three white chips. (Actually, 12 out of 18 give three). By doing so, Y does not earn more money from the well-appreciated white chips than X. By giving three white chips to Y (which is most frequent), X and Y earn exactly the same amount from allocating white chips (900 HUF). Furthermore, this typically goes together with an offer of 6 black chips. *This speaks for separate accounts for black and white chips* and is a blatant mistake (from a normative point of view) in the low payoff mode. It can be hidden in the high payoff mode, where the same earnings from the two separate resources receive 7 (or 8) white chips and 8 (or 4) black chips for Y, which is indistinguishable from primitive chip equity. This might explain why there are so few outliers in the high payoff mode.

6. Equity and the separate resources heuristic

Equity, taken/ considered? separately for earnings from black and white chips, is surely inefficient from a normative point of view, but offers some behavioral advantages: it simplifies a complex task by splitting it into two separate ones. For those who think equity is important, equity becomes easy: if the two parties receive equal earnings from both resources, the final earnings cannot be imbalanced. This is the mental accounting heuristic, as described by *Tversky and Kahneman* (1981). We set the following limits for "equity and separate resources":

$4 = y_b = 8$ and $2 = y_w = 4$ for low payoff mode and $4 = y_b = 8$ and $6 = y_w = 9$ for high payoff mode.
These limits guarantee that a player's share either of the black or the white chips is at least 33% and does not exceed 67%. In Table 7 we present the frequency of proposers whose offers satisfy the requirements of "equity and separate resources" at least once:

	The responder invests	The responder does not invest
At least one of the two offers (rather)equalizes shares both for black and white chips	17	12

The offer does not equalize shares neither in the low, nor in the high payoff mode	8	18

Table 7. Frequency of proposers whose offers satisfy the requirements of "equity and separate resources" at least once

When the responder invests in payoff information, there are relatively more proposers entertaining the idea of "equity and separate resources" (the difference is significant according to the chi-square test, p=0.05). In principle Pareto-optimality and the idea of "equity and separate resources" are conflicting. They prove to be conflicting behaviorally, too, because the proposers characterized by at least one Pareto-optimal offer are not likely to equalize earnings separately for resources and vice versa (p=0.001, chi-square test).

"Equity and separate resources" seem to be responsible for the decrease in "constrained efficiency" when the responder invests. The question arises: why is the heuristic so easy to grasp? On the basis of our data, there is no easy answer. As a heuristic, it appeals to bounded rationality. Perhaps asking for information reveals more than just the desire to decrease uncertainty. It might convey mistrust, which makes conflicts, refusals more likely. This explanation could be confirmed by another experiment, where transparency (common knowledge about the payoff mode) has its origin in the experimental setup and is not a consequence of the responder's behavior. If the decrease in efficiency disappears for "predetermined transparency," our finding could be "cognitive loss coming from mistrust." This type of cognitive loss could be the third type of losses caused by mistrust, beyond the loss that is due to an absence of cooperation (*Axelrod, 1984*) and the loss due to additional administrative control (*Williamson, 1999*).

Actually, we ran this experiment where transparency was guaranteed with 40 X-Y pairs. 16 (15) out of 40 proposers offered efficient and constrained offers in the low (high) payoff mode, and 20 out of 40 proposed such an offer at least once. 'Equity and separate resources' heuristic appeared /was observed/perceived in 22 proposers. In sum, proposals rooted in? this predetermined transparent experimental setup seemed slightly less optimal than those rooted in the intransparent one, but more optimal than proposals made by responders with investments in payoff information. The rough categorical independency analysis did not result in significant differences, either for the first or the second comparison. That is why, instead of the analysis of frequencies of constrained and efficient offers, we compared how distant the two offers, taken together, were from the Pareto-optimal one. Table 8 presents the averages and SD values of minimum numbers of chip pieces which should be given to the other party, in the two offers taken together, to make the offers Pareto-optimal. The difference between the three groups is significant (Kruskal Wallis Test, p =0.05). The two transparent conditions differ/vary considerably (the difference/variation is significant according to the M-W-U test, p =0.05), but transparency, compared to the condition of private information, makes no difference/is irrelevant/immaterial when it is guaranteed.
This result supports the hypothesis that it is mistrust which attracts attention. The question of the missing beneficial effect of pure transparency remains to be answered.

	No transparency (N=30)	Transparency is guaranteed (N=40)	Transparency is enforced (N=25)
The distance from the 'constrained and efficient' category	3.9 (3.1)	4.32 (3.6)	6.52 (3.5)

Table 8. Distance from the 'constrained and efficient' category.

7. Conclusions

Our experiment has generated/provided the following insights:

1. 30 out of 55 responders do not invest in payoff information. Those who invest are more uncertain and trust the proposer less. This finding confirms conceptual links between trust and uncertainty (for a theoretical analysis, see *Güth and Kliemt*, 2000).
2. On average, investing in payoff information does not pay either for the responder or in terms of efficiency.
3. On average, the offers claim approx. 60% of the "pie" for the stronger party in terms of monetary chip values. Proposers claim only 40% in the low payoff mode, which supports that total payoff maximization matters even when it favors the responder. The proposer deviates from these 60% in the condition of no investment: there she claims almost 70%.
4. 72 out of 110 allocation proposals are not constrained and efficient. The offers are especially rare when the responder invests. The heuristic of "equity and separate resources" is very likely when the other invests. The opposite tendencies result when the partner does not invest in payoff information. A possible explanation is that asking for information conveys mistrust.
5. Equity and efficiency are only partially conflicting in our task. By choosing a Pareto-optimal allocation, it is possible to compromise between total payoff maximization and equity.

Both, the holistic approach as implied by "equity and efficiency" and the separate account approach ("equity and separate resources"), as employed in our experiment, suggest considerable heterogeneity in problem solving among our participants.

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